RELIGIOUS BELIEF IN THE THOUGHT OF SIR ARTHUR STANLEY EDDINGTON

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Religious Belief in the Thought of Sir Arthur Stanley Eddington

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Abstract

Sir Arthur Stanley Eddington (1882-1944) was a distinguished British scientist and committed Christian. Where many see science and religion as two separate and incompatible universes of discourse Eddington developed a way to conceive of them as complementary and compatible. He maintained that science addresses the measurable world and spirituality addresses the unseen world. Both find their source in the divine and are rooted in beauty, truth and especially experience. In this thesis Eddington's religious thought is compared and contrasted with Rudolf Otto's concept of the numinous in order to bring out the structure and depth of Eddington's thinking. Eddington, in fact, tapped into the essential core of all religions: religious experience. For Eddington this is mystical communion with the divine, or as Otto would say, the 'numen praesens.' Eddington unites aesthetic, scientific and spiritual aspects of existence in a way that promotes religious and scientific freedom. Moreover, in seeking fulfillment and purpose in life Eddington breaks down traditional religious boundaries and promotes freedom of exploration, and this gives added depth to his religious thought.

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Table of Contents

Introduction

Sir Arthur Stanley Eddington, a Christian and scientist, had a profound understanding of religious experience. It allowed him to bring together religious and scientific thinking in a unified way. Eddington continues to stand as an example for people struggling with this conflict. This thesis is comprised of four chapters each uniquely contributing to the overall intention of the whole. The following overview will give the reader the necessary perspective to navigate through the entirety of this thesis.

Chapter one introduces Arthur Stanley Eddington (1882-1944) as a British scientist and devout Christian. Eddington's thought is rooted in Quakerism. To develop an appreciation of the tenants of Quakerism we explore four stages of Quaker history. To familiarize ourselves with Eddington as a person we explore his upbringing, schooling and key role models. Finally we turn to Eddington's stance on the war as both a conscientious objector and an astrophysicist. Eddington promoted internationalism and after an expedition to confirm Relativity Theory he began popularizing topics in science and religion. This chapter establishes how important it was for Eddington to live as a scientist and a Quaker; his integrated beliefs were reflected in how he lived his life.

After looking at the development of Eddington as a person we turn to his thoughts. Chapter two takes a look at the specific elements of Eddington's religious thought and how it relates to his scientific thinking. To do this we consider two major topics the first is *The Scientific Enterprise of Religious Experience*. Science and religion are related and interact through seeking, symbols and experience. Eddington also suggested ways in which science and religion needed to maintain a degree of separation. The second topic addresses *The Scientific*

Enterprise and Human Consciousness. This takes a look at the significance of people in a cosmological context. Next we consider the role of two aesthetic elements, beauty and truth, and how they relate to science and religion. This chapter is meant to establish the specific ways in which science and religion interact with one another in Eddington's thought. This of course is an exceptional feat given the traditional difficulties in combing the two.

Chapter three takes a closer look at Eddington's religious thought. It is the depth of Eddington's religious thinking that has allowed him to find unity in his life. As a means of exploring Eddington's thoughts on religion we use the categories of the numinous as developed by Rudolf Otto. We examine Eddington's religious thought by comparing and contrasting it with these categories. This comparing and contrasting allows us to delve deeper into Eddington's thinking. In looking at the role of silent worship and mysticism we see how the concept of the *numen* especially resonates with Eddington's own experiences with silent worship and mysticism. Presenting Eddington's religious thinking against the background of Otto's numinous allows for a clear appreciation of Eddington's complexity. This chapter seeks to show the depth of Eddington's religious thought, something sometimes overshadowed by his scientific accomplishments.

Chapter four is the final chapter of this thesis. We look at how Eddington's unification of science and religion stands as an example today for people seeking scientific and religious freedom. Next we consider where on the spectrum of thinking Eddington fits, in uniting science and religion, by considering him in the context of Polkinghorne and Faraday. These are two other Christian scientists who united and separated religion and science, respectively. Finally we take a last look at Eddington's integration of science and religion using an example based on cosmology. The concluding section of this thesis, *Seek and Ye Shall Find Fulfillment*, describes

the ways in which Eddington was able to do just that, seek and find meaning in his life, fulfilling his purpose through spiritual and scientific outlets as a religious scientist.

Chapter One

The Life and Times of Sir Arthur Stanley Eddington

Sir Arthur Stanley Eddington was a distinguished British scientist and devout Christian who was born in 1882 and lived until 1944. In contrast to some scientists of today, Eddington was convinced that science and religion were not conflicting universes of discourse. My thesis seeks to explore how Eddington successfully integrated his scientific and religious thought.

The concepts of 'science' and 'religion' have meanings which are wrapped up in their historical context. Even within a specific time period there is often a range of conflicting definitions, particularly in the case of religion. This thesis uses specific examples of science and religion grounded in a particular time, place and person. The kind of science Eddington was most involved in was astrophysics with a focus on the internal constitution of stars and General Relativity.[1] The kind of religion he was most familiar with was British Quakerism, a faith that Eddington had been born into and embraced in his adulthood.

One may wonder how Eddington, a man rooted in the past, can speak to us today about science and religion. This thesis proposes that Eddington's thought is still relevant and can contribute in a positive way to the ongoing dispute about the relationship between science and religion.[2] In the same way that Eddington's 'two tables' are still being recited and his scientific

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1 Arthur Eddington, *The Internal Constitution of the Stars* (Cambridge: Cambridge University Press, 1926); Arthur Eddington, *Space, Time, and Gravitation: An Outline of the General Relativity Theory* (Cambridge: Cambridge University Press, 1920). See Appendix A for a list of Eddington's scientific works.

2 The issue has become a hotly debated and divisive one. Richard Dawkins, for example, has become a bestselling author by writing about religion and science. Richard Dawkins, *The Blind Watchmaker* (New York: Norton, 1986); Richard Dawkins, *The God Delusion* (Great Britain: Bantam Press, 2008); Richard Dawkins, *Unweaving the Rainbow: Science, Delusion and an Appetite for Wonder* (Boston: Houghton Mifflin Company, 1998).

texts still consulted, Eddington's thought is continually relevant and enduring.[3] This discussion continues in the final chapter of this thesis after his thought has been considered.

By first exploring the historical circumstances that shaped Eddington's worldview we are better equipped to understand the complexity and development of his ideas. Eddington seems to exhibit qualities common to the Quakerism of his time; his scientific and religious thought are consistent with approved Quaker practice. The following chapter begins with an overview of four phases of Quaker history, leading into Eddington's own time period and delving into his personal history. Of interest in his intellectual development are three primary role models that enter his life: William Graham, Arthur Schuster and Rufus Jones. As an adult living through World War One Eddington's values of internationalism and pacifism become evident as he aligns himself with Quakerism and active peacekeeping.

Four Phases of Quakerism

Phase One

The middle of the seventeenth century was a time of civil war in England. During this period of conflict and the following English Interregnum new religious movements emerged. At the time there was a single established national church, the Church of England. It was Episcopalian, un-dogmatic and Protestant in nature. The Established church provided for its

3 Eddington has been recognized for his 'two tables' example which describes a commonplace and scientific understanding of a table. This is discussed further in chapter three under the heading *Rational and Non-Rational.* See Eddington, *The Nature of the Physical World* (London: J.M. Dent and Sons Limited, 1928), 5ff.

members and legally discriminated against outcast people.[4] Quakers were among the first wave of dissenters to develop during this time period along with Baptists and Congregationalists.[5] Quakerism was later followed by Methodism, the Salvation Army and finally Pentecostalism in the twentieth century.[6] It was in 1652 that George Fox began the sect that would eventually turn into the Society of Friends. He began publicly preaching a new kind of Christianity in the Yorkshire-Lancashire-Cumbria area of northern England.[7] He spoke of an Inner Light within people that connected them with God, guided them in thought and deed and made everyone equal. Fox had undergone his own conversion and experienced this Inner Light prompting him to preach to others. He stressed religious purity and social justice with an emphasis on individual religious experience. Fox resisted hierarchal religious authority, preaching a Christianity of social change. God could be experienced directly unmediated by clergy or dogmatic prescriptions. Fox had a large group of faithful followers committed to his vision with more people being converted every day. As a result of their non-conformity and radical beliefs Quakers[8] were subject to imprisonment and some were ultimately martyred.[9] This struggle to create and sustain their beliefs helped to shape the Quaker faith. They forged their identity through conflict with the Church of England. This period of Quakerism has been described by Howard Briton as the 'heroic' or 'apostolic period.'[10] Quakers of Eddington's time often referred

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4 Adrian Hastings, *A History of English Christianity 1920-1990* (London: SCM Press, 1991), 32.

5 Steve Bruce, *Religion in Modern Britain* (New York: Oxford University Press, 1995), 6.

6 Bruce, 12.

7 Geoffrey Cantor, *Quakers, Jews and Science* (New York: Oxford University Press, 2005), 12.

8 Followers of Fox had been called, 'Children of the Light,' 'People of God, or 'Friends.' Fox began using the term 'Quaker' to describe trembling before the Lord. The term Quaker is used in a non-discriminatory way.

9 Cantor, 20.

10 Cantor, 21.

back to this early period and the original themes of George Fox: the Inner Light, equality and the individual, unmediated experience of God.[11]

Phase Two

The second phase of Quaker history is known as the 'quietistic' phase and spans the late seventeenth century up until the end of the eighteenth century.[12] In 1689 the British government passed the Toleration Act, effectively allowing Quakers to register their Meeting houses. This eased religious discrimination and relieved the pressure of securing Quakerism as a religion.[13] The Toleration act combined with the death of George Fox in 1691 contributed to a milder form of Quakerism.[14] John Wilhelm Rowntree has described this period of rest after tribulation, "like a rowing crew after a fierce race, rest[ing] on their oars."[15] With less emphasis on defending their faith Quakers could at last turn inward and reflect on their own creativity, mysticism and what it meant to be a Friend. This quietist phase saw a change in Quaker Meetings from more spontaneous and emotional to silent and contemplative.[16] Despite this shift Quakers did not withdraw from the practicalities of the world. On the contrary they pursued industry and science

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11 William Graham was discontent with the shape of Quakerism in his time, and proposed a reconnection with the original messages of Quakerism while still pursuing liberalism.

12 Matthew Stanley, *Practical Mystic: Religion, Science and A. S. Eddington* (Chicago: University of Chicago Press), 17.

13 Cantor, 23.

14 Thomas Kennedy suggests that George Fox embodied radicalism in Quakerism against opposing forces. Thomas Kennedy, *British Quakerism 1860-1920* (Oxford: Oxford University Press, 2001).

15 John Wilhelm Rowntree, "The Rise of Quakerism in Yorkshire," in *John Wilhelm Rowntree: Essays and Addresses*, ed. Joshua Rowntree (London: Headley Bros, 1906), 64-65.

16 Kennedy, 17-18.

with a great work ethic.[17] Many Quakers took an interest in astronomy and botany, building observatories and greenhouses for themselves.[18] As a whole Quakers were less interested in converting others and more interested in tending to their own affairs. During this time Quakers were known for their honesty, their strength of character and their distinct nature in speech and plain clothing.[19] Quakerism had been efficiently organized with a system of monthly and quarterly Meetings with representatives meeting yearly. Decisions made during Yearly Meetings in London affected all Quakers. Advice on child rearing, education, business and the proper manner of conduct, all made their way back to Quaker homes. Members were expected to marry within the faith and children were taught by other Quakers. Due to its exclusivity, Quakerism had become somewhat of a secluded sect and was increasingly unappealing to outsiders. Part of the problem lay with the Quaker refusal to take oaths or pay tithes. The Affirmation Act of 1722 circumvented this problem by recognizing an 'affirmation of honesty' in courtrooms. Gradually the oaths and religious requirements for civic positions, academic appointments and land ownership also faded away facilitating the Quakers re-emersion into society.[20] The quietist phase lasted for nearly a hundred years before something from the outside world broke through and initiated change.[21]

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17 Cantor, 23.

18 Cantor, 25. Astronomy and botany were popular choices among Quakers as these subjects focused on prioritizing and observing God's creation. See Cantor, 234.

19 Cantor, 25.

20 Cantor, 26.

21 Kennedy, 18.

Phase Three

The third stage of Quakerism lasted from the late eighteenth into the nineteenth century. Quakers joined the evangelical calling that was sweeping through English churches. There was an emphasis on a literal understanding of scripture and salvation as a gift from God.[22] With Evangelicalism came increased interaction with the outside community. The bible was reintroduced into 'Meetings for Worship.' Though some silence remained the singing and prepared sermons of Protestant services overtook the format of traditional Meetings.[23] This shift laid the groundwork that enabled Friends to unite with other evangelical Christians. More than ever before people started to join the Quaker congregation introducing new members of both genders of all ages.[24] The rift between Quakers and the rest of the world began to lessen. Outside marriages were permitted and speech and dress obligations were dropped. [25] Though not everyone had agreed with the increased evangelicalism[26] it had led to positive impacts in the community at large. The Society of Friends took a special interest in the needs and causes of others such as their involvement in the anti-slavery movement.

When a popular evangelical Quaker named Joseph Bevan Braithwaite Sr., attempted to introduce the Richmond Declaration at a Quaker Yearly Meeting, changes were swift in

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22 Stanley, 18.

23 Kennedy, 111.

24 Kennedy, 111.

25 Cantor, 27.

26 One group called the Beaconites left the society because of its lack of scriptural emphasis, and overdrawn regard for the Inner Light. This was known as the Beacon Controversy. See Cantor, 26.

coming.[27] The Richmond Declaration had come from the Richmond Conference held in Indiana in September of 1887. It was a declaration of faith and beliefs of Quakers.[28] The Declaration sparked a controversy in England centered around creeds, clergy and what it meant to be a Quaker in the modern world.[29] This declaration led to the eventual decline of the evangelicalism that had dominated British Quakerism for about fifty years.[30]

Phase Four

This leads us into the fourth and final stage of Quakerism: Modernism in the late nineteenth century.[31] By this time Quakers had great variety in their communities. Some were wealthy and lived in urban centers while others were poor and lived in the countryside. Likewise some remained quietist and rather traditional while others were very much worldly and favoured modern dress and speech.[32] As a whole Quakers had concerns about how to relate to the modern world. The Manchester conference of 1895 addressed these controversial concerns and defined what it meant to be a modern Quaker. The aim of the conference was to clarify for outsiders the intentions of Quakerism and to strengthen the commitment of younger Friends. A number of

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27 John William Graham was concerned about Braithwaite and wrote to his parents saying that J.B. Braithwaite had been espousing a creed, however it had gained little support there. See Kennedy, 112-113.

28 Contemporaries were much more inclined to see the Richmond Declaration in a negative light, as compared with people today. Rufus Jones made the comment that the Richmond Declaration was, "a relic of the past … [which] made no effort to interpret Christianity to this age … [and] reflected no sign of the prevailing intellectual difficulties over questions of science and history." Kennedy, 113.

29 Stanley, 19.

30 Kennedy, 113.

31 The term Modernism was first used by Howard Brinton to describe the fourth phase of Quakerism. See Cantor, 27.

32 Cantor, 17.

influential, liberal Quaker leaders spoke at the conference including John William Graham, John Wilhelm Rowntree and W.C. Braithwaite, the son of the evangelical Braithwaite Sr. They proposed that Quakerism was open to modernism, biblical criticism and scientific advances, like the theory of evolution, precisely because they were not limited by creeds.[33] As the Meeting progressed it became clear that the messages of Liberal Quakerism dominated over evangelicalism.[34] One section of the conference pertinent to our inquiry was entitled, "The Attitude of the Society of Friends Towards Modern Thought." It was clear that Friends could no longer hide themselves from the 'dazzling light of scientific knowledge.'[35] J. Rendel Harris,[36] one of the liberal Quaker speakers at the conference, posed much the same question that we hear today – is it possible to be a modern, intelligent, rational person while still maintaining religious faith? He suggested that it was necessary to regard spiritual and mental faculties as from the same source, honouring the same divinity and equally entitled to investigation.[37] He also suggested that science and religion mutually complimented each other. Both were avenues of exploring and appreciating the world. There could be no division, or compartmentalisation of ideas, as this would stop progress. He favoured having a provisional scientific understanding of the world as it is apt to grow just as religious experiences grow.[38] The chair of "Modern Thought," Thomas Hodgkin, advocated scientific development unfettered by religious

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33 Stanley, 19.

34 Kennedy, 149-150.

35 Kennedy, 151.

36 Harris was a lecturer in palaeography at Cambridge; he was accompanied by Silvanus Thompson and William Graham, two other liberal Quakers. See Kennedy, 150.

37 Stanley, 21.

38 Stanley, 20.

constrictions like a literal interpretation of the bible.[39] Hodgkins address was entitled, "Can a Scientific Man be a Sincere Quaker?" His answer was yes. In a fitting statement he claimed, "creed is not separable from conduct … a man's religion is not that which he professes, but that which he lives."[40] John William Graham concluded the section on modern thought. In particular he argued against biblical literalism and authority.[41] He urged people to reclaim their Inward Light[42] and to live daily with religious experience. In their everyday lives Quakers had the opportunity to connect with God not through an unchanging, unerring scripture. Science could not prove or disprove religion. Our assurances come directly from religious experience.[43] The message of the Manchester conference was clear: Quakers were rediscovering their Inner Light, rejecting absolutism and literalism in scriptural interpretation, rejecting clerical orders and embracing modernity as a part of a spiritual search for truth.[44] Quakers from all over England learned how to embrace the modern world.

Geoffrey Cantor has named Eddington as a representative who reflected the post-1895 spirit of Quakerism.[45] In taking a brief look at his life we will find that Eddington was both a product of his personal circumstances and the Quaker Renaissance that developed from the Manchester conference.

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39 Cantor, 267-268.

40 Report of the Proceedings of the Conference of Members of the Society of Friends held in London, 1895. See Kennedy, 152.

41 Though there was excitement about the discussion on modern thought especially in younger Quakers, another evangelical wing was disturbed by the comments, and the notion that others would consider these ideas normative for the Society of Friends. See Kennedy, 152.

42 'Inward Light' is interchangeable with 'Inner Light.'

43 Stanley, 21. Rufus Jones also suggested that there was no need for religious proof. See Stanley, 38.

44 Stanley, 22.

45 Cantor, 13.

Eddington's Early Years

Arthur Stanley Eddington was born on the 28th December in 1882 as a Quaker from a long line of Quakers. His sister Winifred Eddington had been born four years earlier, the first child of Sarah Ann Shout and Arthur Henry Eddington. Sarah Ann's Quaker ancestry stretched back to George Fox and the origin of Quakerism. Arthur Henry was a well educated man descended from fourth generation Quaker farmers. He achieved a Bachelor of Arts from the University of London and was employed as a tutor at Flounder's College. He went on to reach the post of headmaster at Stromengate School in Kendel.[46] Eddington would have been raised in a way consistent with Quaker values of the time. That meant abstaining from alcohol, theatre and tobacco.[47]

The Eddington's family happiness was short lived. Arthur Henry died during the Stromengate typhus epidemic in 1884. At the tender age of two and six, Arthur and his sister were taken to live with their grandmother and mother in Somerset. Only two years later Mrs. Rachel Eddington died leaving the family to uproot once more to Varzin in southern England. There at last was Eddington's familiar boyhood home on Walliscote Road. This final childhood settling place was both beautiful and historically rich. It was the site of Arthurian legend and close to Wells and Glastonbury, known for their cathedrals.[48]

Even before receiving a formal education young Eddington had a keen interest in large numbers and observable natural phenomenon like the stars. He was able to marry his interests by

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46 Vibert Douglas, *The Life of Arthur Stanley Eddington* (London: Thomas Nelson and Sons Limited, 1956), 1.

47 Though Eddington tended to stay true to his Quaker values he did move away from some of the more conservative tenants of his upbringing. In later years Eddington attended the theatre and on a few occasions indulged in champagne or beer. He also grew quite fond of his pipe.

48 Douglas, 1.

attempting to count the numbers of stars in the night sky, then the number of words in the bible – reaching somewhere into the middle of Genesis. He had learned his multiplication tables up to twenty-four times twenty-four before ever learning to read. At six his interest in astronomy had begun and by age ten, equipped with a three inch telescope, the night skies were greatly illuminated.[49]

Stanley, as his family called him, was home-schooled until his attendance at the Brynmelyn school in Weston. There his teachers kindled an existing love of mathematics, physics, and literature. Academics aside Eddington was a well behaved, modest child who loved sport as much as academia. Cycling became a lifelong hobby and he was known for his skills in cricket and football as a youth. With the death of Arthur Henry the Eddington family survived on a modest budget however the cost of a university education for Stanley would have certainly been too high. Fortunately he was able to overcome that challenge by being awarded scholarships. First the Somerset county scholarship, valued at sixty pounds a year for three years, and then an additional twenty pounds from a Victoria and London University scholarship.[50] The choice of university was still a delicate matter.

Eddington's Education and Career

Gone were the times that Quakers could only attend Quaker institutions however Friends were still slow to take advantage of the fact.[51] Quaker attendance at Cambridge or Oxford was

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49 Douglas, 3.

50 Stanley, 24.

51 Even after the Acts of 1854 and 1856, and the dissipation of religious tests in 1871 young Quakers were still slow to attend exclusive universities. It was not until the early 1880 that male Quakers would join their female counterparts at Cambridge. See Cantor, 90.

more a matter of opening up Quaker society and entrusting students to a non-Quaker institution. More liberal minded Quakers wanted to expand their intellectual horizons by having a presence in great institutions of learning. This was a topic of interest within the faith between disputing Manchester rationalists and Unitarians.[52] Quaker students were ultimately encouraged to attend Oxford and Cambridge despite the risk that they might abandon their beliefs.[53]

Given his modest budget and religious background Eddington decided to attend Owen's College. Owen's College was a part of Manchester University and was located in the centre of what was described as nonconformist England.[54]

The Influence of John William Graham

A friend of Stanley's father, John William Graham, headed Dalton Hall, the Quaker residence at Owen's College. These familial connections would have further contributed to Eddington's choice of University.[55] William Graham attended the University College of London and then King's College of Cambridge before devoting his life to teaching and reviving the Society of Friends.[56] Graham's main goal was to bring Quakerism, and new generations of Quakers especially, into the modern world. As principal of Dalton College he distributed a pamphlet that Eddington would certainly have read, entitled, "The Meaning of Quakerism." In it he described Quakerism as an experientially based faith as it relates the world to God. It was not through dogma, creed or tradition that one could move with the times but with a questioning

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52 Cantor, 91.

53 Cantor, 90-91.

54 Stanley, 24.

56 Stanley, 24.

spirit. Things that could be questioned were the most useful as a source of knowledge and were capable of influencing our lives. Graham came to be somewhat of a representative of the Manchester Conference. He was liberal while still being true to the origins of Quakerism and the ideas of George Fox. His desire was to represent Quakers as being modern and a part of the larger society.[57] When over the course of his first year Eddington achieved top marks in Mathematics, Latin and English, Graham wrote to Sarah Eddington concerning her sons extraordinary success, and he did so again during Eddington's second year.[58] Graham instructed Eddington on what it meant to be a Quaker in English society. As Graham mentored Eddington, he took on Graham's ideals: the importance of the Inner Light, pacifism, and a modern pursuit of knowledge. Through Eddington Graham was able to convey his vision of a modern Quakerism. Eddington's studies at Owen's College had gone well and culminated in a first class standing.[59] Eddington's scientific success and embodiment of modern Quakerism would have reflected well on both Graham and his ideals.[60]

The Influence of Arthur Schuster

A second influential figure in Eddington's life was Arthur Schuster a dominant personality in the Owen's College physics department. Eddington worked closely with him

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57 Stanley, 27. Review of "The Meaning of Quakerism," unknown source, J.W. Graham Papers.

58 Douglas cites three years of tutoring under Schuster (Douglas, 5), whereas Stanley cites four years of tutelage. Stanley, 29.

59 Douglas, 5.

60 Stanley, 29.

during his years at Manchester.[61] Schuster set the tone for scientific education in the college, especially within the physics department. Matthew Stanley, author of *Practical Mystic: Religion, Science and A.S. Eddington*, cites two specific ways in which Schuster impacted Eddington. The first was Schuster's integration of math and science.[62] It was Schuster's belief that physics ought not to exist in isolation; the meaning of physics is in its application. The integration of laboratory work, original work and theory allowed for a complete approach to science. As a Quaker Eddington had already been taught to integrate different areas of thought and so this would have seemed a natural progression for him. Schuster discussed the role of symbols and the delicate balance between theory and practicality that led to a gradual accumulation of tentative knowledge.[63] It was through '*Fingerspitzengefühl*'[64] that a scientist could intuitively feel his way around the subject and understand which method had to be applied.[65] Eddington paid heed to Schuster's advice and turned it into the groundwork for his own unique scientific method, as detailed in chapter two. As Eddington engaged in his own research he developed a theory on the formation of absorption lines in stellar atmospheres building upon what Schuster and Schwarzschild had begun.[66]

The second influential idea was the notion of internationalism in science. This would be of great importance to Eddington during World War One. Schuster explained in "International

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61 Douglas, 5.

62 Stanley, 29.

63 Stanley, 31. Eddington went on to think extensively about symbols and symbolic knowledge in the world of science, as discussed in chapter two.

64 Literally translated from German as "finger tip sensation," meaning a feel for something, used by Stanley, 30.

65 Stanley, 31.

66 Douglas, 191.

Science"[67] that international scientific cooperation was necessary for fields such as astronomy and geodesy, whereby observations came from around the globe. It also provided perspective on the insignificance of political and racial boundaries.[68] Schuster stated,

> I do not wish to exaggerate the civilising value of scientific investigations, but the great problems of creation link all humanity together, and it may yet come to pass that when diplomacy fails - and it often comes perilously near failure - it will fall to the men of science and learning to preserve the peace of the world.[69]

Peace through science would have been a message well received by Eddington as he took pacifism quite seriously.

Cambridge and Beyond

One can now understand Cantor's suggestion that Eddington's life exemplified the spirit of the Quaker Renaissance,[70] as he lived through it and held close company with some of its greatest advocates.

After his success at Manchester Eddington applied for an entrance scholarship to Cambridge and was successful in being awarded seventy-five pounds a year towards Natural Science at Trinity. Though Trinity and Cambridge were most decidedly Anglican Eddington needed the opportunities that a larger department could afford. Trinity in particular had a strong reputation in mathematics and science boasting the attendance of men such as Isaac Newton.[71] In

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67 Arthur Shuster, "International Science," *University Review*, June 1906. Found in Stanley, 31.

69 Stanley, 32.

70 Cantor, 13.

71 Quaker students were very receptive to mathematical and scientific teachings, as the Quaker school systems favoured science over classics. See Cantor, 93.

Cambridge Eddington immediately set to work on preparing for the Tripos Exam.[72] During his second year Eddington took the exam. He was awarded Senior Wrangler, a title of distinction, in 1904.[73] Never before had a second year student achieved this[74] and never before had a Quaker.[75] His scholarship award was increased to one hundred pounds by the second term, though he continued to apply for further funding. Eddington expanded his horizons outside of academia, making time for leisure activities of hiking, bicycling, golfing and watching all manner of sport.[76] After being awarded a BSc. in Physics he took up teaching jobs and tutoring at the University. In the winter of 1906 Eddington joined the Friend's Guild of Teachers. The organization had originally trained teachers of Quaker schools but later expanded to include all teaching Quakers. Just that year Graham had been appointed as president of the guild. Graham continued to espouse the values of the Manchester Conference in his new position and made new plans to work in the education system. He encouraged the integration of religion with a progressive, modern life in both teachers and students. Through 'seeking' and by bettering established methods the world could be improved. Eddington attended the annual Meeting of the Friend's Guild that year in

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72 Candidates for the Tripos, or subject, were called 'Wranglers.' The Mathematical Tripos exam was a long, arduous mathematical exam placing wranglers in positions based on their marks.

73 Cantor, 93. See Appendix C Photos of Eddington.

74 Douglas, 11.

75 Stanley, 33.

76 He often bicycled long journeys, meticulously recording the distances traveled. He also enjoyed hiking and generally spent his time off being in nature. Much of his time in nature was spent with close friend C.J.A. Trimble, whom he had met at Trinity. Stanley, 33. There has been speculation that the relationship between Eddington and Trimble was of a romantic nature. Douglas suggested that the relationship between Trimble and Eddington created, "an almost impenetrable barrier to intimacy with others." Douglas, 7. Douglas went on to later describe Trimble as an "intimate friend." Douglas, 32. Furthermore, in the BBC documentary *Einstein and Eddington*, Eddington is portrayed as a homosexual. The consequences of being identified as a homosexual were quite severe in those times. To keep such a secret would have been a terrible strain on him, as suggested by Miller 38-39.

Dublin and remained a faithful member for life.[77]

When the position of Chief Assistant at the Royal Greenwich Observatory opened it was left to the Astronomer Royal to seek out eligible candidates. It was widely regarded as a position of distinction. He came at once to Eddington who accepted the position.[78] This job opportunity enabled Eddington to gain further practical skills with the highest quality astronomical equipment. Eddington began his own original research there. He became close with other astronomers around the globe. This was just the sort of international partnership that Schuster had promoted back at Owens. Eddington's work on statistical cosmology gained him admittance to the Royal Astronomical Society in 1906. Despite his professional success, Eddington felt as though his religious community was lacking. Eddington did not find the same spirit of progress in the London Meeting houses where Quakers were still more conservative. As a result he changed Meeting houses twice during his time at the Cambridge Observatory. In an effort to seek out like minded Quakers Eddington participated with the Society of Friends at University, attended the 1907 Peace Conference and attended Summer School in Kendel in 1908.[79]

The Summer School Movement

John Wilhelm Rowntree wanted to change the way that Quakers perceived the ministry. His goal was to encourage an educated, inspired ministry. Around this time George Cadbury had

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77 Years later Eddington ascended to the rank of presidency of the Friend's Guild and held the position for several years. Stanley, 35.

78 Eddington had written to his mother concerning the position but did not expect to be accepted. After going to Greenwich, he picked up on the enthusiasm of the Dons, and their desire for a physicist even without specific practical knowledge. In February of 1906 he received the official letter of his appointment to the post. See Douglas 13-14.

79 Stanley, 36.

been concerned about the formality of Quaker Meetings; he wanted to see renewed life in them. Rowntree contacted Cadbury about a 'Summer School' idea. The Summer School was to be set up as a demanding nature retreat.[80] Participants would essentially live in the country, camping, listening to key speakers, walking the hills and meditating. John Wilhelm hoped that it would "do much to widen the imagination and to stimulate a desire for greater spiritual power and more ability to give it expression."[81] Cadbury responded with high hopes and financial support. The Summer School movement answered a call to improve the education of Quaker leaders on an intellectual and spiritual level. Attendants could go back to their respective Meeting houses and share what they had learned. The Summer Schools intended on moving Quakers from an attitude of quiet reflection to being a part of the larger society and changing world.[82]

The Summer School that Eddington attended called for Quakers to engage with modernism and become representatives of Quaker spirituality in their lives. The Summer School continued the values established during the Manchester Conference. [83] Conservative Quakers tended to be self isolating, while evangelical Quakers tended to focus on biblical literalism. What the Summer School movement promoted was a moderate form of Quakerism that reemphasized the Inner Light, while introducing active peace seeking and involvement in the modern world through social activism.[84] Emerging again as an influence on Eddington's life was William Graham, a key speaker of the Summer School in 1908. He was joined by another Quaker, Rufus

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80 Douglas, 31.

81 Kennedy, 171-172.

82 Stanley, 36. Quakers seem to find themselves isolated from the rest of society, as with the quietist phase. They continue to strive to become integrated into the modern world, just as Eddington seeks to intregrate his science and religion.

83 Stanley, 36.

84 Stanley, 40.

Jones, who was keenly interested in Quaker mysticism.[85] Eddington's along with other Quakers' conception of mysticism was highly influenced by Rufus Jones.

The Influence of Rufus Jones

Rufus Jones was an American Quaker who was dedicated to preserving Quakerism and had an interest in mysticism in particular.[86] He emphasized religious experience over theological interpretation, as it had been during the time of Christ. Acknowledging and nurturing one's Inward Light through religious experience strengthened the entire Quaker community.[87] Quakers experienced a daily mysticism that allowed them to advance in the world. It was not a secret, hidden conviction, but an outward show of faith.

Jones also explained that an experiential approach to religion, characteristic of Quakerism, had nothing to fear from science. No discovery of mathematics, physics or biology could undermine a personal, experiential relationship with God. Proof or disproof of religion was outside of the realm of science. Furthermore Jones thought that there was no need for religious proof.[88] He described what it was to be a modern, practical mystic.[89]

> They [practical mystics] are very busy persons, overloaded with their own life work, their vocation, but that in no way prevents them from being transmitters of great moral and spiritual forces; quite the contrary, they are

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85 Stanley, 37.

86 Jones was deeply influenced by Josiah Royce, Francis G. Peabody and William James. All contributed to his understanding of mysticism, James especially, whose text *Varieties of Religious Experience* was akin to Jones' own thoughts on Quaker mysticism. See Kennedy, 160ff.

87 Stanley, 37.

88 Stanley, 38.

89 This is likely what inspired Stanley to call his book, *Eddington: Practical Mystic.*

> all the better transmitters because they are steadied and stabilized with a weighty occupation.[90]

As a liberal Quaker Jones's theological ideas were quite progressive and so he was careful to ground them in traditional Quaker values. Like Jones, Graham believed in stressing mysticism claiming that "Quakerism is mysticism in a pure form."[91]

Jones and Graham were like minded about the direction of modern Quakerism. Both believed strongly in the values advocated by the Manchester Conference. Jones worked diligently spreading the word about the Inward Light and the value of mysticism. He advocated a re-evaluation and appreciation of the Peace Testimony. The Peace Testimony was a concept tracing back to George Fox that Jones and Graham, among other Quakers,[92] wanted to revive. Jones noted that many Quakers had not fully appreciated or understood the Peace Testimony as it had been an 'unexamined inheritance.'[93] The Peace Testimony was more than just an obscure piece of Quaker history. It was important for Quakers to appreciate the depth of the commitment to peace and to understand the grounds for this testimony. There was nothing passive about pacifism. Quakers taught an active peace making based on respect for the divine spark in people.[94] Graham suggested that Quaker's followed Christ's example of pacifism, and to harm another is to harm their Inward Light. Graham wrote a book entitled *Evolution and Empire* [95] concerning The Society of Friend's thinking on peace. He encouraged peace keeping at the

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90 Stanley, 39.

91 John William Graham, "The Meaning of Quakerism," [1990] unknown source, J.W. Graham's papers. See Stanley, 26.

92 W.C Braithwaite wanted to see a revisited Peace Testimony as well. The Yearly Meeting sent out a request to monthly Meetings in an effort to emphasize the Peace Testimony. See Stanley, 28.

93 Kennedy, 313-314.

94 Stanley, 39.

95 William Graham, *Evolution and Empire* (London: Headley Brothers, 1912).

international level and among people of all faiths and beliefs. The Yearly Meeting in London similarly proposed a clarified Peace Testimony. They stated that violence was an act of destruction against the divine spark in people.[96] Eddington was like-minded in his thoughts about peace keeping and internationalism.

In 1913 Eddington was offered a Plumian Chair at Cambridge, followed by his election to Fellow of the Royal Society the next year. He published his first book *Stellar Movements and the Structure of the Universe*[97] with good results. Eddington remained at the Greenwich Observatory for eight years before moving to Cambridge.[98]

World War One

Internationalism

Along with the rest of the world Eddington had to face the political and social realities of The Great War.[99] As a scientist and a Quaker his values were tested. The outcome of his personal struggle shows us how Eddington understood himself in a scientific and religious context and what happened when he was asked to choose between his science and faith.

As an academic Eddington was not sheltered from the affects of the war. In fact the

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96 Stanley, 28.

97 True to Eddington's style, this text was accessible outside of the field of astrophysics to general scientists. Herbert Dingle commented, "knowing nothing of the subject, never having heard the author, and attracted solely by the title, I acquired a copy, found its general meaning within my understanding, and thence forth saw the sky with new eyes." Douglas, 26.

98 Douglas, 25.

99 Eddington had attended the British Association meetings in Australia, along with Frank Dyson, when the war began. Upon his return to England the country had already been at war for three months. See Douglas, 92.

Astronomical Society was immediately affected. Official communications of the Royal Astronomical Society that had been running through Kiel, Germany were promptly cut.[100] Cooperation among scientists had officially ended leaving no way to officially communicate astronomical discoveries.[101] Internationalism was close to Eddington's heart; to see such a swift cessation in communication would have been disappointing. Beyond that serious repercussions were befalling conscientious objectors. These were individuals who, often for religious reasons, could not in good conscience participate in the war.

At the very onset of the war one of Eddington's colleagues, Ernest B. Ludlam, was imprisoned for conscientiously objecting to the war.[102] Ludlam had been a member of the Emergency Committee for the Assistance of Germans, Austrians, and Hungarians in Distress.[103] Eddington applied for his own conscientious objector status but Cambridge University had already provided his exemption. Cambridge avoided the unpleasantness of having an employee listed under conscientious objector status. They filed to have Eddington's exemption based on work of national importance. Once Eddington was registered as a scientist his application for conscientious objector status was never processed; it was a contradiction of terms to be understood as both religious and a scientist. [104]

Although the desire for solidarity was strong not all Quakers agreed about their level of

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100 Stanley, 81.

101 Later a neutral position in Denmark, controlled by the Copenhagen centre, resumed the central role. As the war progressed even that position required special permission from the War office. See Stanley, 81.

102 Stanley, 93.

103 This committee was formed to help displaced citizens in England unable to return home. A group of high profile men began the committee and placed its central headquarters in Westminster, next to the recruiting committee for the war. See Stanley, 93.

104 Stanley, 135.

participation in the war. Shortly after the war announcement two Quaker Members of Parliament joined the national cause. During the first wartime Meeting for Suffering,[105] Henry Marriage Wallis appealed to Quaker youth to recruit. More than two hundred did.[106] The official position of the Society of Friends concerning the war was left to the Friends who remained at home; theirs was a stance of pacifism and non-military involvement. One third of the Society of Friends ultimately supported the war. There remained an unknown number who were deeply confused about what to believe.[107] The society created acceptable Quaker alternatives for those members stirred to be active and to participate in some way. Friends created the Friends Ambulance Unit,[108] the Friends War Victims Relief Committee and also the Fellowship of Reconciliation.[109] The Young Men's Service Committee was also established during the highly anticipated Yearly Meeting in 1915. During this Meeting affirmation of the Peace Testimony was 'officially' encouraged. [110] With the tide of war sweeping over England it was clear that Quakers wanted to be active in a way that supported their faith. Eddington was no exception. One outlet for Quakers discussed by William Graham and Rufus Jones in particular was to actively seek pacifism through internationalism.[111] Quakers could promote international wellbeing over the sort of

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105 Friends formed a committee called the Meeting for Suffering, dating back to 1676, when Yearly Meetings were not in session. See Kennedy, 312-313.

106 Henry Marriage Wallis was a Friend who had aided war victims in the Balkans. Kennedy, 312-313.

107 Kennedy, 314.

108 The Quakers created the Friend's Ambulance Unit, a volunteer based nursing unit. The FAU became controversial and as the war progressed the unit became closely affiliated with military powers. Douglas 79.

109 The Fellowship of reconciliation was not exclusively Quaker, it came out of the Llandudno Conference. See Kennedy, 317. Also, Quakers did not limit themselves to helping only in defending countries, but helped in the other countries as well, including France, Holland, and Russian refugee camps. See Stanley, 92-93.

110 Kennedy, 317-318.

111 Internationalism was sought out among others in a variety of ways. Quakers supported the victims of war in other countries, promoting international wellbeing among the affected.

nationalism that caused conflict. As a scientist this was something that Eddington could engage in. In response to the war and in support of pacifism Eddington focused on internationalism in science.[112]

Among internationalists was H.H. Turner, a distinguished astrophysicist who had worked for the international cause. During the course of World War One he rejected his former view that science could be above politics. He believed that including the scientists of hostile nations would lower the bar of scientific achievement. He wrote an article to this effect that was published in the Oxford Notebook. Eddington was moved to respond to this fellow astrophysicist, who was also a public figure and former advocate of internationalism. Eddington made his own contribution to the Oxford notebook entitled, *The Future of International Science.* In it, he had written,

> I think that astronomers in this country realize the disaster to progress which would result from dissolution of partnership, and there is no disposition to belittle the contributions of Germany. Some of the problems of our science can only be attacked by world wide cooperation ... the lines of latitude and longitude pay no regard to national boundaries. But, above all, there is the conviction that the pursuit of truth, whether in the minute structure of the atom or in the vast system of the stars, is a bond transcending human difference – to use it as a barrier fortifying national feuds is a degradation of the fair name of science.[113]

Eddington saw beyond the confines of his particular lab, field of research and even country. Science became a unifying force in support of peace. Eddington wished to unite scientists through an appeal to internationalism as an example to the rest of the world. The replies to Eddington's address were conservative[114] and then filled with animosity.[115] As support for the war

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112 Stanley, 79.

113 Stanley, 88-89.

114 A colleague, Jospeh Larmor, replied to Eddington's address. Eddington wrote a letter to Larmour explaining his personal objections. See Stanley, 90.

grew opposition to conscientious objectors did too. The Quaker strategy, as was part of Eddington's strategy, was to humanize what had become a demonized people. German scientists had worked closely with British scientists before the war. These colleagues and comrades had not changed. When the war ended their expertise would continue to be valuable.[116] Eddington pushed for a science without boundaries. Artificial divisions did not have a place in the laws of science and were contrary to internationalism.

Quakers were identified as conscientious objectors and were increasingly unpopular. They were perceived as supporting the atrocities of the war when in fact their desire was to prevent, or end wars. Rufus Jones described the Quaker position as follows:

> In the clash of arms such waves of hate are generated that everybody who belongs even remotely to the enemy peoples is supposed to be himself an enemy and therefore treated as an outcast to be shunned by everybody. It seems difficult to remember, under such circumstances, how many innocent sufferers there are and how tragic are the experiences of those who are free from all complicity in wrong-doing but who have been caught in the great net spread for really dangerous enemy aliens. Friends could not forget sufferers and they knew, furthermore, that there were very many persons, even in the enemy countries as well, who were not enemies in act or spirit, who were not responsible for the war, who did not approve of barbarities, and who were eagerly praying for the tragedy to come to an end so that men and women and children might once more *live*.[117]

By humanising the enemy, by breaking down artificial boundaries, and reaching out indiscriminately with compassion, the Quakers attempted to bridge the gulf between nations and

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115 The Oxford Notebook's reply to Eddington's question ("What stands in the way of continuance of cooperation for the welfare of astronomers?") was as follows, "My reply to you is that the facts stand in the way – hard, horrible facts, such as we should not have believed possible before the war. He [Eddington] proposes to shut his eyes to these facts, and to test the situation by the play of our imagination in connection with some individual. Surely Prof. Eddington is here using his preconceptions formed before the war, and his own shirking from horrors, to help him in ignoring actual hard facts? Is it not an actual fact that babies have been killed in ways almost inconceivably brutal, and not as a mere individual excess, but as a part of the deliberate and declared policy of the German army? Is it not a fact that German men of science have gone out of their way to declare their adhesion to these things." Stanley, 91.

116 Stanley, 89.

117 Rufus Jones, *A Service of Love in Wartime* (New York: Macmillan, 1920), 3-4. See Stanley, 94-95.

hasten the end of the war. As the war progressed Eddington's colleagues at the Royal Astronomical Society were less inclined to support internationalism. It seemed impossible to believe that any citizen or scientist of Germany was not involved in the wrongs committed by their country and government.[118] Eddington held fast to his beliefs. He remained unwavering in his commitment for peace and internationalism.

The Cambridge Observatory was one of the most important in Britain and its staff could not operate without Eddington. The Cambridge Observatory had a large poster with a list of eligible men exempted and the reason for exemption; it listed only a single name.[119] Eddington was ultimately the sole staff member remaining exempt from the war.[120] Eddington's exemption status was not a light appointment. He was required to carry papers with him at all times. As opposed to Oxford, described as a highly patriotic university, Cambridge had a Friends Society and Socialist Society that encouraged pacifism. There was pressure on Cambridge to become more patriotic. Eddington did not succumb to the pressure. There was great tension in Cambridge and Eddington was being pressured by Trinity Fellows to use his exemption status to further the war effort.[121] There was growing concern about the large number of conscientious objectors in Cambridge, and discrimination of conscientious objectors was harsh.

As the war continued it soon become clear that there was an increased need for manpower. The government began revoking or shortening exemptions to the war, including those based on conscientious objections. Conscription was imposed in Britain in January of 1916.

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118 Stanley, 92.

119 It was policy that a large poster in the workplace described the list of eligible men exempted and the reason for exemption. See Stanley, 136.

120 Stanley, 133.

121 Stanley, 138-139.

Conscription was a difficult reality for a society that boasted personal freedom without government interference.[122]

True to their organized nature, with the announcement of conscription, Quakers met to discuss how to deal with it. Fighting was largely dismissed immediately. The question of alternative non-violent military service was up for discussion. The final word from London confirmed that military service and alternative military service contributed to the war effort and was contrary to Quaker beliefs.[123] Although this was the official position Friends tended to listen to their own voices. In the end Friends ultimately participated in the war at all levels. The Jesus Lane Meetings that Eddington attended came to the decision that alternative military service was up to the individual's conscience.[124] The initial confusion facing Quakers at the onset of war returned once more.

Conscientious Objector Status

Eddington was forced to revaluate his situation when his exemption was finally revoked. Scientists as well as scientific organisations were being called on to do their part for the war effort. To make matters worse scientists were used as soldiers, instead of applying their professional expertise. The British government was not particularly interested in injecting science or technology into the war.[125] Eddington could not, in good conscience, aid in the war

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122 Stanley, 125.

123 Stanley, 129.

124 Stanley, 139.

125 A 'Neglect of Science' Committee was formed to that effect, led by Lord Rayleigh. Scientists became useful as the country needed to replenish the chemical supplies they had formerly imported from Germany. See Stanley, 130-131.

effort in any capacity.

Revoking Eddington's status brought to a head the tensions that surrounded him. Eddington belonged to two opposing sides as a scientist and a Quaker. On the scientific front he was a Fellow of the Royal Society, Secretary of the Royal Astronomical Society and was fast becoming an important figure in the field of astronomy. As a scientist of Cambridge he was pressured to contribute to the war effort. On the other hand as a lifelong Quaker, from a long line of Quakers, Eddington had strong feelings about pacifism and active peace keeping. In one sense he was shirking his responsibility as a scientist unwilling to lend his services. In another way he belonged to the Society of Friends and felt the weight of British opposition towards pacifism.[126]

When Eddington's scientific exemption was revoked he stepped forward with a conscientious objection.[127] Eddington had been categorized as a scientist, exempt due to his scientific duties. It was unacceptable for him to *also* have religious objections. The categories of conscription did not allow for the possibility of a religious scientist.[128] There had been a case similar to Eddington's where a Quaker school teacher had applied for exemption on the grounds of national importance and conscientious objection. The tribunal turned him down for claiming to be both nationally valuable and religious. Ordinary Quakers were given special mention as a legitimate body of believers known for their pacifism. Any variation in Quakerism was cause for

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126 Stanley, 124. Politically based pacifism was quite new. Conscientious objectors were equated with the Society of Friends from the government's viewpoint. Stanley, 129.

127 Douglas, 93.

128 Any argument for exemption with a variety of reasons was not considered as a whole; individual claims were considered separately. Separate forms had to be filled out for employment, or conscientious objections, weakening any unified cases. See Stanley, 125.

suspicion. Birthright Quakers were most straightforward and secure. [129]

> The Cambridge Observatory tried to renew Eddington's scientific exemption saying,
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> In making application for the exemption of the Director, Prof. A. S. Eddington, it should be stated that in consequence of the death of the First Assistant [of the Observatory] in the explosion of the Vanguard, and of the death of the Second Assistant in action in France, the Director is the sole remaining member of the Staff.[130]

As a result a three month exemption was issued. An appeal followed and Eddington was put before the tribunal. At last he would have an opportunity to voice his religious objections, much to the anger of his colleagues.[131] Eddington's national importance was the official topic of the hearing. During the proceedings Eddington stated his conscientious objection though it was not a matter up for discussion. He pointed out that his initial application for conscientious objector status had been dismissed due to his scientific exemption. The tribunal decided to remove the scientific exemption and refused to address his Quaker beliefs. Eddington proceeded to reapply for a conscientious objector status before a Cambridge Tribunal. During the hearing he attempted to explain his position.

> My objection to war is based on religious grounds. I cannot believe that God is calling me to go out and slaughter men, many of whom are animated by the same values and patriotism and supposed religious duty that have sent my countrymen into the field ... Even if the abstention of conscientious objectors were to make the difference between victory and defeat, we cannot truly benefit the nation by wilful disobedience to the divine will.[132]

A cabinet level intervention would have been Eddington's last recourse. Lamor and Newall, colleagues of Eddington, attempted to provide him with a plausible scientific case for exemption.

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129 Stanley, 135.

130 Stanley, 145.

131 Stanley, 164.

132 Douglas, 93.

At this point Eddington would not consider an exemption based on his work alone. He insisted on being recognized as a conscientious objector in addition to any scientific exemption.[133] This nullified both the hard work of his colleagues and the exemption. Eddington resisted the pressure of his scientific community to aid in the war effort and declined an offer that did not support pacifism. Eddington wanted to be recognized as a conscientious objector despite the difficulties that entailed. This was all occurring at a time when objectors were being imprisoned.

Eddington the Adventurer [134]

It so happened that at that time Astronomer Royal, Frank Dyson, an old colleague of Eddington's, was mounting an expedition to test Einstein's Theory of Relativity during the 1919 eclipse. Eddington was somewhat of an expert on Relativity. During the war Eddington had been one of a few scientists to maintain communication with neutral and 'enemy' scientists.[135] Willem de Sitter, a scientist from the Netherlands was interested in this new theory of Relativity being developed by a German scientist named Albert Einstein. He had submitted a copy of the paper to Eddington along with his own thoughts in 1916 and 1917.[136] The Physical Society of London requested a report on Relativity from Eddington. He wrote and published it in 1918. Eddington had become the chief defender of Relativity. He later published a small volume called *Report on*

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133 Eddington "saw no shame" in the possibility of peeling potatoes in Northern Ireland alongside of other Quakers in internment camps. Miller, 51.

134 Quakers who actively sought peace during war times were known as 'adventurers.' Eddington was also recognized as an adventurer as he had taken part in the expedition to confirm the Theory of Relativity. See Stanley, 79.

135 Stanley, 96-97.

136 Douglas, 38.

the Relativity Theory of Gravitation.[137] Frank Dyson submitted a written statement to be read during Eddington's second hearing. In it he described the expedition being planned and requested Eddington's participation.[138] During an upcoming eclipse on May 29th, 1919 the sun would be in front of a bright field of stars. This would create the perfect environment for measuring deflection. Gravitational deflection was a plausible way of confirming Einstein's theory. The committee responded favourably to Dyson's request. Eddington's exemption was reissued for a year provided that he participate in the expedition. In an unexpected turn of events, Eddington was also recognized as a genuine conscientious objector. This additional confirmation would have pleased Eddington who was officially recognized as both an indispensible scientist and also a legitimate Quaker pacifist. Eddington maintained his role as a scientist but was adamant in using it for the greater cause of pacifism. It was not enough that he was recognized as scientifically invaluable, he felt that he needed to be understood as a conscientiously objecting Quaker as well. Eddington did not compromise his ideals. Even in a system that did not allow for religious scientists, Eddington was granted exemption from the war as a scientist and as a conscientious objector based on religious grounds. The armistice was signed just a few weeks later, relieving the pressure of being recalled once more.[139]

In regards to the expedition, Dyson was motivated by a technical curiosity that Eddington shared. In addition Eddington saw this as an opportunity to reach out to German researchers. The expedition would require international cooperation. Eddington would be travelling with one

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137 Stanley, 100-102.

138 Douglas, 94.

139 Arthur Miller, *Empire of the Stars* (Boston; New York: Houghton Mifflin Company, 2005), 51. Eddington's participation in the expedition was not primarily to escape conscription, as he was genuinely interested and knowledgeable about relativity. In fact he described the moment of experimental confirmation of relativity as 'the best moment of his life.' Douglas, 41.

group of scientists to Principe, an island near the coast of West Africa, while another group would be headed to Sobral in South America. The Royal Society and the Royal Astronomical Society were gathering their resources to send the teams on their way.[140] Eddington's hopes of confirming the Theory of Relativity were also high, as he held a keen interest in the outcome.[141]

Observations were collected at the end of an arduous journey to reach their destination. Despite some cloud cover and heat disturbances to contend with the observations made were sufficiently conclusive. There was an agreement between the results of the deflection and Einstein's value. The moment that Eddington confirmed this agreement he later described as the best moment of his life.[142] The results of the expedition were presented before the Royal Astronomical Society and the Royal Society. Dyson presented a report of the Principe and Sobral expeditions and discussed the possible implication of the results.[143] The results confirmed Einstein's theory of relativity.[144] There was great publicity behind the successful expedition. The names Einstein, de Sitter, Weyl and Eddington appeared daily in newspapers.[145]

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140 Stanley, 103.

141 Douglas has published a humorous but telling conversation that attests to Eddington's perceived commitment. Cottingham, a fellow accompanying Eddington on the expedition asked Frank Dyson "What will it mean if we get double the Einstein deflection?" to which Dyson replied, "Then Eddington will go mad, and you will have to come home alone!" It was not three months later when Eddington had examined his plates that he turned to Cottingham and said, "Cottingham, you won't have to go home alone!" Douglas, 40. Relativity was confirmed and Eddington was elated.

142 Douglas, 41.

143 Douglas, 42.

144 Stanley, 110.

145 Douglas, 42. See Appendix B: Photos of Eddington.

Road to Recovery

After the war Britain was recovering from the physical as well as the emotional effects of trench warfare. Demonization of the enemy continued long after the war had ended and it was a difficult struggle to promote internationalism especially between British and German scientists. The opinion remained that German scientists were at their very core barbaric and had recently shown themselves to be capable of cruelty. Arthur Shuster, who was born in Germany, was being pressured to resign his position at the Royal Society. German citizens were expelled from the Royal Society based on their nationality.[146] Scientific relationships shut down. Journals were no longer made available to German scientists and their own journals were not accepted.[147] This lasted for an additional year. Under those circumstances the expedition carried out by the Royal Astronomical Society was a tremendous sign of goodwill. British scientists were travelling across the world to confirm the theories of a German scientist. Einstein wrote an article for the *Times* after the initial piece about the expedition had been published. He supported the international effort behind the expeditions saying,

> After the lamentable breach in the former international relations existing among men of science … it was in accordance with the high and proud tradition of English science that English scientific men should have given their time and labour … to test a theory that had been completed and published in the country of their enemies in the midst of war.[148]

This was precisely Eddington's intention in participating in the expedition, to advance science in a way that united enemies of war. The expedition and findings helped to publically ameliorate

146 Stanley, 100.

147 Stanley, 98.

148 Stanley, 116.

the tensions between German and English scientists. Things were gradually starting to change; Einstein was chosen to receive the Gold medal of the Royal Astronomical Society.[149] The decades to follow would see the struggle to restore internationalism in science. Eddington continued his quest for peace and along the way accepted the position of president of the National Peace Council, an organization seeking peace in the time after the war.[150]

The war was popularly blamed on science, technology and the representatives of these fields. After the war England, along with the rest of the world, met with the theory of evolution and declining church attendance. There was a shift from natural theology to scientific naturalism. Materialist science was brought to Britain in the 1920s by advocates of communism and socialism. They wanted to see science applied to every aspect of life as in the new Soviet Union. Materialist, left wing scientists were localized in Cambridge, with Eddington being stuck in the middle. Eddington began directing his arguments against philosophical materialism and the moral materialism that many around him were advocating. Through the Gifford Lectures, the battle for public opinion had begun.

Popularizing Science and Religion

At the time of its introduction the Theory of Relativity did little to upset religion. There were philosophical and religious questions however that assumed the larger context of the debate between idealism and materialism. Eddington's writings such as *Space, Time and Gravitation*,[151]

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149 Unfortunately at the last minute, with a German as the elected candidate, the RAS chose not to give out a medal. Eddington wrote an apology to Einstein and nominated him again in 1920 without much of a response. Six years passed before Einstein finally received his medal. See Stanley, 120.

150 Stanley, 122.

151 Stanley, 192. Also of interest is Eddington's *Mathematical Theory of Relativity.*

began to explore the philosophical and scientific implications of Relativity Theory and opened the way for others. It was not until the end of the 1920s and into the 1930s that contemporaries like Joseph Needham attempted to integrate scientific and religious topics. In this way another religious scientist, James Jeans, was often mentioned in the same breath as Eddington. Though their ideas were distinct and often the source of great disputes between them, they were conflated in public opinion.[152]

Eddington engaged with the Theory of Relativity on all levels, through physics, metaphysics, philosophy and religion. Eddington understood the theory of relativity the same way that he understood all scientific work, with an integrated philosophical and scientific perspective. Matthew Stanley proposes that Eddington's reception of relativity fits in with the movement of liberal theology.[153] In liberal theology other sources were capable of having authority in religion. These included modern history, personal experience and also science.[154] Eddington was turning away from evangelical interpretations and towards a more liberal theology.

People like Rudolf Otto, William James and Friedrich Schleiermacher were all pointing to religious experience as the core of religion; Eddington's name was an addition to that list. Eddington identified experience as a link between religion and science. The value of experience was recognized both in relativity and also in religion.[155] This union of science and religion was not agreeable with everyone. Within the Church of England the worry about uniting science and religion persisted. The church thought this might lead to the rationalization and the eventual

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152 Stanley, 236.

153 Stanley, 154.

154 Stanley, 190.

155 Stanley, 192-193

elimination of religion leaving only science to guide the people. Eddington was at the forefront of those responding to these concerns. This question of the interaction between science and religion was addressed in an anthology edited by Joseph Needham entitled *Science, Religion and Reality*, published in the 1920s. This text in particular helped in part to build "a climate of opinion in scientific circles which was far more tolerant of religion."[156] Eddington contributed to the collection of essays. One review commented that Eddington's contribution supported mysticism. Mysticism could not be explained away through science nor could it conflict with scientific discourse. Ultimately science was not as impenetrable a fortress of knowledge as we might have suspected.[157]

Eddington's life was filled with research and writing of a scientific and religious nature. He became known for popularizing deep scientific thought. He appealed to his readers with a conversational writing style and colourful examples. He reassured people that they could hold onto their traditional beliefs while still moving forward into a modern world. [158] Eddington's writings did much for the reputations of scientists at a time when the nature of the scientific individual was under scrutiny. In combining science and religion he wrote *The Nature of the Physical World* (1928),[159] *Science and the Unseen World* (1929),[160] *New Pathways in Science* (1935)[161] and *The Philosophy of Physical Science* (1939),[162] texts of interest for this thesis.

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156 S. W. Sykes, "Theology," in *Twentieth Century Mind*, ed. C.B. Cox and A.E. Dyson (Oxford: Oxford University Press, 1972), 162. See Stanley, 190.

157 Taken from the response of J. W. N. Sullivan, review of *Science, Religion and Reality*, ed. Joseph Needham, *Times Literary Supplement*, November 12, 1925, 748. See Stanley, 190.

158 Stanley, 195.

159 Arthur Eddington, *The Nature of the Physical World* (London: J.M. Dent and Sons Limited, 1928).

160 Arthur Eddington, *Science and the Unseen World* (London: George Allen & Unwin Limited, 1929).
161 Arthur Eddington, *New Pathways in Science* (Cambridge: Cambridge University Press, 1935).

162 Arthur Eddington, *The Philosophy of Physical Science* (Great Britain: Cambridge University Press, 1939).

Matthew Stanley lists two themes that created popular appeal for Eddington. People perceived that traditional values had been forsaken, leading to the war. Alternately people felt that traditional values were being opposed, as with socialism. Eddington shared his belief that traditional values were defensible. It was acceptable to base our lives on our beliefs. As a scientist on the edge of modern research Eddington was also following the most modern religious trend by embracing liberal theology. This inspired and pleased liberal theologians of Britain.[163]

Eddington was also heavily criticized along the way. His criticism can similarly be grouped together into three sections. First, Eddington was criticised for talking about things outside of science. As a scientist he could only speak with authority on scientific topics. Philosophers in particular attacked his ability to speak philosophically.[164] Second, Eddington was criticized for being a religious scientist. As a scientist, it was necessary to separate his science from his religion. His movement from one to the other, blurring the lines, threatened the viability of science in a religiously dominated world. Third, Eddington was criticized for being too popular, for misleading people into thinking they could understand complex topics in science, religion and philosophy.[165]

Eddington was certainly discussing topics outside of his professional expertise. He was

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163 Popularity of liberal theology ended with the onset of WW II. See Stanley, 235.

164 Eddington described his work interchangeably as philosophy and scientific philosophy, as in *The Nature of the Physical World*. Stanley, 236. Critics include Susan Stebbing who wrote *Philosophy and the Physicist* (London: Methuen, 1937); W.T. Stace, C.E.M. Joad and Bertrand Russell. Russell initially responded positively to Eddington's writings. He consulted Eddington's work, particularly concerning the philosophical implications of Relativity Theory. After the publication of *The Nature of the Physical World*, which clearly described Eddington's spirituality and its connection with science, there was a shift in Russell's attitude towards Eddington. Russell no longer treated Eddington as a colleague with whom he had a professional disagreement, but rather Eddington had become a theological 'lackey' for him to criticise. See Stanley, 215ff.

165 Stanley, 236.

not a trained philosopher and his ideas ought not be judged as such. He was a religious scientist and made no apologies for it. In fact he effectively combined his faith and scientific research. Admittedly Eddington simplified scientific theories for greater accessibility for the general public, but his own understanding of their complexities would certainly have assured accuracy.

Having explored Eddington's temporal context, his upbringing, role models, career and Quaker faith, we are in a better position to appreciate his thinking. We turn now to the details of the main tenants of Eddington's thinking about the relation between science and religion.

Chapter Two

Eddington, Science and Religion

The Scientific Enterprise and Religious Experience

'Seeking' in Science and Religion

It is very illuminating to see how Eddington has linked science with his own religion of Quakerism. Several unique features of Quakerism enable it to coexist well with science. Quakers, for example, have a strong tendency to *seek* and they also do not have creeds or accepted formulas. Texts that promote unchanging beliefs can hinder seeking, as it may conflict with doctrine.[166]

Scientists are in much the same situation as Quakers in making sense of experiences and seeking out the truth. Eddington speculates that even the Quaker name 'Seeker' would appeal to 'the scientific temperament.'[167] Eddington emphasizes 'seeking' over 'finding.' The *spirit* of seeking is most important as is the *intention* behind the seeking. Finding may seem settled but it is in fact transitory because it changes from generation to generation. "It [finding] tarnishes rapidly except it be preserved with an ever-renewed spirit of seeking."[168] That is the same with science. Many things will be turned on their head in fifty years. Error is mixed with truth at times, in science and in religion, and we are 'impelled to strive' for that truth.[169] The attitude of

166 Eddington, *Unseen World*, 53.

167 Eddington, *Unseen World*, 53.

168 Eddington, *Unseen World*, 53.

169 Eddington, *Unseen World*, 16.

seeking over finding contrasts with the more conventional scientific mode of investigation, whereby the method is directed at obtaining results. In scientific observations, results and conclusions are the main intention and the journey is a means to achieve them.

Science and religion have a true spirit that finds expression in the same way, albeit with differing methods and results. Eddington asserts, "You will understand the true spirit neither of science nor of religion unless seeking is placed in the forefront."[170] Through seeking, science and religion are connected. Their methods of seeking are different but the action and desire is the same.

The spirit of seeking does not tolerate a creed. This leads to a second common feature of Quakerism and science. Eddington explains,

> If our so called facts are changing shadows, they are shadows cast by the light of a consistent truth. So too in religion we are repelled by that confident theological doctrine which has settled for all generations just how the spiritual world worked. But we need not turn aside from the measure of light that comes into our experience showing us a Way through the unseen world.[171]

If we sense that our questions have been settled and the answers put forth in a creed, there would be less of a need to seek. Quakers do not have the spiritual world mapped out; they are still learning and wondering. Their own experience guides them. Eddington asserts that, "Quakerism in dispensing with creeds holds out a hand to the scientist."[172]

Eddington suggests borrowing from Quakerism a statement that would serve scientists well.

These things we do not lay upon you as a rule or form to walk by; but that

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170 Eddington, *Unseen World*, 54.

171 Eddington, *Unseen World*, 55-56.

172 Eddington, *Unseen World*, 54.

> all with a measure of the light, which is pure and holy, may be guided; and so in the light walking and abiding, these things may be fulfilled in the Spirit, not in the letter; for the letter killeth, but the Spirit giveth life.[173]

The light is a point of orientation in our seeking and a part of our spirit. Rejecting a creed does not mean rejecting belief and it does not mean that one's beliefs are not strong. Quakers can believe that they are on the right path without accepting the details along the way as permanent. Similarly the scientist is not committed to the results of scientists that went before him, but will strive to test and improve what has been established. The reworking, reassessing and improvement of science is not a calamity but essential progress in the right direction. [174] It is not in the results that we obtain, but in the questions that we are prompted to ask that we measure the progression of knowledge.[175] Eddington describes an 'inner sanction for development' from God.

> Science can scarcely question this sanction for the pursuit of science springs from a striving which the mind is impelled to follow, a questioning that will not be suppressed. Whether in the intellectual pursuits of science or in the mystical pursuits of the spirit, the light beckons ahead and the purpose surging in our nature responds.[176]

The same spirit of discovery in science propels us forward in our spiritual lives. Here then is another very fundamental link between science and religion. Both are fueled by the same energy, coming from the same source, and leading us to different but valuable truths. Eddington follows the same purposeful 'surging' in his nature when he acts as an astrophysicist, as when he partakes in a Quaker sermon. Other individuals may more commonly only follow one expression of their Inner Light, in a scientific or a religious direction. Eddington was called to follow both.

The activity of the scientist can fulfill the spirit in the same way as the activity of a

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173 Eddington, *Unseen World*, 55.

174 Eddington, *The Philosophy of Physical Science*, 222.

175 Eddington, *New Pathways in Science*, 325.

176 Eddington, *The Nature of the Physical World*, 315.

religious experience. A mystic source within us may be satisfied through a search for knowledge and lead to self fulfillment, "The instinct to amass, perfect and glorify knowledge does not stand alone; it is akin to other instincts which claim the same acceptance, proceeding alike from a mystic source welling up in our nature."[177] Attaining knowledge fulfills an instinct from a mystic upwelling but it is not the only outlet for mystic upwellings. The scientist as well as the ordinary person would surely agree that knowledge is not the only outlet of merit in this life.

As our understanding of the world deepens and changes so does this desire to "seek out."[178] The results are not the desired end; the striving itself is the key. It is not knowledge that is valuable but the desire for knowledge. Eddington unites scientific and religious striving. The scientist uses his mind to understand physical phenomenon, while the religious person finds the spiritual through experience. Both are connected by a light that carries us forward. [179] There is an innate human purpose which finds fulfillment equally in science and religion.

Seeking is based on the belief that it is worthwhile to search and it is possible to find meaning in the world. Eddington points out that such an inner conviction of truth lies at the heart of many aspects of life.

> I have … pointed out that the attribution of religious color to the domain must rest on inner conviction; and I think we should not deny validity to certain inner convictions, which seem parallel with the unreasoning trust in reason which is at the basis of mathematics with an innate sense of the fitness of things which is at the basis of the science of the physical world, and with an irresistible sense of incongruity which is at the basis of the justification of humour. [180]

The validity of inner religious convictions parallel the validity of inner convictions in science. In

177 Eddington, *The Philosophy of Physical Science*, 222.

178 Eddington, *The Philosophy of Physical Science*, 222.

179 Eddington, *The Nature of the Physical World*, 315.

180 Eddington, *The Nature of the Physical World*, 335.

the case of the scientific world, there is a faith in our ability to reason, and in discernable factors of the world that we can understand and organize. Similarly in religious thought there are also convictions by which we orient our thinking. We recognize their function as an essential part of our nature.[181] In the same way that we can naturally accept beauty without having to defend its validity, so we can appreciate the spiritual world in the same naturally occurring, sensitive way.[182]

In the scientific task of observation the initial step is to first believe that what we see has significance. By the same token, "the mystic recognizes another faculty of consciousness, and accepts as significant the vista of a world outside space and time that it reveals."[183] When we compare how this knowledge is gained, it would "be wrong to condemn alleged knowledge of the unseen world because it is unable to follow the lines of deduction laid down by science as appropriate to the seen world."[184] Unfortunately, however, scientists often view religious knowledge as vague and undefined[185] as compared with their own precise observations. Religious knowledge seems lesser by comparison because of this lack of precision. The unseen world cannot be explored using the same tools as the seen.[186] This is the realm of the supra-rational. Eddington is thus asking a very pertinent question when he says: "What is the proper orientation of a rational being towards that experience which he so mysteriously finds himself partaking

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181 Eddington, *The Nature of the Physical World*, 335.

182 Eddington, *The Nature of the Physical World*, 335.

183 Eddington, *Unseen World*, 46.

184 Eddington, *Unseen World*, 46.

185 Eddington, *Unseen World*, 47.

186 Eddington suggests that religion relies on an unseen world and science relies on a seen world. It can be argued that a lot of theoretical science relies on unseen phenomenon which is only mathematically proven and that in fact a great deal of scientific work is unseen. As Eddington explains this in greater detail we see that there is a further division between metrical and non-metrical that is more significant.

of?'[187] That orientation is inclusive, and holistic. Science orders our experiences to make sense of our world. It is not always completely successful in its attempts, as it is confined to a physical description of the universe.[188] Religion on the other hand is not intended to describe those physical aspects of our environment but rather it deals with unseen aspects. Science and religion thus have a complementary role to play in understanding human experience.

In discussing human experience Eddington believes that sense impressions are not the whole reality. Eddington defines experience as an interaction with one's environment. He confirms,

> If religion is not an attitude towards experience, if it is just a creed postulating an ineffable being who has no contact with ourselves, it is not the kind of religion which our Society [The Society of Friends] stands for. The interaction of ourselves with our environment is what makes up experience.[189]

Eddington argues that scientific experience, organized in experiments via the scientific method, finds parallels with religious experience, even though religious experience is not so clearly defined. Religious experience is the foundation of religion in the same way that scientific experience is the key to science. For Eddington it is through personal religious experience that we can find affirmations of God.

> The desire for truth so prominent in the quest for science, a reaching out of the spirit from its isolation to something beyond, a response to beauty in nature and art, an Inner Light of conviction and guidance—are these as much a part of our being as our sensitivity to sense impressions?[190]

Indeed they are. Observing the physical world solely in scientific terms will not allow us to fully

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187 Eddington, *Unseen World*, 27.

188 Arthur Eddington, "Chapter IX: Professor Sir Arthur Eddington," in *Science and Religion,* ed. Joseph Needham (London: Gerald Howe Limited, 1931), 119.

189 Eddington, *Unseen World*, 25.

190 Eddington, *Unseen World*, 27.

appreciate the world. We respond to aesthetic things in life that exist 'beyond' our scientific conceptions. There are things like "feelings, purpose, [and] values [that] make up our consciousness as much as sense impressions." [191] When we follow our sense impressions they lead us to the physical world. When we follow these other aspects of value, they lead us to an unseen world. Those aspects not confined to a 'metrical system' and not existing within space and time deserve consideration.

There is a spiritual world alongside of a physical world, even if it cannot be scientifically defined or described, from which experience comes. Eddington understands that the methods used in exploring sensory and non-sensory experience are different. He says,

> All I would claim is that those who in the search for truth start from consciousness as a seat of self knowledge with interests and responsibilities not confined to the material plane, are just as much facing the hard facts of experience as those who start from consciousness as a device for reading the indications of spectroscopes and micrometers. [192]

Religious and scientific explorations are quite equally dealing with reality, and real concerns, though they use differing approaches. Going beyond simple physical observation does not imply straying from reality.

Science and religion have the ability to guide us and to be involved in our lives because they are experientially based. Human experience fundamentally links science and religion. The experiences themselves differ but their core as lived realities are the same.

Experience unites science and religion, but paradoxically also safeguards religious belief against being falsified by science. Scientific dogma gained through scientific experience cannot shake the belief and understanding gained through religious experience. Eddington states,

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191 Eddington, *The Nature of the Physical World*, 310.

192 Eddington, *The Nature of the Physical World*, 278.

> I doubt whether there is any assurance to be obtained except through the power of the religious experience itself; but I bid him hold fast to his own intimate knowledge of the nature of that experience. I think that will take him closer to the ultimate truth than codifying and symbolizing can reach.[193]

This firsthand experience is essential. In regards to science addressing God's existence Eddington states, "If I may say it with reverence, the soul and God laugh together over so odd a conclusion."[194] The experiments of science, for all its achievements, cannot approach spiritual experiences.[195]

So for Eddington religion and science are ultimately experientially based. The experiences of science do not conflict with the experiences of religion. The findings of science do not conflict with religious experience, and without religious dogma, there is no cause for conflict. Both religious and scientific experience deal equally with reality, and address reality. Our experiences extend beyond sense impressions into the unseen world. As we travel through seen and unseen territory the same spirit of seeking, coming from a higher power, guides our search.

Symbols and Experience

Another point of contact between science and religion is in the interpretation of information. In its explorations and descriptions of the physical world science eventually brings

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193 Eddington, *Science and Religion*, 128.

194 Eddington, *Unseen World*, 43.

195 There are of course scientists and Christians who disagree with that perspective. This is explored further in chapter four.

us to a world of symbols.[196] The physicists' equations are filled with symbols and these symbols are not easily explained. It is not the physicist's task, suggests Eddington, to find the meaning beyond the symbol.[197] Symbols that make up the scientific world come from metrical data, while the symbols of the spiritual world come from within human consciousness. Given this distinction, let us see how Eddington seeks to unify these two worlds of discourse.

Eddington describes a 'background to pointer readings.' He suggests that given the absolute nature of our values, they must, "Belong to the background, unrecognized in physics because they are not in the pointer readings but recognized by consciousness which has its roots in the background."[198] The key to understanding the entirety of physics rests in our consciousness. Our consciousness is rooted in the background against which we can understand these symbols.[199] Symbols, says Eddington, are in fact grounded in reality. Our consciousness gives color and meaning to the symbolic world.[200] What is behind the pointer readings is of a nature "continuous" with our minds.[201] We have a connection with the physical in a way not tapped into by science, because science is limited to the symbol. By integrating the scientific perspective with other aspects of the seen and unseen world we will arrive at a whole picture of reality.[202] Science is necessarily reductionist. It deals with observations of the physical world, but

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196 This is not to suggest that religion does not make use of symbols, as of course it does. Eddington instead focuses on the symbols of science.

197 Eddington, *Unseen World*, 20.

198 Eddington, *Nature of the Physical World*, 317.

199 Eddington, *The Nature of the Physical World*, 317.

200 Eddington, *The Nature of the Physical World*, 317.

201 Eddington, *The Nature of the Physical World*, 318. It is important to note that Eddington did not wish to put this forward as a complete theory. See Eddington, *The Nature of the Physical World*, 317ff.

202 Eddington, *The Nature of the Physical World*, 278.

reality encompasses more than the physical world. Symbolization takes us beyond the physical world. Through our use of symbolic language we are able to point to that which is beyond our physical world and, indeed, beyond ourselves.

When we have a personal relationship with the spiritual it cannot be reduced to something which can be understood by the 'method of physics.' Such a relationship, says Eddington, is a, "mental and spiritual nature of ourselves, known in our minds by an intimate contact transcending the methods of physics … that stirring of consciousness transmutes the whole story and gives meaning to its symbolism."[203] More than giving symbols meaning, we are even beyond the symbol. We are beings to whom the truth matters and are intimately connected with the truth because of our intimate contact with something greater, by means of our consciousness.[204]

Eddington attempts to describe this spiritual world by saying, "Whilst therefore I contemplate a spiritual domain underlying the physical world as a whole, I do not think of it as distributed so that to each element of time and space there is a corresponding portion of the spiritual background."[205] That is to say, there is a spiritual background but it does not mirror the physical but rather has its own character.

Eddington invites us to "picture … consciousness, not this time as a bundle of sense impressions, but as we intimately know it, responsible, aspiring, yearning, doubting, originating in itself such impulses as those which urge the scientist in his quest for truth."[206] It is here we find a truer representation of ourselves. The quest of science is the quest for truth, however it takes more than an impassionate observer to be a scientist. It requires the whole of our being.

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203 Eddington, *Unseen World*, 24-25.

204 Eddington, *New Pathways in Science*, 321.

205 Eddington, *New Pathways in Science*, 322.

206 Eddington, *Unseen World*, 26.

Here we begin to see the complex and unique interaction of science and religion. The spiritual world emerges from our consciousness while the scientific world is built of mathematical symbols. Science and religion have their own domains, one of the physical world and one underlying both physical and also spiritual. Both explain our experiences and reality in their own way. Both deal with their own realms of knowledge.

Science and the Verification of Religious Experience

On its own terms, science can no more define God than empirically accept his existence. Eddington postulates that if scientists did care to seek out God on their own terms the conflict might be great indeed.

> And yet if the scientist were to repent and admit that it was necessary to include among the agents controlling the stars and the electrons an omnipresent spirit to whom we trace the sacred things of consciousness, would there not be even graver apprehension? We should suspect an intention to reduce God to a system of differential equations. [207]

If we were to scientifically admit that such a being exists, another set of problems would arise. For then we would use our primitive methods of science to define and dissect the personality of God, and perhaps we might not like what we find. God would exist as a scientific description.

> But what else could we expect. If we confine ourselves to the methods of physical science we shall necessarily obtain the group structure of the religious experience – if it has any … If our method consists in codifying, what can we possibly obtain but a code? If the scientific method is found to reduce God to something like an ethical code, this is a sidelight on the nature of the scientific method, I doubt if it throws any light on the nature of God.[208]

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207 Eddington, *The Nature of the Physical World*, 272.

208 Eddington, *New Pathways in Science*, 318.

The method has determined the form of the results. Eddington points out the worry that analysing God may lead to the discovery that he is not but 'a personification of abstract principles,' because of the scientific method. This reflects the nature of the inquiry, and not the nature of the subject. [209] The role of the human being is essential in knowing intimate truth. [210]

Eddington acknowledges the difficulty of looking at the line of division between a material and spiritual world solely from the perspective of the scientist.[211] He confirms that "From this [material] side all that we could assert of the spiritual world would be insufficient to justify even the palest brand of theology that is not too emaciated to have any practical influence on man's outlook." [212] When science is encouraged to support religion, therefore, any harmonious coexistence is lost. Eddington describes a pseudo natural science intruding into the spiritual realm.[213] He does not advocate using science to confirm religious thought. In fact, he believes that such an attitude is detrimental to both the fields of science and religion. Specifically:

> Sanctify[ing] … revelations of science by accepting them as new insights into divine power is liable to grate a little on the scientific mind, forcing its free spirit of inquiry into one predetermined mode of expression; I do not think that the harmonising of the scientific and the religious outlook on experience is assisted that way.[214]

It is a burden to science to be the discoverer of truths that substantiate religious faith. It is also incompatible, as the tenants of science are open to revision in a way that faith is not. Science is based on a foundation of continuous improvement and revision. There is a constant process of re-

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209 Eddington, *Science and Religion*, 128.

210 Eddington, *Science and Religion*, 128.

211 Eddington, *The Nature of the Physical World*, 335.

212 Eddington, *The Nature of the Physical World*, 335.

213 Eddington, *Unseen World*, 32-33.

214 Eddington, *Unseen World*, 16-17.

evaluation and testing to improve theories. Scientific discoveries that carried the weight of religious implications would have limited freedom to change. Eddington says that in science, the drive to discover is always present however, "the ideal of what constitutes scientific explanation has changed almost beyond recognition."[215] Religious faith cannot be built on such unsettled ground. Basing religious thought on scientific fact is not irreligious, to Eddington, but abstaining reflects 'a tidiness of the mind' that prevents mixing scientific research and religious inference.[216] In the same way that religion would not benefit from a scientific backing, so science would not benefit from an intrusion into its efficient method. This is not to say that science would not benefit from elements of creativity, value and a sense of aesthetics in its scientists. But Eddington asserts, "It is part of our contention that there exists a wide field of research for which the methods of physics suffice, into which the introduction of these other aspects would be entirely mischievous." [217] The methods of physics, in addressing problems of physics, are well defined and efficient, based on years of revised research. It is not advisable to insert aspects of human religious experience where it is out of place.

Eddington believes that a conflict between science and religion can be avoided if both resign themselves to their own particular field with naturally occurring points of connection. The key to establishing peace is to clearly understand the differences and boundaries between science and religion.[218] Eddington notes, "The religious reader may well be content that I have not offered him a God revealed by quantum theory, and therefore liable to be swept away in the next

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215 Eddington, *Unseen World*, 20.

216 Eddington, *Unseen World*, 17.

217 Eddington, *The Nature of the Physical World*, 334.

218 Eddington, *The Nature of the Physical World*, 336.

scientific revolution."[219] Religion cannot be based on science, or discoveries found in the natural world. The scientific method simply does not allow for it.

Quakers have questioned why they should not use examples of divine perfection from the scientific realm.[220] Eddington claims that those who ask this question do not fully understand the meaning of what they are asking. He acknowledges that analogies may be useful between science and religion, however, the consequences may be more far reaching and unpredictable than imagined. "If ever scientific law makes a serious inroad into the spiritual domain the consequences will not be limited to supplying texts for sermons,"[221] says Eddington. Here we see the respectful separation once more. Eddington believes that science has a symbolic language which is ill suited to describe spiritual realities.[222] He suggests, "There is a kind of unity between the material and the spiritual worlds—between the symbols and their background—but it is not the scheme of natural law which will provide the cement."[223] That is, in and of themselves the symbols of science and religion cannot provide a common background between the two universes of discourse.

Our religious faith can and must also exist independently of our scientific perspectives. The scientific explanation of our existence will not give meaning to, or a foundation for, our spiritual lives. We may well feel impelled to seek the truth about the existence of our planet, about the origin of our species or about the nature of our consciousness. Exploring the answers to these questions may certainly be intensely interesting, but should not, Eddington states, create

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219 Eddington, *The Nature of the Physical World*, 338.

220 Eddington, *Unseen World*, 32-33.

221 Eddington, *Unseen World*, 33.

222 Eddington, *Unseen World*, 33.

223 Eddington, *Unseen World*, 33.

anxiety in us. The answers to these questions will not change our spiritual realities. Our spiritual experiences are quite independent of these scientific discoveries about the nature of ourselves and the world. [224] Science operates well within the physical world, while spirituality operates in an unseen world and both come together in that totality we think of as human experience.

The Interaction of Science and Religion

Eddington sometimes seems to be torn between the exactness of physical science, and the far reaching insight of spirituality. As a well known scientist he carefully weighs the merit of each field, and perhaps after some soul searching questioned, "I am not sure that the mathematician understands this world of ours better than the poet and the mystic. Perhaps it is only that he is better at sums."[225] Eddington has discovered, even as a dedicated astrophysicist, that mathematical equations are not a precondition to happiness or a life well lived. There are truths beyond the practicality of science. Understanding comes in many forms.

Eddington can accurately describe natural phenomenon through scientific means. When he considers his descriptions, he notes that they are accurate and precise. Still, a part of him cannot help but want more. There is something lacking in his descriptions, not lacking by scientific standards, but lacking by human standards. As a person with thoughts and hopes and dreams, Eddington is not satisfied by a one dimensional description. He wants to fully know a phenomenon, and approach it from all different sides.

Eddington described wave formation using a standard text of hydrodynamics, that

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224 Eddington, *Science and Religion*, 120.

225 Eddington, *New Pathways in Science*, 324.

described, through mathematical equations, the point at which wind can form waves and when gravity waves appear. He contrasts this examination of waves with another creative examination, an excerpt from a poem written by Rupert Brooke entitled *The Dead.*[226] In setting these two interpretive descriptions of waves against each other, each perspective becomes immediately distinct and valuable in their own right. Eddington proposes that, "Life would be stunted and narrow if we could feel no significance in the world around us beyond that which can be weighed and measured with the tools of the physicist or described by the metrical symbols of the mathematician."[227] More than knowing about additional significance, Eddington suggests that we can *feel* that significance. Eddington is deeply connected with realms outside of science.

He affirms that, "Starting from aether, electrons and other physical machinery we cannot reach conscious man and render count of what is apprehended in his consciousness."[228] What we cannot reach is a morally responsible person, who is rational, and who pursues the truth. Eddington is concerned with what is outside of the physical world, and points out to scientists that not everything has a physical basis.[229]

Eddington muses that, "It is almost as though the modern conception of the physical world had deliberately left room for the reality of spirit and consciousness."[230] There are things that the world of science will miss, without having realized that anything is missing. When we discuss God, we are not confined to explore the idea of God in the same realm in which atoms and electrons are explored. Eddington gives the example of an alien visiting our planet on

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226 See Appendix B for Rupert Brooke's Poem *The Dead IV.*

227 Eddington, *The Nature of the Physical World*, 305.

228 Eddington, *The Nature of the Physical World*, 329.

229 Eddington, *The Nature of the Physical World*, 330 ff.

230 Eddington, *New Pathways in Science*, 320.

Armistice Day, and trying to deduce the cause of the cessation of silence. The alien observer experiences two minutes of silence and understands it to be the result of a natural force, like the cessation of light during an eclipse. The silence has a significance that cannot be predicted by observing the natural laws of physics. Eddington continues on to say,

> If God is as real as the shadow of the Great War on Armistice Day, need we seek further reason for making a place for God in our thoughts and lives? We shall not be concerned if the scientific explorer reports that he is perfectly satisfied that he has got to the bottom of things without having come across either.[231]

The scientific method will obtain only those results that are able to be calculated, measured or observed. Eddington is not trying to suggest that science is losing its explanative powers, or that it is not in a position to contribute to 'human development and culture' but rather that we are starting to distinguish the ways in which it is contributing.[232] Eddington harkens back to the personal experience we have of God, saying, "If we claim that the experience that comes to us in our silent Meetings is one of the precious elements that makes up the fullness of life, I do not see how science can gainsay us."[233] Eddington's faith remains unthreatened by his scientific work.

Our personal experiences of God are valuable and protected. Eddington advises caution before integrating scientific discoveries with religious revelation, as science might take away more from religion than can be sustained. Religion, and feeling, being outside of measurement, would not have a place in a scientific system.[234]

Eddington's purpose, then, is twofold. He wants to set aside a place where science can function and grow in ways unimpeded by religion, and as well, to allow us room to explore what

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231 Eddington, *Unseen World*, 41-42.

232 Eddington, *New Pathways in Science*, 324.

233 Eddington, *Unseen World*, 30.

234 Eddington, *Unseen World*, 30-31.

lies behind those scientific experiences. They are two separate areas of thought, motivated by a single driving impulse, with differing methods and outcomes, differing kinds of knowledge, but always oriented towards truth.

The Scientific Enterprise and Human Consciousness

Humans and their Cosmological Context

Eddington's interest in astronomical phenomenon led him to consider the origin of the universe, our galaxy, our planet and our species. Cosmology is a source of great interest and contention in religious and scientific communities. Eddington devised a way of thinking about cosmology that sought to put to rest any conflict. Eddington was a pioneer in that he was a scientist who stressed that physical phenomena were only part of a larger picture. There was a physical world and an unseen, spiritual world.

In considering cosmology Eddington often pairs scientific topics with everyday examples and religious analogies.[235] Eddington often used biblical language in his scientific descriptions. At the beginning of his lecture *Science and Religion* Eddington describes the creation event. He uses the phrase 'strange doctrine of science' to describe the events that led to the formation of our planet.[236] Eddington describes scientific events occurring at 'the Beginning'[237] and during

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235 Though Eddington has been criticised for stepping outside of his area of expertise in making these observations, he none the less felt compelled to share his thoughts without apology.

236 Pairing *science* with the words *strange doctrine*, automatically puts religion into our thoughts. The use of biblical terms is not altogether surprising given that the lecture's audience, Quakers, would respond to religious terminology. See Eddington, *Unseen World*, 9.

237 Eddington, *Science and Religion*, 130. Notice the capitalization of the word 'Beginning' giving added significance.

'days of creation.'[238] This presents a mix of biblical mythology and scientific hypothesizing.

By using such methods of comparison Eddington makes the distant and abstract seem intimately familiar and understandable. Eddington compares the differences in the mass of new born stars, for example, with the masses of new born babies, eliciting a familiarity not associated with stellar masses. Eddington was known for making obscure scientific theory accessible to the general public. His use of everyday or religious language enables him to effectively communicate scientific thought to his audience.[239] He does not, however, go beyond religious allusions. He strictly rejects the notion of intermixing religious and scientific concepts in support of each other.

Contrary to traditional biblical doctrine Eddington acknowledges that our world is not the centre, nor the 'hub,' of the universe.[240] In describing the rest of the galaxy our own insignificance becomes most acute.[241] Eddington considers cosmologically induced humility to be healthy. [242] Our world is physically unimpressive, save for the fact that life evolved on our planet. Out of the initial chaos emerged order in the form of regular, identifiable patterns. Those elements which were formed at the planet's conception are now being discovered. The precursors and building blocks of life were enabled in the distant recesses of time, leading to our universe and everything in it.[243]

Though Eddington describes atomic interactions, the formation and collision of matter,

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238 Eddington, *Unseen World*, 10-11.

239 As discussed in chapter one, footnote164, this led to extensive criticism of Eddington.

240 Eddington, *The Nature of the Physical World*, 165.

241 Eddington, *The Nature of the Physical World*, 165.

242 Eddington, *Science and Religion*, 118.

243 Eddington, *Unseen World*, 12-13. For example, these include the ninety-two elements of the periodic table whose discrete number ensures great diversity but also limitations.

and other strictly scientific events, there is a driving force behind them - Nature.[244] Nature is the personified and driving force behind creation. Giving a capitalized name and gender (feminine) to this force seems to lessen the randomness associated with world-building. Nevertheless, Nature does make mistakes and is unpredictable. Eddington refers to 'Nature's Arithmetic,'[245] and 'Nature's Experiments.'[246] Nature is capable of having a plan,[247] experimenting [248] and making mistakes before reaching "her greatest achievement Man" or perhaps her greatest mistake.[249]

Many scientists, of course, think of humans as a mere accident, and a very insignificant accident when they are seen in a cosmological context. But Eddington says that the human accident was metaphorically, 'looked after' by the feminine force of Nature.[250] Humans were bestowed with "a certain stirring of restlessness, in the organ called the brain."[251] We were thereby given the ability to learn and grow, and to take care of ourselves. These descriptions of humankind, though intermixed with religious terminology, are still scientific descriptions of our significance in the physical world. Eddington continues,

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244 Eddington capitalizes the word Nature as the force behind creative events. As described in chapter three Eddington perceives a connection between God and Nature. In naming the random force 'Nature,' it was perhaps a more suitable choice than calling it God. Eddington does not deny the randomness associated with creation, nor is he hesitant to use words like 'accident' in describing the events.

245 Eddington, *Unseen World*, 16.

246 Eddington, *Unseen World*, 25.

247 Eddington, *Unseen World*, 12.

248 Eddington, *Unseen World*, 12.

249 Eddington, *Unseen World*, 15.

250 Eddington's use of non-inclusive language i.e., 'man' and 'mankind' reflects the accepted language of the time. His attributing "Nature" with a feminine gender may have greater significance than just an arbitrary choice, however his views on gender issues are outside of the scope of this thesis. Furthermore, any specific thoughts on gender are not apparent in his published works.

251 Eddington, *Unseen World*, 15.

> For exact science invokes, or has seemed to invoke, a type of law inevitable and soulless against which the human spirit rebels. If science finally declares that man is no more than a fortuitous concourse of atoms, the blow will not be softened by the explanation that the atoms in question are the Mendelian unit of characters and not the material atoms of the chemist. [252]

There is something not quite human about science, in that it is 'soulless' and without the sensitivity of the human spirit. People tend to fight against it for that reason. We will not find the entire meaning of humankind within the realm of science. That is why it is so important to cultivate an appreciation of these other areas.[253]

Eddington addresses questions of human significance in the face of scientific descriptions of insignificance. The significance of our species is found outside of our biological origins. Our significance is outside of even the physical world and rests in an unseen world. Eddington explains, "He ['man'] displays purpose in an inorganic world of chance. He can represent truth, righteousness, sacrifice. In him there flickers for a few brief years a spark from the divine spirit. Are these as insignificant as he is?"[254]

Despite our accidental beginnings we seem to have purpose, drive and direction in a chaotic world. Armed with our consciousness we stand for things that have meaning.

Eddington suggests that we have innate qualities that make us human and color our view of our environment. Given the gift of consciousness, Eddington asserts that, "Whatever we have to apprehend must be apprehended in a way for which our intellectual equipment has made provisions." [255] We perceive in a way that we are able. Eddington explains that we have a

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252 Eddington, *The Nature of the Physical World*, 243-244.

253 Eddington, *The Nature of the Physical World*, 243.

254 Eddington, *Science and Religion*, 118.

255 Eddington, *The Philosophy of Physical Science*, 115.

predetermined 'form of thought' where we fit observational knowledge. This means that non-sensory knowledge sometimes gets forced into that frame of thought and becomes descriptive of a non-metrical, spiritual world. The knowledge that we have is predetermined by our ability to receive a particular form of it. So, says Eddington,

> The realisation that physical knowledge is concerned only with structure points the way by which the conception of man as an element in a moral and spiritual order can be dovetailed into the conception of man as the plaything of the forces of the material world.[256]

Our conception of ourselves is influenced by 'forms' of physical knowledge, so much so that we become defined as another physical form in the material world. Our view of humankind is determined by our perspective on the material world and the elements therein. Further along these lines Eddington explains,

> It is a natural suggestion that the greater difficulty in elucidating the transcendental laws is due to the fact that we are no longer engaged in recovering from Nature what we have ourselves put into Nature, but are at last confronted with its own intrinsic system of government. [257]

We must consider the possibility that what we find in the world is what we have put into the world and ultimately reflects the nature of our thinking as much as the nature of the objective world. Again, preconceived forms reflect our thought patterns and are projected onto the outside world. Transcendental laws are outside of that scope and are more difficult to conceptualize.

Given a scientifically accurate description of the human organism, there is clearly still more to say. People are more than their biological descriptions. Humans have value and significance beyond their physical circumstances. Where science describes the physical creation of the planet and the chance occurrences of life, spirituality joins in to explain purpose and

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256 Eddington, *The Philosophy of Physical Science*, 223.

257 Eddington, *The Nature of the Physical World*, 239.

meaning. Eddington has found a way, through personification of natural forces, to familiarize us with even the abstract and random. Eddington asks the question outright, "Does this prodigality of matter, of space, of time find its culmination in Man?" [258] Eddington's own response to this question is a very clear yes.

Humans and the Apprehension of Beauty and Truth

One aspect of human significance is an appreciation of beauty and truth.[259] Though not scientifically quantifiable this human capacity has meaning for Eddington, both spiritually and scientifically. Eddington sees a connection between beauty, the natural world, and spirituality.

The scientific paradigm does not take beauty into account. The scientific approach remains the reductionist approach in this respect. We may find a complete description of science to be rather incomplete when it comes to meaning. Eddington gives the example of the Blessed Damozel, a character from a famous poem by Dante Rossetti, whose appreciation of the earth, and of life, was rich and meaningful.[260] Eddington introduces the notion of an Einsteinian understanding of the earth, through curvature of space time. He elaborates, "If the Blessed Damosel[261] sees the earth in the Einsteinian way she will be seeing truly – I can feel little doubt

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258 Eddington, *The Nature of the Physical World*, 169.

259 It is of interest to note that beauty, love and truth are a familiar trio. The absence of love as a non-metrical quality in the thought of Eddington seems striking. In listing valuable elements outside of science, love would be a favourite choice. It is, after all, the central theme in Christianity, and cited in I Corinthians 13. It is possible that Eddington's own sexual orientation inhibited him from speaking of love? See footnote 76.

260 See Appendix C for Dante Rosetti's poem *The Blessed Damozel.*

261 Eddington's original spelling of the word Damozel has been retained as 'Damosel.'

as to that – but will she be *missing the point*." [262] We may be accurate and yet miss a deeper meaning.

For Eddington beauty is often found in connection with nature. Let us consider an idyllic scene described by John Hoyland quoted in *Science and the Unseen World.*

> There is an hour of the Indian night, a little before the first glimmer of dawn, when the stars are unbelievably clear and close above, shining with a radiance beyond our belief in this foggy land. The trees stand silent around one with a friendly presence. As yet there is no sound from awakening birds; but the whole world seems to be intent, alive, listening, eager.[263]

At its conclusion the author states that, "the veil between the seen and unseen becomes so thin as to interpose scarcely any barrier between the eternal beauty and truth and the soul which would comprehend them."[264] This feeling of merging with nature beyond the barrier of human and non-human attests to the degree of connection sometimes experienced with the natural world. There is no observable, scientific explanation as to why we would feel drawn to nature or why we would respond as we do. There is no excuse for the mystic thought that overtakes our minds and sense impressions.[265] The strictly scientific mindset cannot appreciate these moments but Eddington can. He understands it as an essential part of experience. Being so essential and yet so absent from the all inclusive, explanative powers of science, troubles the thoughtful Eddington.

The fact that we can experience this connection attests to the appreciative capacity in our nature. In the course of human experience there have "arisen minds capable of transmuting the

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262 Eddington, *Science and Religion*, 123-124.

263 Eddington, *Unseen World*, 28-29.

264 Eddington, *Unseen World*, 29.

265 Eddington, *Unseen World*, 29.

bare structure into the richness of our experience." [266] It may not be the biological purpose of an organism to perceive richness and beauty none the less it seems to be a part of our experience to understand it in that way. In one of Eddington's more memorable quotes he suggests, "We cannot say that the rainbow, as a part of the world, was meant to convey the vivid effects of colour; but we can perhaps say that the human mind as a part of the world was meant to perceive it that way." [267] We cannot attribute scientific purpose where there is none, however we can acknowledge that we have an ability to recognize value. As beings existing in the world, we have a way of interacting with our surroundings which makes beauty and value obvious. If we so readily appreciate these things then in experiencing them we are fulfilling that aspect of our nature.

An appreciation of beauty is significant because it is in our nature and that nature comes from a greater power,

> In our own nature, or through the contact of our consciousness with a nature transcending ours, there are other things that claim the same kind of recognition – a sense of beauty, of morality, and finally at the root of all spiritual religion an experience which we describe as the presence of God.[268]

Eddington groups beauty, morality, spirituality and the experience of God, together. We experience these in the same way, in the same category. Eddington can connect many aspects of his life by finding the beauty in them and thus linking them to spirituality. This is the fulfillment of our nature for "the mystic influence of a scene of natural beauty is right and proper for a human spirit."[269] Natural beauty impacts us in a mystical way. Even as scientists we do more

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266 Eddington, *The Nature of the Physical World*, 322.

267 Eddington, *The Nature of the Physical World*, 316.

268 Eddington, *Science and Religion*, 126.

269 Eddington, *The Nature of the Physical World*, 324.

than observe the world impartially; as people we also appreciate the world on a human level. This ability is not a fault but a gift from a greater power. Eddington asserts,

> If likewise the spiritual world has been transmuted by a religious color beyond anything implied in its bare external qualities, it may be allowable to assert with equal conviction that this is not a misrepresentation but the achievement of a divine element in man's nature. [270]

We ought to trust our ability to feel for the natural world and trust our inner sense of value[271] as they tap into something divine, and drive us to pursue ideals though they are beyond our reach.[272] We have an inner compass that allows us to trust in the good of what we perceive.

In science, as in religion, we sometimes have an idea of what is correct. Eddington continues, "We trust some inward sense of fitness when we orient the physical world with the future on top, and likewise we must trust to some inner monitor when we orient the spiritual world with the good on top."[273] People make judgements of significance, either based on their own power, or on a higher power. Even in science we must be convinced by the significance of what we see. Any attempts to order or examine the physical world require that at least. [274] In spirituality we may have convictions which our nature pushes us to hold on to. As with science we can be influenced by what we think is correct.[275]

Our inner convictions are our compass on a spiritual journey.[276] It is also useful in our scientific endeavours. Obviously we are entrusting ourselves to a greater source of truth, power,

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270 Eddington, *The Nature of the Physical World*, 322.

271 Eddington, *The Nature of the Physical World*, 323.

272 Eddington, *The Nature of the Physical World*, 323.

273 Eddington, *The Nature of the Physical World*, 325.

274 Eddington, *The Nature of the Physical World*, 321.

275 Eddington, *The Nature of the Physical World*, 324.

276 Eddington, *Science and Religion*, 130.

and goodness, and not just in an appreciation of beauty but in an orientation in life. We have two alternatives, says Eddington. Either absolute values do not exist, or they do. And if they do, then we must,

> Trust optimistically that our values are some pale reflection of those of the Absolute Valuer, or that we have insight into the mind of the Absolute from whence come those strivings and sanctions whose authority we usually forbear to question. [277]

Our trust and orientation towards the good guides our experiences, sensory or spiritual. The Absolute Valuer, who has many names, is both a part of our nature and beyond our human nature. Eddington is tied to what he calls 'innate convictions,' and also the ability to test those innate beliefs that we hold to be true. This power to test our own ideas, "can be nothing less than a ray proceeding from the light of absolute Truth, a thought proceeding from the absolute Mind."[278] Truth comes from one source, and though our seeking takes on different forms, we come back to that origin. Scientists as well as the religious minded are seeking after truth from the same source.

Defending religion, in Eddington's view, takes on the same form as a defence of an aesthetic outlook; both seem to occur naturally in people and rest outside the scope of science. Eddington specified, "The sanction seems to lie in an inner feeling of growth or achievement found in the exercise of the aesthetic faculty and equally in the exercise of the religious faculty."[279] The aesthetic and religious faculty are separate, but from the same inner sanction. Referring to aesthetic beauty Eddington states, "It is akin to the inner feeling of the scientist which persuades him that through the exercise of another faculty of the mind, namely its

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277 Eddington, *The Nature of the Physical World*, 318. This calls to mind Descartes thoughts on perfection. Eddington has been called a modern-day Descartes. Stanley, 218.

278 Eddington, *Science and Religion*, 130.

279 Eddington, *New Pathways in Science*, 317.

reasoning power, we reach something after which the human spirit is bound to strive."[280] Eddington suggests that the scientist feels something that innately persuades him of the value of a scientific mindset. It is the same way with religion, whereby we feel compelled to a truth. For Eddington, "the harmony and simplicity of scientific law appeals strongly to our aesthetic feelings. It illustrates one kind of perfection, such as we might perhaps think worthy to be associated with the mind of God."[281] This is an argument that continues to be heard today, taking the form of aesthetic appeal.[282] Eddington is moved by the scientific simplicity that is so apparent and sometimes so beautiful to a physicist or mathematician. On the other end of the spectrum, sometimes complex intricacy is inspiring. The beauty that is undefined by science and unreachable by the scientific method is found within the inner workings of physics.

Eddington does not believe that scientists are wholly concerned with atoms, electrons and reality while religious seekers are limited to significance and values. He does not agree with scientific philosophers that, "science, being solely concerned with correct and colorless description, has nothing to do with significance and values."[283] For Eddington, "Truth and untruth belong to the realm of significance and values."[284] Science can contribute to conversations regarding the significance of our universe and lives. Eddington distinguishes between an official attitude and the actual attitude taken by scientists. The official attitude entails a scientist solving problems, without a concern for how they came about. The reality is that scientists go beyond the scientific attitude. As people our concerns are far reaching. In a specific example of addressing

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280 Eddington, *New Pathways in Science*, 317.

281 Eddington, *Unseen World*, 32.

282 Einstein, for instance, is quoted to have said, "When the solution is simple, God is answering."

283 Eddington, *Unseen World*, 38.

284 Eddington, *Unseen World*, 38.

the public, for instance, scientists go beyond the purely scientific paradigm as beings who have values and to whom the truth matters.[285] In interpreting the results, the creativity involved mirrors one's own insights and values. The specialized field of physics cannot accommodate or explain the depth and breadth of the human spirit in its responses to values or spiritual matters. In science one can appreciate the significance and value of truth. As we come to accept beauty, truth and value as a part of ourselves, the world, and even science, our strictly scientific thinking can expand to accommodate a fuller picture of reality. Otherwise, one may lose sight of the most important part of experience.[286]

The creativity that we inject into the world, in appreciation, or sentimentality, cannot be measured or seen. It is, scientifically speaking, an interpretation that Eddington has called 'illusion.'[287] Truly, we do not know reality through scientific means; we know 'the skeleton of reality.' [288] The rest, outside of symbols and equations, we have filled in using our imaginations. Essentially Eddington describes the process whereby the stimulus we receive is a skeleton and the mind clothes that skeleton with familiar associations. These familiar associations are pleasing and, 'quite illogically we are glad,' as a result.[289] When we appreciate something, not based purely on objective merit but subjective interpretation, we are essentially creating an "illusion" that is not scientifically substantiated. Our minds may be the source of this creative-illusion but it is also the source of reality. As we interpret the data of our lives we chose that interpretation as

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285 Eddington, *Unseen World*, 38.

286 Eddington, *Unseen World*, 38-39.

287 In some ways this is an unfortunate use of the term 'illusion.' Illusion inevitably conjures up Freud and his famous *Future of an Illusion*. Eddington's thought, however, is far from that of Freud.

288 Eddington, *The Nature of the Physical World*, 307.

289 Eddington, *The Nature of the Physical World*, 306-307.

reality. Eddington continues by saying, "Deeper than any 'form of thought' is a faith that creative activity signifies more than the thing it creates." [290] The creativity in and of itself is of intrinsic worth and comes from a greater power. Eddington suggested that if we followed the path that physics sets out, we would find the world bereft of 'createdness.'[291]

Eddington, as a physicist, understands the nature of the physical world. It leaves no place for the sort of unstructured creativity that we may find in our lives. Without the spiritual element, all is left formless and void. Eddington explains,

> I must excuse myself from attempting a solution. The operation of cutting out illusion in the spiritual domain requires a delicate surgical knife; and the only instrument that I, a physicist, can manipulate is a bludgeon which, it is true, crushes illusion, but at the same time crushes everything of non-material significance and even reduces the material world to a state of uncreatedness.[292]

The physicist is not equipped to work in the spiritual world, as subtleties outside of the metrical would not be grasped. There are also a great many other aspects of everyday life resting outside of its scope.[293] Eddington suggests that,

> the first step in a broader revelation to man must be the awakening of image-building in connection with the higher faculties of nature, so that these are no longer blind alleys but open out into a spiritual world—a world partly of illusion no doubt, but in which he lives no less than in the world, also of illusion, revealed by the senses. [294]

Image building is a way for us to conceive of what exists beyond the physical world. We may use

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290 Eddington, *The Philosophy of Physical Science*, 222.

291 Eddington, *Science and Religion*, 130.

292 Eddington, *Science and Religion*, 130.

293 Eddington, *New Pathways in Science*, 316. Eddington does not understand why religion would be so singled out when there are other aspects of experience, outside of the physical, that are not accommodated by the pattern of physics. Among a number of possible answers, we may speculate that religion stands out as an area once in possession of great power, rivalling scientific discoveries for control.

294 Eddington, *The Nature of the Physical World*, 311.

those images to find truth. These conceptions of images may serve as a tool to expose us to a spiritual reality.[295]

An experience based on feeling, creativity, or illusion does not immediately mean it is not worthwhile. We must consider this more carefully. Eddington questions the truthfulness of a reality beneath and beyond the mystical illusions that we have.[296] We may experience, from nature, what was not projected in nature but what we recognize as projected *by* nature. Our experiences may be shaped by our own personal, pleasing inclinations. This does not automatically rule out the possibility of deeper meaning. Eddington clarifies,

> Of course I do not mean that we can arrange the details of the scene; but by the light and shade of our values we can bring out things that shall have the broad characteristics we esteem. In this sense the value placed on permanence creates the world of apparent substance; in this sense, perhaps, the God within creates the God in Nature. [297]

Eddington, finding God in a still, quiet voice, looks to the world and hears echoes of that divinity. In his appreciation of God, he has an appreciation of nature, of science, of beauty, of morality, of truth, and projects a sense of peace and seeking. Eddington has no desire to rid us of the creativity or 'illusion' in our religious experiences, and points out its existence in scientific practice as well.

Science is not without its own illusion. We once thought that we could quite accurately imagine the atom and its nature in a way more precise than our description of the transcendent. Things like consciousness, beauty and humour were obscure in comparison. Since then, this picture of atoms as billiard balls, has become outdated. Eddington adds

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295 Eddington, *The Nature of the Physical World*, 307.

296 Eddington, *The Nature of the Physical World*, 307.

297 Eddington, *The Nature of the Physical World*, 317.

> As for the external objects, remorselessly dissected by science, they are studied and measured, but they are never known. Our pursuit of them has led from solid matter to molecules, from molecules to sparsely scattered electric charges, from electric charges to waves of probability. [298]

The atomic model may have seemed more definite, as it was a scientific description, but it was quite erroneous. Like everything else the atom comes down to pointer readings associated with an unknown background. We may begin by thinking that we have understood but in the end mystery may be resumed, leaving us questioning once more. Our questioning resumed, we find ourselves at a higher level. We have at the very least eliminated a possible explanation, and learned from our error. Through amelioration there is growth. Through experience and creativity we understood, as accurately as possible, however we were still under an incomplete impression of the truth.

We have an element of creativity that enables us to conceptualize and appreciate the spiritual world. Eddington calls this creativity illusory, in that it cannot be objectively measured. We may turn our backs on 'illusion' and return to the hard facts of experience: pressure, force, gravity and mathematical equations. However, the world is truly made of molecules, of atoms and of electrons that we lose sight of. The material world is more than what we see at face value, and has an underlying truth. Therefore physical reality is also bound to illusion, as it rests disconnected with its descriptive symbols and remote sensory experiences. Though we may use creativity to interpret our extra-sensory experiences in a way that is illusory, science is also bound to a world that is not free of such 'illusions.'

Eddington cherishes creativity, or illusion making, as a gift from divinity and holds the experience of creative-illusion as a fulfillment of our nature. He states,

> It is, however a very one-sided view of truth which can find in the glorious colouring of our surroundings nothing but misrepresentation—which takes

298 Eddington, *New Pathways in Science*, 322-323.

> the environment to be all-important and the conscious spirit to be inessential. [299]

Our interpretations are of great significance, as they utilize our spirit and connection to a greater power. Our consciousness, choosing to see the world as it does, is fulfilling its creative nature. Eddington stresses the importance of spiritual experience. How else are we to fill in our perspective of the transcendent, to connect with nature, than by using our minds? We have an appreciation that is not objectively discernable. Eddington warns us, "The spiritual element in our experience is the creative element, and if we remove it as we have tried to do in physics on the ground that it also creates illusion, we must ultimately reach the nothingness that was the Beginning."[300] Our discussion of illusion continues in chapter three where we consider it in the context of mysticism.

Referring back to the creation event, perhaps, Eddington prefers not to exist in a world that is 'uncreated.' A balance must exist between the physical environment, understood in a purely scientific way, and an aesthetic or spiritual appreciation. Eddington is careful to point out that he does not rank an intellectual, scientific appreciation as lower than a mystical appreciation, nor can one take the place of the other. Here we see the complexity of Eddington's thought. Both fields are indispensible in their own right.

In summation, the beauty and truth that we discover is very much present in all aspects of life, whether it be natural beauty or the beautiful simplicity of a mathematical equation. Our capacity to appreciate beauty, and to recognize good, comes from a higher power. We fulfill aspects of our nature by appreciating the world aesthetically, for Eddington that happens in science and faith. That process of appreciation can be interpretative, and uses elements from our

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299 Eddington, *The Nature of the Physical World*, 321.

300 Eddington, *Science and Religion*, 130.

imaginations to better conceptualize the truth. Just as in mystical experience we use elements of our consciousness to understand our reality, so in science we use our values and sometimes creativity in interpretive ways. Science and religion are united by their inclusion of beauty, values, truth and creativity, all of which fulfills our nature as people and connects us with a greater power than our own.

It is important to note that Eddington is not a trained philosopher. Some of his ideas do echo those of famous philosophers. His ideas on truth and beauty, for example are similar to those of Descartes[301] who said that our notion of perfection must stem from a Perfect Being as we (being imperfect) would be unable to conceive of it in our imperfect state. But Eddington's thought on this matter is not nearly as rigorous as that of Descartes. Neither are Eddington's ruminations on human consciousness meant to lay a foundation for epistemology. Eddington is a scientist by training and not a philosopher. He was criticized by philosophers who seemed to resent his forays into what they considered to be their fields of expertise.[302] But Eddington should not be judged as a philosopher. His work may not have philosophical rigour, but he is still an important figure in the discussion about science and religion. Much of his significance lies in the fact that he was well known in his day as a populariser of difficult ideas and concepts. He was able to present his ideas on science and religion in an accessible way. The fact, however, that he was such a successful populariser has tended to obscure from the public view the deeper religious dimensions of his thought. It is to those deeper dimensions that we now turn.

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301 See footnote 277.

302 See footnote 164.

Chapter Three

Eddington's Religious Thought

Rudolf Otto

While Eddington addressed topics in physics and mystical religious experience in England Rudolf Otto was writing about holiness in Germany. Although there is no evidence to suggest that they were familiar with each other's work their thoughts on religion share similarities. In particular Otto's conception of the *numinous* resonates with Eddington's own thoughts on religious experience.

Rudolf Otto was born in 1869 near Hanover, Germany. Little is known of his childhood or upbringing. He was the son of a merchant and attended a local gymnasium during his early school years. He later studied at the Universities of Erlangen and Göttingen in Germany. With his university training Otto began a lifelong career teaching theology. His academic pursuits were only briefly interrupted by a short stint in Prussian politics. Much like Eddington Otto lived during a time of political and religious upheaval.[303]

Das Heilige, Otto's most famous work, was published in 1917 as World War One was coming to an end. Translated as *The Idea of the Holy*[304] it was of central importance to his career. *The Idea of the Holy* is the core text of Otto's work with earlier texts foreshadowing its arrival

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303 While living in Germany Otto lived through World War I, the Treaty of Versailles, the Weimar Republic, the rise of the National Socialist movement and the election of Adolf Hitler to power. His death in 1937 followed injuries from a previous accident. Rudolf Otto, *The Idea of the Holy* (New York: Oxford University Press, 1977), xi.

304 Eric Sharpe was right to observe that, "Rudolf Otto's English translator was foolish to render *Das Heilige* as 'The *Idea* of the Holy.' An imperative does not become an idea without losing much of its force." E. Sharpe, *Nathan Soderblom and the Study of Religion* (Chapel Hill, NC: University of North Carolina Press, 1990), 211. See Melissa Raphael, *Rudolf Otto and the Concept of Holiness* (Oxford: Clarendon Press, 1997), 5.

and later texts exploring it in greater detail.[305] Philip Almond, an Ottonian scholar, suggests that "the clarification of the core of religion, and of its connection to religion's rational factors, is the overall aim of *Das Heilige*, and indeed, of Otto's work as a whole."[306] Furthermore, as the subtitle suggests, Otto's aim was to enquire "into the non-rational factor in the idea of the divine and its relation to the rational."[307] This thesis concerns itself with that non-rational, numinous core. Additional texts that directly pertain to the numinous are *A Supplement to the Idea of the Holy*,[308] *Das Gefühl Des Uberweltlichen (Sensus Numinis),*[309] and *Mysticism East and West.*[310]

Das Heilige responds to the religious ideologies at the time of its inception. The nineteenth century was a time of secularism and rationalism among religious elite. Romantic and liberal Protestants were concerned with the high class nature of Christianity and its place as a religion among other colonial faiths.[311] Otto's own historical circumstances, influences and sources are of importance in exploring the origin of his thought. This thesis, however, is only concerned with the final product of the numinous categories compiled in *Das Heilige.*

The categories of the numinous act as a heuristic device in exploring Eddington's

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305 Philip Almond, *Rudolf Otto: An Introduction to his Philosophical Theology* (Chapel Hill: University of North Carolina Press, 1984), 8.

306 Almond, 26.

307 From Rudolf Otto's complete title: *The Idea of the Holy: An Inquiry into the Non-rational factor in the idea of the divine and its relation to the rational.*

308 Rudolf Otto, *A Supplement to The Idea of the Holy* (Oxford: Oxford U.P, 1931).

309 Rudolf Otto, *Das Gefühl Des Uberweltlichen* (München: C.H. Beck'sche Verlagsbuchhandlung, 1932). Texts that were not expected to sell in large quantity were not translated from German into English, leaving only a German copy in publication.

310 Rudolf Otto, *Mysticism East and West* (New York: Macmillion, 1970).

311 Raphael, 3.

religious thought. Otto's categories are used exclusively for this purpose.[312] Using a term of Bernard Lonergan's, I am using the categories of the numinous to "spiral" further into the meaning of Eddington's thought on religion.[313]

Das Heilige, although composed by Otto, contains a composite of ideas originating from past German theologians.[314] Otto had been influenced by a number of great thinkers in his lifetime and *Das Heilige* reflects these influences. Raphael compiled a list of Otto's formative influences starting with Luther, Ritschl, Kant,[315] Schleiermacher,[316] Troeltsch[317] and later Neo-

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312 The word heuristic comes from the ancient Greek *heuristskein*, meaning "to find." The field of heuristics is a field of discovery, of seeking and finding. Heuristics originated with Plato in ancient Greecian geometry. Plato assumed a solution to a geometrical problem and worked backwards to what he knew, or else started from the known and worked forwards to a desired result using analysis and synthesis respectively. Since its origin as a mathematical method heuristics have been used in everyday decision making. Gerd Gigerenzer, Peter M. Todd and the ABC Research Group, *Simple Heuristics that make us Smart* (Oxford: Oxford University Press, 2001). Heuristics are also used in academic disciplines. Andre Delano Abbot, *Methods of Discovery: Heuristics for the Social Scientists* (New York: W.W. Norton and Co., 2004).

313 Bernard Lonergan, *Method in Theology* (Darton, London: Longman & Todd Limited, 1971), 208. To clarify, however, it is not the aim of this thesis to use Lonergan's method. Heuristics have been used as part of theological methodology. Lonergan describes different heuristic uses in *Method in Theology.* In describing the transcendental method, Lonergan describes its functions, one of which is heuristic. In the heuristic function, inquiry transforms an unknown into a known. Lonergan suggests that, "Within method the use of heuristic devices is fundamental. They [heuristics] consist in designating and naming the intended unknown, in setting down at once all that can be affirmed about it, and in using this explicit knowledge as a guide, a criterion and/or a premise in the effort to arrive at a fuller knowledge." Lonergan, 22. Understanding is heuristic in that it 'brings to light the relevant data.' See Lonergan 188-191. Before we can begin to understand we gather relevant data heuristically. The gathering of this data however is impacted by who we are as we approach the question. Another example, closer to our use of heuristic devices, is found in Hans-Georg Gadamer's text, *Plato und die Dichter* where he interprets Plato's utopia as a heuristic device. In this way, Plato's *Republic* acts as a model. This model is not identical with what it models, but stands as a heuristic device for understanding what is being modeled. See Hans Gadamer, *Plato und die Dicher* (Frankfurt/Main: Klostermann, 1934).

314 For additional information see J. Oman, *The Natural and the Supernatural* (Cambridge: Cambridge University Press, 1931).

315 Eddington was also highly influenced by Kantian philosophy.

316 Otto was concerned, like Schleiermacher, with the essence of religion, beyond the morality and the rationality that had been layered upon it. For Otto as well as Schleiermacher feeling the holy, beyond thinking, is most important and the beginning of all religions. Raphael, 60. The connections between these thinkers are extensive and many can be found in *The Idea of the Holy.*

317 From Troeltsch came Otto's "pluralistic worldview and his concern for the autonomy of religious consciousness," believing as well, "the premise of Troeltsch's religious-historical school, the task of theological is the psychological analysis of religious consciousness." Raphael, 66.

Fresianism.[318] Otto's own contribution lies in his phenomenological approach, methodological contributions and development of the connection between non-rationality and holiness. Otto was also responsible for popularizing the term *sensus numunis*, the non-rational element of holiness.[319] Otto claims that holiness belongs to the sphere of religion although it is ineffable in eluding rationality.[320] Holiness is not narrowly restricted to ethics, rationality or morality as we associate it today. Otto wants to isolate that part of the holy that contains non-rational elements.[321] That isolated meaning, outside of rationality and morality, is what Otto has called the numinous.[322]

Defining our terms becomes problematic. Otto's terminology is often beyond rational definition and comprehension. Furthermore the numinous is a term whose meaning must be 'evoked' and only by those who are capable of 'deeply felt religious experience.'[323] Nevertheless, the following description attempts to introduce the numinous as a concept. The numinous is wholly other from what is found in the natural world. It can also induce a numinous state of mind. That numinous state of mind necessarily occurs while experiencing the *numen.*[324] This numinous state of mind is *sui generis;* it is unable to be properly defined as it is 'primary datum.' The *numen* itself is the original apprehension that later becomes conceptualized as God. It

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318 Otto often makes reference to the concept of *Ahndung*, as created by Fries. See Otto, *The Idea of the Holy*, 145-7.

319 D. Bastow, "Otto and Numinous Experience," *Religious Studies* 12 (1976):176. See Raphael, 71.

320 Otto, *The Idea of the Holy*, 5.

321 Otto also adhered to Barth's Dialectical Theology, "recognizing objectivity and reality as the source of revelation and divinity and ... the grounding of religion ... [which] can not be totally grasped rationally." Almond, 3.

322 From the Latin word *numen*, combined with omen becoming ominous and the numinous. Otto, *The Idea of the Holy*, 6-7.

323 Otto, *The Idea of the Holy*, 8.

324 Raphael, 8.

originates as an 'unspecified divinity.'[325] To approximate the meaning of the numinous we can discuss what resembles it through metaphor and analogy. These approximations may stir recognition and awaken the numinous in one's spirit.[326] Both the state of mind and what is being experienced is called numinous. Over time the numinous was integrated into religious systems and has become morally and theologically meaningful in a religious context. The original numinous experience is at the core of all religions, linking all religions. That numinous core is an emotional, reactionary response to the presence of a divine, transcendent power.[327]

The elements of the numinous as described in *Das Heilige* contribute to a deeper understanding of the *numen.*[328] These categories will be explained in the following pages along with their illuminating connections to Eddington's thought. Towards the end of this chapter we discuss the Quaker Sermon of Silence, where the numinous presence is clearly experienced. Whether or not Eddington experienced the numinous as Otto described is really not the focus of this chapter. Incidentally it seems clear that he has experienced the numinous, as there are quite a few parallels. However, our goal here is to clearly explore the depth of Eddington's own thoughts using these categories. Eddington's experiences do not need to be described as numinous in order to be meaningful, however his thought certainly benefits from the comparing and contrasting with the *numen* as understood by Otto.

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325 Raphael, 8-9.

326 Otto, *The Idea of the Holy*, 7.

327 Raphael, 61-62.

328 It is not the intention of this thesis to justify the existence of the *numen* or 'numen praesens,' but rather to use the terms and their categorical descriptions as a useful heuristic device illuminating Eddington's thought.

Rational and Non-Rational

Otto begins his description of the numinous by first distinguishing between the rational and the non-rational. The existence and interaction of rationality and non-rationality is the foundation upon which we can consider the numinous. For this reason additional emphasis will be placed on understanding these concepts. Otto has taken up a longstanding tradition that emphasizes the non-rational in religion. Specifically the rational and non-rational have been interacting throughout Christian history. Otto first encountered the non-rational essence of religion in Martin Luther's writing and then in the Old Testament 'religious awe.'[329] To define our terms, let us begin with the rational. An object that can be thought of, understood intellectually, analyzed or defined is rational. A religion is rational when it has knowledge about God and conceives of his attributes. When we conceive of God we tend to do so rationally. The attributes that are limited and restricted in us are often understood as absolute and whole in God. This rationality is constructive in that it allows *belief* to be possible as opposed to just feeling. Christianity is superior to other religions, according to Otto, partly because of its ability to conceptualize, know and believe things about God. Through faith we learn *things* about God. Rationality is innately expressible through language. Language lends itself to actual ideas and concepts whereas what lies behind or beyond language is not so easily communicated. What lies behind all of these rational assertions and expressible ideas is a supra-rational subject that is rationally inexpressible and requires an alternate, deeper sort of comprehension and communication.[330] Otto explains, "Beneath this sphere of clarity and lucidity lies a hidden depth,

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329 Almond, 29.

330 Otto, *The Idea of the Holy*, 2.

inaccessible to our conceptual thought, which we in so far call the non-rational."[331] Rationality and non-rationality are primarily based on objects and secondarily based on ones thinking or feeling about objects. An object that can be thought of is rational. A non-rational object is not within "the domain of … conceptual understanding"[332] and it essentially cannot be thought of or described.[333] Despite emphasizing the non-rational Otto recognizes the legitimacy of the rational in religion. Rationality derives from, and is related to, a non-rational core.[334] Otto advocates pursuing the rational before ever seeking the non-rational. He says, "I feel that no one ought to concern himself with the *Numen ineffabile* who has not already devoted assiduous and serious study to the *Ratio aeterna.*"[335] The non-rational is not a facile entrance into religion but a path that may be taken after careful study of rational religious elements.

The interaction between the rational and non-rational is of particular interest to Otto.[336] In the section *Analogies and Associated Feelings* Otto's term *Schematizierung* refers to a 'schematization' which explains the relationship between the rational and the non-rational. The non-rational is schematized by the rational. [337] One example is that of holiness. Holiness was initially comprised of the non-rational until it underwent schematization. It was schematized using moral, doctrinal and ethical considerations turning it into something quite rational. Otto likens the 'interpenetration' of a rational religious consciousness with the non-rational to the

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331 Otto, *The Idea of the Holy*, 58

332 Almond, 56.

333 To describe the indescribable is, of course, difficult. We may only go so far, and then point into the distance, at a presence. Also, though the numinous is found in a non-rational core, it is not *irrational*.

334 Almond, 26.

335 Almond, 27.

336 Almond, 9.

337 Otto, *The Idea of the Holy*, 45.

"interweaving of warp and woof in a fabric." [338]

It is clear that we will not reach the numinous if we restrict ourselves simply to rational assertions. The numinous is based on belief and feelings rather than deducible, logical fact. Rational elements can be penetrated by non-rational ones.[339] These are not incompatible or unrelated methods. Rationality will only take us so far, revealing only according to the questions we have asked and the methods we have used. The remaining distance must be covered non-intellectually. Concerning the numinous Otto tells us,

> To know and to understand conceptually are two different things, are often even mutually exclusive and contrasted. The mysterious obscurity of the *numen* is by no means translated into unknowableness. Assuredly the '*deus absconditus et incomprehensibilis*' was for Luther no '*deus ignotus*.'[340] And so, too Paul 'knows' the peace that passeth understanding.[341]

Otto teaches us that we can know things deeply and with certainty without having an intellectual conception of its form.

Having explored Otto's foundation of rationality and non-rationality we may wonder how Eddington, as a scientist, might react to the notion of non-rationality as a bearer of knowledge. Right away for the scientific mind this notion may be difficult to accept.[342] Let us consider an example of Eddington's that might explain his perspective. In chapter two of *The Philosophy of Physical Science* entitled *Selective Subjectivism* Eddington tells an interesting story. An ichthyologist casts a net in the ocean and scientifically classifies his catch. He determines two

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338 Otto, *The Idea of the Holy*, 46.

339 Otto, *The Idea of the Holy*, 47.

340 *Deus absconditus et incomprehensibilis* translates into 'the hidden and incomprehensible God.' This hidden, incomprehensible God is not a, *Deus ignotus*, 'an unknown God.'

341 Otto, *The Idea of the Holy*, 135.

342 Within the framework of the scientific method, the entirety of truth cannot be found. Science is restricted to rational objects in a rational world using the scientific method. Science covers a world that responds to laws that can be measured, observed, and are suited to experimentation and observation with repeatable results.

repeatable generalizations. First, that no sea creature is less than two inches long. Second, that all sea creatures have gills. An observer objects to these two generalizations. He recognizes that with a two inch net sea creatures of a smaller size are not catchable. Eddington claims the problem rests in the two respective subjects. The observer is referring to the entire ocean of fish. The scientist is not concerned with the fish belonging to an objective or subjective class but rather a catchable class. When a net of specific sensory and intellectual equipment is directed towards the ocean that is physical science there will be restrictions on what can be discovered. To make things clearer, Eddington explains himself quite fully.

> The catch stands for the body of knowledge which constitutes physical science, and the net for the sensory and intellectual equipment which we use in obtaining it … Dropping the analogy, if we take observation on the basis of physical science, and insist that its assertions must be verifiable by observation, we impose a selective test on the knowledge which is admitted as physical. [343]

Eddington's illustration was directed towards selective subjectivism, however it also illustrates other points pertinent here. First, there are limits to the kinds of knowledge that are observationally verifiable. Second, the method determines the results. The scientific method used will dictate the sort of results obtained. In the same way that the non-rational cannot be grasped using purely rational reasoning, wider reality cannot be recognized through strictly scientific means. This is an unexpected statement coming from a scientist, but quite characteristic of Eddington's thought. Let us move a bit closer to Otto's thinking by introducing Eddington's thoughts on metaphysics.

Pertaining to the metaphysical sphere outside of physical science Eddington suggests, "Those who are dissatisfied with anything but a purely objective universe may turn to the metaphysicians, who are not cramped by the self-imposed ordinance that every assertion must be

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343 Eddington, *The Philosophy of Physical Science*, 16-17.

capable of submission to observation as the final Court of Appeal."[344] Eddington recognizes that there are unseen things in the world that are beyond the logic of science. In fact his text entitled *Science and the Unseen World* goes to great length to describe such topics.

As Otto divides the rational and the non-rational Eddington divides the metrical, or measurable, and the non-metrical. In his book *The Nature of the Physical World* Eddington wrote, "I venture to say that the division of the external world into a material world and a spiritual world is superficial, and that the deep line of cleavage is between the metrical and the non-metrical aspects of the world."[345] Eddington often connects with spirituality through the material world, however the difference between measureable and non-measurable is more prominent in his scientific career. Eddington separates aspects of the world that require science, measurement and sense experience with aspects of the world that do not. This includes 'the unseen world,'[346] governed by all things non-metrical and often spiritual. Eddington believes that humankind has not been created exclusively to respond to sense impressions and rational elements.[347] Instead we are meant for another kind of experience that is non-scientific. When we turn away from sense impressions we are in fact turning towards our true calling: the unseen world. Eddington proposes that we yearn towards the spiritual world because that is where we belong. The net of science does not fall close to these waters.

Eddington continues with the initial division and describes another division that results from it. There is a division between the world of the scientist and the world of the average

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344 The Final Court of Appeal refers to a final criteria based on the ability to be observed. Eddington, *The Philosophy of Physical Science*, 17-18.

345 Eddington, *The Nature of the Physical World*, 266.

346 The title of a text by Eddington. Arthur Eddington, *Science and the Unseen World* (London: George Allen & Unwin Ltd, 1929).

347 Eddington, *Unseen World*, 28.

person. Here we learn of the now famous example of two tables and two possible ways of understanding the world around us. During his 1927 Gifford Lecture Eddington described two pens, two chairs, and two tables. Our first encounter is the common experience of a substantive table familiar to the ordinary person. It is solid, functional and commonplace. The second table we perceive is a scientific table. The scientific table is described in the most accurate and thorough of scientific terms. It is made of mostly empty space punctuated by electric charges moving at high speeds. All the while it is still supporting the weight of whatever is resting on it. The scientific mindset understands the world in scientific terms of mathematical formulas. It is a more accurate world, scientifically speaking, but not a world that is practical to live in. The average person takes the world at face value and has a very common sense understanding of his surroundings. The common sense table will always have a place in everyday life despite the increased accuracy of the scientific table. We live in the common world of everyday experience, even though there is a scientific reality that is perhaps more accurate. Eddington is able to live, simultaneously, in both of these worlds as a scientist and a Quaker.[348]

We can explore this secondary division even farther. Eddington suggests that there are two kinds of knowledge: a symbolic and an intimate knowledge. The scientist has symbolic knowledge, as with the language of physics, for instance. In the case of the physicist's symbols there is often nothing other than the symbol. As far as the physicist is concerned, "the attributes of this world, except in so far as they are reflected in the measures, are outside scientific scrutiny."[349] There may not even be a common sense symbol behind what the physicist has conceived of.

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348 Eddington, *The Nature of the Physical World*, 5ff.

349 Eddington, *The Nature of the Physical World*, 7.

> Science aims at constructing a world which shall be symbolic of the world of commonplace experience. It is not at all necessary that every individual symbol that is used should represent something in common experience or even something explicable in terms of common experience.[350]

Symbolic knowledge is what we gain from physics, which is masterful at explaining symbolic interactions.[351] The world of mathematical symbols, however much it is meant to explain ordinary experience, is often inaccessible. The average person relates to the intimate knowledge gained through experience. We have an intimate knowledge of our own consciousness and of things like the aesthetics in nature. Again it comes back to the division between the two types of perspectives. The scientific perspective perceives a metrical world, a world of the scientist and a world of symbols. The everyman lives in the non-metrical world, a world of the average person and a world of intimate knowledge. Then there are those, like Eddington, who move easily between both.

In Eddington's schema it is here in the non-metrical world of the average person that the unseen world may be appreciated. The numinous would be found in intimate knowledge. Eddington, in his thinking about metrical and non-metrical perspectives, has created a division that is not unlike Otto's. The metrical division of Eddington is certainly limited to rational observation and action. The non-rational division of Otto is akin to the unseen, spiritual world that falls under the category of the non-metrical. Otto emphasizes that it is not in the rational that we find the deeper part of numinous religious experience. For Eddington as well there are significant elements outside of the metrical or measurable. Outside of the strictly scientific there is an unseen, spiritual world that deserves attention even if it cannot be conceived using conventional, scientific means.

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350 Eddington, *The Nature of the Physical World*, 9.

351 Eddington, *The Nature of the Physical World*, 9.

Though Otto and Eddington are concerned with different elements, Otto with defining the numinous and Eddington with describing intimate and symbolic knowledge, they both come to define comparable and compatible categories. Eddington sides with the non-metrical in seeking out greater truth and Otto with the non-rational in enabling a numinous encounter. When we delve into this place that is non-metrical for Eddington and non-rational for Otto we find that both men have found a spiritual presence. The objective here is not to homogenize Eddington and Otto's thought but rather to explore them simultaneously in order to better understand Eddington. As a well-established theologian Otto's categories are not only well recognized and respected but they are also clearly defined and give structure to Eddington's thought.

The concepts of rationality and non-rationality are closely linked with orthodox religion. With the development of orthodox religions, religious phenomenon became an increasingly rational phenomenon. Otto describes orthodoxy as the mother of all rationalism. There is a bias in religion towards the rational over the non-rational. Otto suggests that orthodoxies have been stressing the rational aspects of God and obtained a "one-sidedly intellectualistic and rationalistic interpretation" as a result.[352] Orthodox dogmas are without the passion of numinous energy. They have left behind or neglected what is fundamentally the core of religion. In addition interpreted texts have a 'mental atmosphere' that is toned down. This does not allow us to fully appreciate the weight of the non-rational numinous.[353] In making a religion orthodox something essential has been left out. Numinous energy has not adequately been captured. Both Eddington and Otto find limited usefulness in dogmatic interpretations. Otto dislikes the loss of numinous energy and as a Quaker Eddington dislikes the confident certitude. As a Quaker Eddington adheres to a

352 Otto, *The Idea of the Holy*, 3.

353 Otto, *The Idea of the Holy*, 86.

religion that notoriously rejects doctrine.[354] The Quaker faith follows no strict, interpretive dogma. Quakerism is founded on the concept of following ones own Inner Light. Echoing what we have heard from Otto Eddington similarly believes that it is not through 'confident theological doctrine' that one experiences the spiritual world.[355] As Friends grow and change in the world they can develop new ideas and new means of interacting with their surroundings. There is no fixed, binding doctrine to keep them rooted in a particular mindset. Otto recognizes that the numinous needs to be experienced in a pure, authentic way that is true to its original form. In the same way, Eddington's experience of God is unmediated by doctrinal input; his experiences are personal, direct and unimpeded by outside sources.

A Priori

Before delving into the categories of the numinous an additional bit of foundational information is necessary. Otto discusses the *a priori* nature of the rational and non-rational in chapters XIV and XVII, *The Holy as an A Priori Category* Part I and Part II. Otto defines *a priori* by saying, "so soon as an assertion has been clearly expressed and understood knowledge of its truth comes into the mind with certitude of first-hand insight."[356] This *a priori* nature can be found 'latent in the human spirit,' and also, 'directly in our own religious consciousness.'[357] We have the ability to know without having a direct experience that has caused that knowledge.

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354 This has prevented a number of problems for Eddington. Eddington's scientific discovers are not contrary to the facts about the world found in scripture. For Eddington, his science will not prove or disprove his religion.

355 Eddington, *Unseen World*, 55.

356 Otto, *The Idea of the Holy*, 137.

357 Otto, *The Idea of the Holy*, 140.

Furthermore people have an *a priori* capacity to experience religious feeling.[358] Otto suggests that both rational and non-rational aspects of holiness belong to *a priori* categories.[359] People also have an *a priori* ability to recognize holiness and to be drawn towards it. Holiness belongs to an *a priori* category not stemming from sense perception but belonging to the pure reason of the mind,[360] and it is 'hidden in the depths of the spirit itself.'[361] The *a priori* exists in the rational, non-rational and in the interconnection of both.[362]

Otto suggests that our non-rational ideas are as pure as our rational ideas. When we look at these non-rational ideas we find ourselves at the '*Seelengrund,*' the bottom of our soul. Otto quotes Immanuel Kant from *Critique of Pure Reason.*

> That all our knowledge begins with experience there can be no doubt. For how is it possible that the faculty of cognition should be awakened into exercise otherwise than by means of objects which affect our senses. But, though all our knowledge begins with experience, it by no means follows that all arises out of experience.[363]

Otto agrees that knowledge is not limited to what we learn through sensory means. There are sense impressions from the outside world and sense impressions from the self. Otto clearly identifies the numinous with that which comes from inside of the self. At the '*Seelengrund*' we have a pure *a priori* capacity for understanding religion. The numinous comes from inside of ourselves and does not arise out of world data but '*by their means.*'[364] The beliefs and feelings

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358 Otto, *The Idea of the Holy*, 44. Otto takes direct inspiration from Kant, while Eddington is influenced by post Kantian philosophy

359 Otto, *The Idea of the Holy*, 136.

360 Otto refers to pure in the way Kant described pure forms.

361 Otto, *The Idea of the Holy*, 136

362 Otto, *The Idea of the Holy*, 136.

363 Otto, *The Idea of the Holy*, 112-113.

364 Otto, *The Idea of the Holy*, 113.

associated with the numinous are quite apart from anything we might naturally experience through sensory means.[365] It is a *sui generis* phenomenon belonging to a category of its own and deeper than pure theoretical or practical reason.[366] The notion of a person's soul, as an unexplainable and primary phenomenon, has grown from primitive times. We exist in our present state because of the growth of our spirits. We possess a "hidden predisposition ... which awakens when aroused by diverse excitations."[367] Human reason has led to a predisposition in the species for 'a religious impulsion.'[368] We all have the predisposition to recognize our own Inward Light and the Greater Light outside of us. Otto describes the beginnings of this impulsion as,

> an undirected, groping emotion, a seeking and shaping of representatives ... a continual onward striving, to generate ideas, till its nature is self-illumined and made clear by an explication of the obscure *a priori* foundation of thought itself, out of which it originated.[369]

Through our nature we have a religious impulsion that subsequently leads us to recognize the *a priori* in ourselves and the world. Otto describes the earliest manifestations of the numinous in magic, worship of the dead, fairy stories, and especially *daemonism*. These are primitive ways of approaching the numinous with daemonism being the purest.[370] These means of expression were not schematized as much as organized religion today, connecting them more closely with raw, numinous energy.

In continuing with *a priori* experience, Otto finishes his thought in a second chapter. The

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365 Otto, *The Idea of the Holy*, 113.

366 Otto, *The Idea of the Holy*, 114.

367 Otto, *The Idea of the Holy*, 115.

368 Otto, *The Idea of the Holy*, 116.

369 Otto, *The Idea of the Holy*, 116. The author's original spelling has been retained.

370 Otto, *The Idea of the Holy*, 117.

numinous has been moralized in history. Regardless of the outside circumstances of a culture's faith religions have changed from crude to sophisticated and moralized. These divergent religions are heading to the same point demonstrating, "*a priori* factors universally and necessarily latent in the human spirit: those, in fact, which we can find directly in our own religious consciousness."[371] One's ability to reason has turned into a religious impulsion expressed as a continual striving forward. All religions have their foundations in this *a priori* capability in the human spirit.

Otto and Eddington have compatible ideas concerning our reliance on sensory experience and the existence of the *a priori*. In this respect Immanuel Kant influenced Eddington. Kant suggested that we are not limited by our sensory abilities in the pursuit of knowledge. Eddington states, "one of the most immediate facts of experience [is that] consciousness is not wholly or primarily for a device for receiving sense-impressions."[372] Consciousness is able to function in another way by exploring the unseen world. It is in this interior world of intimate knowledge that knowledge arises outside of sensory, scientific and metrical experience.

In *The Philosophy of Physical Science* Eddington defines *a priori* knowledge as "knowledge which we have of the physical universe prior to actual observation of it."[373] *A priori* knowledge is prior to carrying out observation, but not prior to developing a plan for observation. It is an "assertion of the results of observation imagined to be carried out,"[374] requiring observational experience. Eddington understands how *a priori* information can exist and how experience acts as a background enabling recognition of it. He recognizes the negative

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371 Otto, *The Idea of the Holy*, 140

372 Eddington, *Unseen World*, 28.

373 Eddington, *The Philosophy of the Physical Science*, 24.

374 Eddington, *The Philosophy of the Physical Science*, 24.

reputation that *a priori* knowledge has in the field of traditional physics but this does not deter him from using it.[375] For instance, in Eddington's search for a cosmological constant he believed that the constant could come from within, from pure mathematical deduction.[376] He suggests that, "in claiming to determine *a priori* the number of elementary particles in the universe we are not usurping a prerogative which has usually been ascribed to the Creator of the universe."[377] People have the ability to determine, *a priori*, knowledge about the world. This does not upset the role of humans and the role of a creator. We are capable of that sort of exploration.

Both Otto and Eddington have looked towards Kant to develop their ideas about the limitations of sense experience. Both believe in the concept of *a priori* knowledge. Otto's focus is on *a priori* knowledge as the root of religious impulsion and religious capacity in people. Eddington applies the notion of *a priori* knowledge to his scientific research but he recognizes potential religious implications, as he is careful to point out that it does not overstep the boundaries of created and creator.

Mysterium Tremendum

Let us move on to the elements of the numinous that Otto has described. The numinous is a *Mysterium Tremendum.* The *tremendum* is comprised of awefulness, overpoweringness and energy or urgency.[378] Otto attempted to describe the non-describable using German words, as a native German speaker, and concepts that most analogously fit. In the translation from German

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375 Eddington, *The Philosophy of Physical Science*, 24.

376 He did acknowledge that it can only arise in this way because we have access to experimentally derived data.

377 Eddington, *The Philosophy of Physical Science*, 175.

378 Otto, *The Idea of the Holy*, 13.

to English each set of words are an approximation of what was originally intended and ultimately remains beyond the capabilities of any language.[379]

Tremendum: Awefulness

Religious phenomenon is notoriously elusive and the case of religious awe is no different. Religious awe is something best experienced, not described. And it can only be experienced by those who have 'been awakened to the mental predisposition' of the numinous.[380] This awe is a unique, non-natural occurrence. The Christian experience of fear before God's wrath is an example of an awe-filled experience. Otto describes God's wrath in Christian scripture as well as within the gods of the Indian Pantheon. Wrath is another ideogram describing a distinctive religious moment. Otto explains that "Something supra-rational throbs and gleams, palpable and visible, in the 'wrath of God' prompting a sense of terror that no natural anger can arouse."[381] Despite our attempts to define and describe all fall short of the reality that is numinous experience.

The awfulness is joined with a sense of might, power, or majesty that Otto calls *majestas*.[382] This characteristic of awefulness is closely related to a 'creature-feeling.'[383] In its purer, earlier forms, this numinous fear was understood as daemonic dread or a fear of ghosts.

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379 Otto also mentioned the German terms *grausen, Schauer, gruseln* and *Scheu*. In English, religious dread or awe come closest. See Otto, *The Idea of the Holy*, 14.

380 Otto, *The Idea of the Holy*, 15.

381 Otto, *The Idea of the Holy*, 19.

382 Otto, *The Idea of the Holy*, 19.

383 Otto, *The Idea of the Holy*, 21.

People performed ceremonies of worship and sacrifice to appease these wrathful spirits. Physical symptoms manifested themselves including shuddering and creeping flesh. As religions evolved they maintained some sense of the uncanny though not as a central tenant. The awe that characterized their cruder forms is still a part of them as "these gods still retain as *numina* something of the 'ghost.' There is never a complete dissolution of this numinous element, even in the 'purest' forms of worship of God."[384] The awe that arises is still present but the element of wrath tends to diminish. The next characteristic is creature consciousness, followed by overpoweringness. In discussing these features Otto once again had the task of distinguishing unnatural feelings from natural feelings. He credits Schleiermacher with describing 'the feeling of dependence,'[385] that differs from other sorts of dependence. It is not dependence in the natural sense of the word but entirely in a different category. It is religious dependence. The numinous stirs this feeling of unnatural dependence in people whereby we feel utterly surpassed and insignificant in the face it. We are as lowly creatures before something great; Otto calls this the creature-feeling. A consciousness of our createdness as creatures must be experienced in order to be understood.[386] Otto also suggests that "For the 'creature feeling' and the sense of dependence to arise in the mind the '*numen*' must be experienced as present, as 'numen praesens.'"[387] The effects of the numinous on people are useful in identifying the 'numen praesens.'

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384 Otto, *The Idea of the Holy*, 17.

385 Otto, *The Idea of the Holy*, 20.

386 Otto, *The Idea of the Holy*, 20.

387 This differs from what Schleiermacher suggested, when he said that, "[one] can only come upon the very fact of God as a result of an inference, that is, by reasoning to a cause beyond myself to account for my 'feeling of dependence.'" Otto, *The Idea of the Holy*, 10.

Tremendum: Overpoweringness

Closely connected to the creature feeling is the element of overpoweringness. Otto refers to the element of overpoweringness as an 'absolute overpoweringness,' a *tremendum majestas* or aweful majesty.[388] In contrast Otto describes the creature consciousness as a 'shadow or reflection' of the absolute overpoweringness of which we can only supply ideograms. [389] The creature feeling concerns our own feelings of humility and 'submergence' while the overpoweringness is 'as an object over against the self.'[390] Createdness and creaturehood are distinguished by Otto. Createdness calls into play our nature as created beings. Creaturehood is a feeling we encounter before something greater. We experience our own nothingness in the face of it. Taken to an extreme this distinct creatureness is 'the annihilation of the self, and then, as its complement, of the transcendent as the sole and entire reality,' [391] as experienced by mystics. The experiences of awe, overpoweringness and creature-consciousness are in sync with one another. Let us consider Eddington's thoughts on these matters.

Eddington experiences awe in connection with nature. As a nature mystic he speaks of a union with nature as "we are filled with the gladness of the waves dancing in the sunshine, with the *awe* of the moonlight on the frozen lake."[392] The description leads us to believe that it is not a natural awe because it resulted from a mystical connection. Eddington does not experience awe

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388 Otto, *The Idea of the Holy*, 19-21.

389 Otto, *The Idea of the Holy*, 20.

390 Otto, *The Idea of the Holy*, 20.

391 Otto, *The Idea of the Holy*, 21. Otto goes on to describe the connection with mysticism, as discussed at the end of this chapter.

392 Eddington, *The Nature of the Physical World*, 305. Italics added.

in the face of divine wrath but rather in the face of greatness, connected to overpoweringness. Eddington often refers to a force that exceeds and overpowers us. He describes "a nature transcending ours." [393] We are but a spark from a greater power and "in him [man] there flickers for a few brief years a spark from the divine spirit. Are these of as little account in the universe as he is?"[394] Eddington wonders about the significance of humans, who have but a spark of the divine and live but a short while. Eddington accepts that he is dwarfed by a greater power and a greater Mind than his own.[395] As a scientist the creature feeling takes on an astronomical description. Eddington describes our planet as insignificant[396] and us in lowly cosmological terms. Eddington asserts that "Man is one of the gruesome results of this occasional failure of antiseptic precautions [in the universe]."[397] As incidental creatures we are all limited by our narrow understanding of reality.[398] Our own Inner Light, our own power, depends on another, greater source of Light and Power.[399] Unlike Otto, Eddington does not make the distinction between natural feelings and feelings that have natural analogies but are decidedly non-natural. He believes that the feelings expressed towards the natural world and towards the supernatural are quite the same. He states,

> Nor does this pantheism [personification of Nature] awake in us feelings essentially different from those inspired by the physical world – the majesty of the infinitively great, the marvel of the infinitively little. The

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393 Eddington, *New Pathways in Science*, 317.

394 Eddington, *New Pathways in Science*, 310.

395 Eddington, *The Domain of Physical Science*, 217. In reference to a greater power see also Eddington, *The Nature of the Physical World*, 315.

396 Reference to earth's insignificance is made by Eddington in *The Nature of the Physical World*, 9, 24.

397 Eddington, *New Pathways in Science*, 310.

398 Eddington, *The Nature of the Physical World,* 309.

399 A feeling of dependence and insignificance in the face of God might be considered a part of Christianity.

> same feeling of wonder and humility which we feel in the contemplation of the stars and nebulae is offered as before; only a new name is written at the alter. Religion does not depend on the substitution of the word 'God' for the word 'Nature.'[400]

Here we see the strong connection between Nature and God. More significantly here we see the majesty of the great set against the marvel of the infinitively little, this is the sort of awareness that might stir a creature consciousness. The consequent feelings of wonder, or awe, and humility, contribute to the likeness of the *mysterium*.

Exploring the differences between Otto's conceptions and Eddington's allow us to appreciate the uniqueness of each perspective and also the commonalities. Otto's awefulness, overpoweringness and creature feelings appear to be present in Eddington. Eddington links his nature mysticism and scientific perspective with these emotions as these are central focal points in his life. As discussed at the end of this chapter, the element of wrathfulness is characteristically lost for a mystic as is the case with Eddington.

Tremendum: Energy

The final characteristic of the *Tremendum* is its energy or urgency. The energy is most vividly seen in wrath however it "clothes itself in symbolic expressions – vitality, passion, emotional temper, will, force, movement, excitement, activity, impetus." [401] This energy has been expressed from the earliest of *daemonic* worship to the Living God of today. It is a persisting energy that keeps religious feeling from being rationalized away. Otto explains that we have

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400 Eddington, *Unseen World*, 44.

401 Otto, *The Idea of the Holy*, 23.

borrowed terms from our lives and used them to describe this energy. These descriptions are approximations and not actual aspects of the divine. People experience this phenomenon in different ways, engaging and naming it differently. All ultimately refer back to the numinous energy. The numinous energy can be likened to Fichte's ideas on the Absolute, which is gigantic and never resting, and akin to Schopenhauer's *daemonic will.*[402]

Eddington has an active, purposeful energy within him. He describes it as "a yearning towards God. The soul find[s] fulfillment of something implanted in its nature … [and] the light beckons ahead and the purpose surging in our nature responds." [403] There is a yearning and a surging that has been implanted in us. It impels us to respond and follow. This sounds quite like the energy that Otto described. There is something within ourselves drawing us towards it and moving us to action. Otto describes the numinous energy as, 'urgent, active, compelling and alive,'[404] and also believes that concepts are implanted in people. He tells us, "the idea … is only 'arouseable' because it is potentially implanted in him."[405] Eddington feels the need to search; he is filled with an energy that compels him forward. Otto suggests that this energy and the experience of this energy can be found at the core of all religions. Eddington likewise stated "finally at the root of all spiritual religion [is] an experience which we describe as the presence of God."[406] For Otto the connecting feature between religions is the 'numen praesens' and for Eddington it is the presence of God. Both emphasize the experience of the transcendent in uniting religious faith.

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402 Otto, *The Idea of the Holy*, 24.

403 Eddington, *The Nature of the Physical World*, 315.

404 Otto, *The Idea of the Holy*, 24.

405 Otto, *The Idea of the Holy*, 43.

406 Eddington, *New Pathways in Science*, 317.

Otto and Eddington also share openness towards religious experience regardless of the form it may take. For Eddington, "the intimate response of the spirit … is the central point of the religious experience."[407] That intimate response will take on forms that fit the individual. Religion is just that very basic, very personal connection with something transcendent. As a Quaker Eddington is open to truth in whatever form it takes or by whichever name it may appear. He believes that people can connect with the world and open themselves up to a greater consciousness by many names. He talks about the Spirit,[408] an Absolute Valuer,[409] God, a universal Mind, Logos and a World-Spirit.[410] His ideas broach the barrier of religious differences to seek out what is true. Otto similarly finds that the numinous has been expressed in many different forms and faiths: from daemonic worship,[411] to Taoism,[412] Christianity[413] and Islam.[414] For those at higher levels of enlightenment and understanding Otto believes that "Christ is at one with Mohammad and Buddha."[415] God has been called many names and taken on many faces all of which express the same thing. Though Eddington and Otto use different terms they seem to be expressing a complementary experience.

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407 Eddington, *The Nature of the Physical World*, 310.

408 Eddington, *Science and Religion*, 130.

409 Eddington, *The Nature of the Physical World*, 318.

410 Eddington, *The Nature of the Physical World*, 324.

411 Otto, *The Idea of the Holy*, 14ff.

412 Otto, *The Idea of the Holy*, 67.

413 Otto, *The Idea of the Holy*, 64.

414 Otto, *The Idea of the Holy*, 75.

415 Otto, *The Idea of the Holy*, 64.

Mysterium: Wholly other, Fascinating

The *Mysterium* for Otto is both wholly other and fascinating. Beginning with the wholly other it is clearly objective and outside of the self. Out of the mystery of the *mysterium* comes the sense of the 'wholly other.' Like many features of the numinous it too is incomprehensible. The wholly other is "outside of the limits of the 'canny,'"[416] creating feelings of stupor, awfulness and wonder. Otto informs us that we have used many names to describe what was wholly other: spirit, demon, or deva.[417] It is a fundamental characteristic of the numinous that is unnatural, "the wholly other … has no place in our scheme of reality but belongs to an absolutely different one."[418] From there the wholly other becomes rationalized as other elements of the numinous have been. The wholly other may be directly or indirectly associated with natural occurrences but according to Otto this is a false understanding. Extraordinary circumstances may seem attached to the wholly other but they are not.[419] The numinous has a category of otherness that is not matched in the natural world. It is mysterious because we are limited in our understanding and because its character is so foreign to our own.[420]

As a nature mystic Eddington believes that the feelings we have towards God are of the same sort as those towards nature. Otto would not necessarily agree; he believes that the numinous is in no way natural nor does it evoke natural feelings. Eddington does believe in the presence of something that exists outside of the self, that is wholly other and cannot be fully

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416 Otto, *The Idea of the Holy*, 26.

417 Otto, *The Idea of the Holy*, 27.

418 Otto, *The Idea of the Holy*, 29.

419 Otto, *The Idea of the Holy*, 27.

420 Otto, *The Idea of the Holy*, 24.

understood. He describes a "reality transcending the narrow limits of our particular consciousness."[421] It is something outside of ourselves, greater than ourselves and completely other than our own reality – it transcends. We move towards the numinous and want to return to it. Eddington describes "a reaching out of the spirit from its isolation to something beyond."[422] There is something outside of ourselves, beyond ourselves that we yearn towards. Just as Otto calls it *Mysterium*, Eddington calls it mysterious and as Otto calls it wholly other, Eddington calls it, 'something beyond.'[423]

The numinous possesses a dual character. At one end of the spectrum the numinous is fearful, aweful and overpowering. It is too much for us humble creatures. At the other end it is fascinating and appealing. Eddington seems to rest at the fascination side of the spectrum. Let us consider what Otto has said concerning numinous fascination.

Initially people feared the numinous and appeased the demonic forces of which they were afraid.[424] However that does not explain another characteristic of the numinous: its attraction. People have an affinity for the numinous. Belonging to this side of the spectrum we may consider the natural counterparts of 'love, mercy, pity, [and] comfort.'[425] These natural feelings have wholly other counterparts that are whole and complete. Otto explains "the numinous is the

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421 Eddington, *The Nature of the Physical World*, 309.

422 Eddington, *Unseen World*, 27.

423 Eddington, *Unseen world*, 27.

424 Like Otto, Eddington also believes in the presence of daemonic forces. He proposed that primitive man, without the explanatory power of science, found daemonic explanations for natural phenomenon. Eddington maintains that there are still elements of daemonic activity in men and higher animals. This is a force that we can communicate with. Eddington, like Otto, understands that people look to daemonic activity as a possible explanation of power. Both good and evil forces can be found in the world, and both continue to influence people. Otto believes that humans have appealed to these forces, and engaged with them, in much the same way that Eddington claims daemonic elements can be communicated with.

425 Otto, *The Idea of the Holy*, 31.

object of searching and desire and yearning … the human being seeks to get the *numen* into his possession."[426] People want to behold and experience the numinous - to be in a state of numinous possession.[427] Otto describes the fascination as a living factor in moments of religious longing, solemnity, and 'humble submergence of private devotion.'[428] Otto describes a Dionysian element in the numinous as a, 'dizzying intoxication.'[429] At its highest expression the fascination may be expressed in a mystical moment of union,[430] or in a church it may be witnessed as a second birth or conversion. As discussed with the energy of the *tremendum* Eddington is fascinated with seeking out and understanding religious experience. Quakers were formally known as 'Seekers.' His life is a continual seeking and yearning towards God, "in a yearning towards God, the soul grows upward and finds the fulfillment of something implanted in its nature … a striving born with our consciousness."[431] Eddington feels a compelling Inner Light that urges him onward in science and religion. For Eddington it is a fascination that does not find fulfillment. It is reward enough to simply search. He tells us that, "the truth shines ahead as a beacon showing us the path; we do not ask to attain it; it is far better that we be permitted to seek."[432] Something within us causes us to continue. As we are beckoned on, 'the purpose surging in our nature responds.'[433] Eddington is drawn towards religious experience as Otto is drawn towards the numinous.

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426 Otto, *The Idea of the Holy*, 32.

427 Otto, *The Idea of the Holy*, 32ff.

428 Otto, *The Idea of the Holy*, 35.

429 Otto, *The Idea of the Holy*, 31.

430 Otto discusses mysticism in relation to the fascinating in detail. This will be addressed in the final section of this chapter.

431 Eddington, *The Nature of the Physical World*, 315.

432 Eddington, *Unseen World*, 16.

433 Eddington, *The Nature of the Physical World*, 315.

Humankind has a purpose, and is guided by a light lighting the way. We move towards that purpose, encouraged by a drive within us. We are meant to fulfill something in our lives. Eddington identifies an energy that pulls us towards the fulfillment of our nature and our lives. He is fascinated by seeking and his energy compels him forward.

Awakening the Numinous

People have the innate ability to experience the numinous.[434] There is an 'inborn capacity to receive and understand' the *numen*.[435] All that is necessary is for the numinous to awaken in our spirits.[436] Through discussion and guidance we can help others start to sense the numinous so that it "begins to stir, to start into life and into consciousness."[437] Having said that the numinous is also something that cannot fully be taught, it must ultimately be self recognized.[438] Otto identifies the numinous experience in, "reverent attitude and gesture, in tone and voice and demeanour expressing its momentousness, and in the solemn devotional assembly of a congregation at prayer," more than in the analogies and negative attributes that we assign to it.[439] The *numen* is a lived experience best found in life. These numinous experiences have 'an object,' of which no positive conceptions are possible but is contrasted with 'the supernatural' and 'the transcendent.' Combined with a 'spirit of the heart' a living connection can bring out the feeling of the

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434 Otto, *The Idea of the Holy*, 7.

435 Otto, *The Idea of the Holy*, 61.

436 Otto, *The Idea of the Holy*, 60.

437 Otto, *The Idea of the Holy*, 7.

438 Otto, *The Idea of the Holy*, 60.

439 Otto, *The Idea of the Holy*, 60.

numinous from dogma and theory.'[440] With the right spirit even the rational can arouse feelings of the non-rational. Otto explains, "where the wind of the spirit blows, there the mere 'rational' terms themselves are imbued with power to arouse the feeling of the 'non-rational,' and become adequate to tune the mood at once to the right tone." [441] There are direct as well as indirect ways to call the numinous into effect. Indirect means are often related to the natural sphere. Otto described earlier feelings of terror and horror that may be analogous to the *tremendum*. An expression of horror may be an indirect expression of numinous awe, unable to be directly expressed.[442] People have also discovered a sense of the numinous through miraculous events, as is associated with the mystery of the *mysterium*. Miracles are quite relevant as they belong to the mysterious sphere of the *mysterium* and are also the wholly other. When the numinous is aroused by natural feelings, it can replace those natural feelings. When something highly terrifying and confusing confronts a person it can take on a numinous quality. Though the numinous may confront us the reverse can also happen where we seek out the miraculous or else invent it in order to keep that religious awareness. Despite its usefulness the miracle does remain 'an imperfect analogue' to the numinous.[443] All of the indirect means are, "instances of the analogy to 'the mysterium' afforded by that which is not wholly understood."[444]

Otto also believes that sublimity can be expressed in art, bringing to light the numinous. There is a basic desire in us to express the feeling of the sublime. Through sublimity the intended

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440 Otto, *The Idea of the Holy*, 60-61.

441 Otto, *The Idea of the Holy*, 61.

442 Otto, *The Idea of the Holy*, 52.

443 Otto, *The Idea of the Holy*, 65.

444 Otto, *The Idea of the Holy*, 65.

effect is to experience the *numen*.[445] In Chapter IX, *Means of Expressing the Numinous*, Otto tells us that, "In great art the point is reached when we may no longer speak of the 'magical,' but rather are confronted by the numinous itself, with all its impelling motive power, transcending reason, expressed in sweeping lines and rhythm."[446] In the past people have created great works of art in an effort to localize, store and preserve the *numen* in physical form.[447] There are limits to what art can do. Otto maintains that, "in neither the sublime nor the magical, effective as they are, has art more than an indirect means of representing the numinous."[448] Otto describes two ways that Western art can induce the numinous: through darkness and silence. We will consider darkness first and follow with a lengthier discussion of silence.

Empty space produces numinous impressions. Otto clarifies, "For 'void' is, like darkness and silence, a negation, but a negative negation that does away with every 'this' and 'here,' in order that the 'wholly other' may become actual."[449] The emptiness makes the nothing palpable bringing us closer to the non-rational where the wholly other is on familiar ground.

Eddington is also concerned with awakening a spiritual potential through natural and artistic means. He believes that people have the capacity to participate in a greater Light outside of them. We all contain an Inner Light that we alone can awaken. This recognition is something that cannot be taught but must be felt and recognized by each of us. Eddington tells us that, "in mystical feeling the truth is apprehended from within and is, as it should be, a part of

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445 Otto, *The Idea of the Holy*, 66.

446 Otto, *The Idea of the Holy*, 67.

447 Otto, *The Idea of the Holy*, 65.

448 Otto, *The Idea of the Holy*, 68. Unless, of course, the natural feelings were replaced by actual numinous feelings.

449 Otto, *The Idea of the Holy*, 70.

ourselves."[450] Our truth comes from within just as our awakening is an interior phenomenon. Both Otto and Eddington identify a predisposition in people to open themselves up to something greater and to participate in something more. Otto calls it the numinous and Eddington a greater reality. In each case, we alone can recognize it, though outside forces may guide us.

Eddington has indirect triggers to experience the *numen*. For Eddington we also reach out to a greater power in response to natural phenomenon. We reach out from isolation into the beyond as "a response to beauty in nature and art."[451] The spirit is awakened by beauty and reaches out to a higher power. The beauty in a sunset, waves on the water, or even the richness of color is outside of scientific description. That aesthetic appreciation as well as the objects of beauty, are intrinsically valuable and connected to holiness. This attraction towards beauty corresponds to the aspect of fascination of the numinous. Otto suggests that the severe image of the ancient Byzantine Madonna attracts more Catholics than the sweet Madonna of Raphael.[452] It is exactly this sort of sweet beauty that Eddington is drawn towards and fascinated by. Eddington's higher power and Otto's numinous are both inherently recognized by people, and also have a possible trigger of art. Art possess the trigger of beauty and acts as a gateway to the transcendent for Eddington, while art often echoes the sublime for Otto. There is a feeling in both of these thinkers that there are non-rational elements that are worthwhile, though not able to be fully grasped conceptually.

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450 Eddington, *The Nature of the Physical World*, 309.

451 Eddington, *Unseen World*, 27.

452 Otto, *The Idea of the Holy*, 62.

Nature

Feeling sparked by the wholly other will sometimes be attached to natural phenomenon of 'surprising or astounding character.'[453] Otto suggests that the numinous we feel in nature is not the numinous itself. Astonishing natural occurrences reminiscent of the sublime can only help us to *conceive* of the numinous that is out there. However the numinous itself is not found on the natural plane and so these triggers are limited to acting as tools.[454] The numinous is supernatural. It elicits non-natural responses, of non-natural fear and creeping. The numinous 'looms' over the mind as a non-natural presence. It is possible only for those who have 'awakened a mental predisposition,' which itself differs from other natural, mental faculties.[455] Otto suggested that both Fichte and Schopenhauer were mistaken in attributing natural attributes to the non-rational, when natural attributes can be used only as 'ideograms.'[456] The difference between the numinous and natural phenomenon is not a different of degree, but a difference of substance entirely.[457]

Eddington finds sublimity in the natural world in the same way that Otto located sublimity in art. Eddington recognizes that "Nature in the course of the ages achieved the sublime simple structure of the amoeba."[458] Eddington has great respect for the creative abilities of nature and has an intimate union with nature. He believes that natural phenomena are connected with something greater and that all people have a compulsion towards nature for it is a

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453 Otto, *The Idea of the Holy*, 27.

454 Otto, *The Idea of the Holy*, 63.

455 Otto, *The Idea of the Holy*, 15.

456 Otto, *The Idea of the Holy*, 24.

457 Otto, *The Idea of the Holy*, 27.

458 Eddington, *The Nature of the Physical World*, 97.

characteristic of the human spirit.[459] Eddington also speaks highly of a nature mysticism common to all people. Through this appreciation of nature we may find and follow our Inner Light. For Eddington, the beauty of nature does more than point the way. It seems to embody the greater power.

Silent Worship

In describing indirect means of numinous expression Otto discussed the use of silence in Western art alongside of darkness. After describing the major characteristics of the numinous Otto locates the *numen* in a number of places including a Quaker Sermon of Silence. Silence is a reoccurring theme in both Otto and Eddington's work. Otto directly addresses the connection between the Quaker's Sermon of Silence and the numinous. We will discover how this connection relates to Eddington as a practicing Quaker.

Silence is an indirect means of expressing the numinous. Silence, as a response, originates from a fear of using words that could be interpreted as an evil omen.[460] In connection with the numinous silence is "a spontaneous reaction to the feeling of the actual 'numen praesens.'"[461] Examples of this can be found in the Old Testament. Otto gives an example from the book of Habakkuk, "Yahweh is in his holy temple, let all the earth keep silent before him."[462] In another case he quotes from Erlangen, "If thou feelest it truly in the heart, it will be such a great thing to thee that thou wilt rather be silent than speak aught of it."[463] In both cases, silence is

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459 Eddington, *Unseen World*, 30.

460 Otto, *The Idea of the Holy*, 68.

461 Otto, *The Idea of the Holy*, 69.

462 Habakkuk 2:20 in Otto, *The Idea of the Holy*, 68.

463 Otto, *The Idea of the Holy*, 103.

the most appropriate response as we are incapable of responding in any other way.

What darkness does in artwork is what silence is capable of in musical sound. Otto claims that mass music can

> only give utterance to the holiest, most numinous moment in the Mass - the moment of transubstantiation - by sinking into stillness, no mere momentary pause, but an absolute cessation of sound long enough for us to hear the silence itself and no devotional moment in the whole Mass approximates in impressiveness to this keeping silence before the Lord.[464]

This description connects the musical art form, silence, God, and the numinous. Otto's continues to extol the virtues of silence in his description of Silent Worship in Appendix VIII of *The Idea of the Holy*. Moved by the silence Otto describes it as "the most spiritual form of divine service that has ever been practiced."[465] Otto explains the three aspects of the service: the first is the numinous silence of Sacrament, next is the silence of Waiting and finally there is the silence of Union or Fellowship.

In the first stage, the silence of Sacrament, people are silent before God. The participants of the service experience 'The Lord's Visitation of His people.'[466] It is a "culminating sacramental point of the worship … [whereby] 'God is in the midst.'"[467] Otto describes this as the 'numen praesens' a feeling of the presence of the numinous.[468]

The next stage of the silence is the silence of Waiting whereby people turn their focus within themselves. They become instruments of God and may be moved by the Spirit to speak. They wait upon God in silence, speaking only if they are moved to do so. Otto calls this another

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464 Otto, *The Idea of the Holy*, 70.

465 Otto, *The Idea of the Holy*, 211.

466 Otto, *The Idea of the Holy*, 211.

467 Otto, *The Idea of the Holy*, 211.

468 Otto, *The Idea of the Holy*, 211.

numinous encounter.[469]

The third silence completes these three silences. It is the silence of Union. There is oneness with God as well as oneness between individuals. Through that connection we participate in feelings greater than ourselves. In that same way the presence of God and the oneness with God is realized in the third silence.[470]

At this point we naturally may wonder about Eddington's thoughts on silence and silent worship. As a Quaker Eddington has an affinity for silence. Eddington had this to say about Silent Worship, "If we claim that the experience which comes to us in our silent meetings is one of the precious elements that make up the fullness of life, I do not see how science can gainsay us."[471] In this same lecture he gives an example of the meaning of the silence on Armistice Day that cannot be appreciated by a scientific observer. Eddington is pointing out the limits of what science can value. Silence is an object of great value and of subtle character in human culture and inaccessible in science. Eddington was intimately familiar with silence. In *Science and the Unseen World* Eddington claimed that this passage describes his understanding of God:

> And behold the Lord passed by, and a great and strong wind rent the mountains, and brake the rocks before the Lord, but the Lord was not in the wind; and after the wind an earthquake; but the Lord was not in the earthquake; and after the earthquake a fire; but the Lord was not in the fire; and after the fire a still small voice ... And behold there came a voice to him and said, What doest thou here Elijah?[472]

Eddington does not find God in extraordinary natural phenomenon of the natural world but instead God is very quietly inside of him. Eddington is most able to find God in the midst of

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469 Otto, *The Idea of the Holy*, 211.

470 Otto, *The Idea of the Holy*, 212.

471 Eddington, *Unseen World*, 30.

472 Eddington, *Unseen World*, 17-18. The biblical reference is from 1 Kings 19:11-13.

silence, in a still small voice.

The Silent Worship which Otto describes is the very sort of worship of which Eddington partook. In a biography written by A. Vibert Douglas we learn of Eddington's appreciation for silent worship.[473] Douglas tells us that Eddington regularly attended a Quaker Meeting house in Jesus Lane on Sunday mornings. Eddington maintained the traditional devotion and silence in the service that Otto described.[474]

During the silence of Sacrament, while people waited quietly for the presence of God, so too did Eddington wait. Though he was offered a seat of honour, he refused, and sat quietly in the back.[475] Otto described a numinous presence that Eddington might have called the presence of God, or a great power.

During the silence of Waiting, when others were moved to speak, Eddington did not. Those who attended the service with him claimed that he was rarely moved to say anything, preferring to worship in his own quiet way.[476]

During the silence of Union a connection is felt. Eddington described such a union in connection with nature. This is the kind of connection that Eddington spoke of earlier, in *The Nature of the Physical World*, when he said,

> our minds are not apart from the world; and the feelings we have of gladness and melancholy and our yet deeper feelings are not of ourselves alone, but are glimpses of a reality transcending the narrow limits of our particular consciousness. [477]

Eddington has conceived of an otherness outside of consciousness and felt a connection

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473 Douglas, 12.

474 Douglas, 128.

475 Douglas, 128.

476 Douglas, 128.

477 Eddington, *The Nature of the Physical World*, 309-310.

with the world. It is plausible that in his silent appreciation and communication with God Eddington was intimately familiar with Otto's 'numen praesens,' even if by another name.[478]

Mysticism

We have come to the end of this chapter and to the final example of numinous experience. Otto identifies a strong connection between mysticism and the numinous. In considering Eddington's thoughts on mysticism we can draw parallels with Otto's numinous. An examination of mysticism is an examination of a microcosm of numinous characteristics.

Eddington was concerned with religious mysticism *and* nature mysticism. He claimed that, "As a Quaker the deeper side of mysticism ... [was] not foreign to [him]."[479] Eddington was careful to define what he meant by the term mysticism. He is not considering the exceptional cases or extreme instances of mysticism but the everyday mystical experiences. He describes everyday mysticism as simply a 'contact with spiritual power.'[480] Eddington confesses that he is not qualified to address the 'abnormal experiences and revelations' or 'stranger forms of experience and insight' associated with extraordinary mystical experience. Eddington's mysticism concerns daily matters and affairs.[481] Otto suggests that the object of the religious

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478 Otto also suggested that the numinous is not always recognized or identified "he may have neither notion of it nor name for it ... [to] make explicit to himself the nature of that numinous strand running through the religious experience." See Otto, *The Idea of the Holy*, 61.

479 Douglas, *The Life of Arthur Stanley Eddington*, 131. Rufus Jones suggested that during Quaker meetings the members experienced a 'collective mysticism.' See Stanley, 38.

480 Eddington, *The Nature of the Physical World*, 326.

481 Eddington, *The Nature of the Physical World*, 326. This seems to be what Matthew Stanley had in mind when he referred to Eddington as a practical mystic.

consciousness is expressible,[482] just as Eddington attempts to describe his everyday mystical experiences. Despite the everyday nature of the mysticism Eddington does not treat mysticism lightly. He warns us not to dismiss it, "Call it of God, of the Devil, fanaticism, unreason: but do not underrate the power of the mystic. Mysticism may be fought as error or believed as inspired, but it is no matter for easy tolerance."[483] With this in mind let us consider Otto's definition and treatment of mysticism.

Otto recognizes that mysticism is characterized by self-depreciation, "mysticism leads to a valuation of the transcendental object of its reference … so that the infinite self contrasted with it becomes conscious of even its nullity, 'I am nought, Thou art all.'"[484] More succinctly, in mysticism the self disappears until all that remains of reality is the transcendent.[485] There is self depreciation and the self is regarded as something not real.

In mysticism the most prominent elements of the non-rational are mystery, fascination and majesty. The inapproachability of the numinous has declined in mysticism.[486] The *mysterium* is related to the wholly other, supernatural, transcendent, the beyond and overstressing the non-rational. Like the *mysterium* Otto claims that the fascination is a possible shift into mysticism.[487] Furthermore, "At its highest point of stress the fascination becomes the 'overabounding' 'exuberant', the mystical 'moment.'"[488] Fascination, with the inapproachability receding, gives

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482 Otto, *The Idea of the Holy*, 22.

483 Eddington, *The Nature of the Physical World*, 313.

484 Otto, *The Idea of the Holy*, 21.

485 Otto, *The Idea of the Holy*, 21.

486 Otto, *The Idea of the Holy*, 20.

487 Otto, *The Idea of the Holy*, 36.

488 Otto, *The Idea of the Holy*, 36.

way to mysticism. In the West there has not been a religion that emphasizes the horror of the *numen*, though there have been some in the East. The *Tremendum*, in a lesser form, is still present in the dark night of the soul, to use a familiar expression. Otto describes it essentially as an "abyss, the desert of divine nature, into which the soul must descend into agony and abandonment."[489] The mysticism we encounter in the West would likely emphasize the mystery, fascination and majesty. As mentioned earlier, Eddington describes this sort of compelling, active, positive mystical experience with none of the terror associated with the fearful *tremendum*.

In Otto, the element of beyondness, or otherness, is present in mysticism as well. The beyond is in mysticism in the emphasis on non-rationality. The wholly other numinous object is set against everyday experience, the world, Being, and all that exists until finally it is negated into nothing. Mysticism on the other hand is a positive, living force. [490] When the mystic today praises the soul, in the '*fundus animae*' there is still a residue of the dumbfounded nature before the wholly other, as seen in primitive times, or perceptions of ghosts.[491] The mystical experience touches on the wholly other and numen.

Otto believes that an overabounding feeling characterizes mysticism.[492] Like the numinous experience, Otto claims that all mystics have a sense of creature consciousness. As described earlier it is the feeling "not of our created-ness but of our creature-hood, the littleness of every creature in the face of that which is above all creatures."[493] In acknowledging a power

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489 Otto, *The Idea of the Holy*, 103ff.

490 Otto, *The Idea of the Holy*, 29.

491 Otto, *The Idea of the Holy*, 194.

492 Otto, *The Idea of the Holy*, 36.

493 Otto, *The Idea of the Holy*, 22.

greater than ourselves through mystical union we feel our insignificance more acutely. Eddington has a few times described a feeling of surrender to mystical experience.

Mysticism and the numinous are tangled up with each other and with religion. Otto tells us that St. Paul and St. John had 'a strong strain of the numinous.'[494] Since them Christianity is most accurately described as having an 'inclination to mysticism.'[495] In earlier stages the numinous contained the same elements as higher stages of mysticism. In other words the very primitive elements of numinous recognition are still present in mysticism. Otto believes that the mystic understands the soul as 'mystery and marvel.' For mystics religious activity becomes a fulfillment of our nature as we are made for 'religious consciousness.'[496] This echoes what Eddington claimed when he described spiritual experience as fulfilling, 'the purpose surging in our nature.'[497] Religion has both a rational and a non-rational side. When the non-rational, supra-rational elements of religion are over-emphasized we find mysticism.[498] The numinous, of course, is found in the non-rational realm that mysticism occupies. Mystical experiences, like mystics themselves, are not uniform.

Otto believes that there are degrees of mysticism. It is possible to have colourings of mysticism or to be fully mystical. Mystics put differing emphasis on the 'phases and factors of the non-rational.'[499] Eddington concurs, as he believes in ordinary and extraordinary mysticism. Despite these differences of degree and type there is a core of mysticism that is common to all

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494 Otto, *The Idea of the Holy*, 92-93.

495 Otto, *The Idea of the Holy*, 85.

496 Otto, *The Idea of the Holy*, 22.

497 Eddington, *The Nature of the Physical World*, 315.

498 Otto, *The Idea of the Holy*, 22.

499 Otto, *The Idea of the Holy*, 22.

mystics.

In Eddington's case his experiences of transcendence come from the majesty of nature, related to the *mysterium's* fascination instead of the fear of the *tremendum*. Eddington's relationship with nature is closely associated with his mystical experiences. In the passages he has cited in his books Eddington reveals a genuine appreciation of the natural world. The natural world is so engraved in his psyche that he believes it to be a natural inclination of humankind to appreciate it. The rest of humankind recognizes the connection, so much so that "natural mysticism is universally admitted [by the world] in some degree."[500] Eddington describes a connection between people and the natural world in his Swarthmore Lecture when he recounts an idyllic setting described by J.S. Hoyland.[501] Hoyland poetically described a veil between our souls and the eternal goodness in the world. In parts of nature, however, we seem to almost merge with this transcendence. Eddington remarked that in the nature passage there was no direct reference to religious mysticism but rather, "It describes an orientation towards nature accepted by religious and irreligious alike as proper to the human spirit."[502] Eddington feels a strong connection between himself and nature. He believes in a universal connection between people and nature regardless of religious faith.

In uniting with nature Eddington's experiences are emotional. He was filled with the gladness that he felt to be suffused in nature, in the waves and moonlight. [503] Eddington unites humans and nature again this time not in the face of a veil but in response to emotion. The same gladness in people exists in elements of nature. Gladness is able to suffuse into the world, into

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500 Eddington, *Unseen World*, 30.

501 Eddington, *Unseen World*, 29.

502 Eddington, *Unseen World*, 30.

503 Eddington, *The Nature of the Physical World*, 305.

the waves, into ourselves, connecting us in positive energy.[504] Humankind is emotionally connected to nature. Otto reminds us of a numinous emotion whereby "mysticism … retains the positive quality of the wholly other as a very living factor with its over brimming of religious emotion."[505] Eddington emphasizes the universality of nature mysticism. He believes that our spirits ought to be sensitive to nature, as it fulfills the lives bestowed upon us.[506] A natural appreciation of the beauty, the truth and the spirit of nature fulfills one's own nature. We are fulfilling our lives by appreciating the natural world, by being swayed by nature and by recognizing our sensitive spirits in a way that has naught to do with practicality. Though one can only imagine and speculate this does not mean our ponderings do not reflect reality. Eddington inquires into the 'mystical illusions of man' as they may indicate realities that lie beneath, as discussed in chapter two.[507] Though we may create our own imaginative stories in connection with nature there is truth beneath them. Eddington similarly reiterates his belief in the truth behind the so called 'illusion.' He proposes two alternatives when it comes to spirituality and illusion. Either the mystical contact with nature is ethically wrong, or else, "in these moods we watch something of the true relation of the world to ourselves – a relation not hinted at in a purely scientific analysis of content."[508] Eddington chooses to side with the second, whereby there is truth under the illusion not identified by science. The degree of illusion in spirituality is minimal. The feelings, he believes, are quite real, though the 'fanciful imagery' is not. What we experience as a result of 'illusion' is not unreal and the illusion itself is not as unrealistic as we

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504 Eddington, *The Nature of the Physical World*, 306.

505 Otto, *The Idea of the Holy*, 29.

506 Eddington, *The Nature of the Physical World*, 307.

507 Eddington, *The Nature of the Physical World*, 307.

508 Eddington, *The Nature of the Physical World*, 308.

might initially think. The union we feel during mystical experience and the deeper feelings in the natural world are quite real. It is far better to live with the illusion and reap the benefits.

Eddington speaks of a mystical influence in the face of beauty in nature. This influence is proper and natural for the human spirit, as is the following surrender. It is something true in our lives when we connect with the natural world. Also, for those who do not feel it in their own nature, it is not to be argued.[509] Again, a connection is made between nature, the human spirit, and individual experience. This time Eddington explicitly states that the beauty of nature is something our experienced spirits can surrender to. As Otto often suggests those who have not experienced the other are not in a position to understand and Eddington suggests that we do not argue with such people.

Otto suggests that mysticism contrasts the numen with things in this world, with nature and then with Being and anything that is.[510] Otto continues on to say that mysticism is the result of our acknowledgment of an active, all powerful force of causation, one that gives us a heavy feeling of creature-hood. It is combined with theoretical ideas about God and being where God becomes the 'sole cause.' The mystic understands that only the absolute entity exists. His or her own existence becomes less than real. It is either a function of the absolute Being or an illusion.[511] Eddington has acknowledged the presence of illusion in mystical experience. For Eddington, embracing the illusion is necessary, for even our judgment is colored by fantasy; there is truth that lies beneath.

In *The Nature of the Physical World* Eddington describes a connection between nature,

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509 Eddington, *The Nature of the Physical World*, 324.

510 Otto, *The Idea of the Holy*, 29.

511 Otto, *The Idea of the Holy*, 90.

mysticism, reality and truth in the most illuminating of all quotes. We have seen part of this earlier in the section concerning the Silence of Union.

> If I were to try to put into words the essential truth revealed in the mystic experience, it would be that our minds are not apart from the world; and the feelings that we have of gladness and melancholy and our yet deeper feelings are not of ourselves alone but are glimpses of a reality transcending the narrow limits of our particular consciousness - that the harmony and beauty of the face of Nature is at root one with the gladness that transfigures the face of man … By introspection we drag out the truth for external survey; but in the mystical feeling the truth is apprehended from within and is, as it should be, a part of ourselves.[512]

This passage is key for understanding Eddington. It reemphasizes points described earlier in *The Nature of the Physical World* where, in one succinct paragraph, he begins by describing the creativity involved in experiencing nature. We find that our minds are not apart from the world. In other words, our souls are not separated by the veil. The feelings, both positive and negative, are part of something greater. Again, we remember that the gladness of the waves are a part of everything in nature, a part of ourselves even. Finally, we see that it is the truth from within that we ought to be listening to. Just as the truth of our minds is closer than the truth that is separate from us and found through pointer readings. The capacity for religious experience is a human trait, furthermore, the capacity for appreciating that religious experience is introspective. Eddington believes that this introspective approach applies to both religious and mystical experience. He takes the example of a joke and connects these ideas saying, "The real appreciation [of a joke] must come spontaneously, not introspectively. I think this is not an unfair analogy for our mystical feeling for Nature, and I would venture even to apply it to our mystical experience of God."[513] In this quotation Eddington separates Nature mysticism and mystical

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512 Eddington, *The Nature of the Physical World*, 308-309.

513 Eddington, *The Nature of the Physical World*, 310.

experiences of God. At the same time, he is applying the concept of a spontaneous appreciation to both of these experiences, linking them. In the case of a sombre individual unable to understand a joke, "Probably in the recesses of his solemn mind there exists inhibited the seed of humour, awaiting an awakening by such an impulse. The same advice would seem to apply to the propagation of religion."[514] Basically, we are capable of humour, or religious experience, however it is something that cannot be forced but must spontaneously occur. [515] The potential may be recessed but it is present and it is ready to grow once awakened. Eddington describes the relationship between our souls and God in a very personal way. He suggests, "If this kind of scientific dissection (of a joke) is felt to be inadequate and irrelevant in ordinary personal relationships it is surely out of place in the most personal relationship of all – that of the human soul to the divine spirit."[516] In the way that scientifically explaining the mechanics of a joke leaves us without laughter, in discussing the philosophical attributes of God we may find ourselves bereft of joy. We are liable to miss the core of religious experience, that is the intimate connection between spirit and Spirit. Eddington speaks of a close personal relationship with God that is outside of the boundaries of what science can address.

Through these categories of the numinous we have explored Eddington's thought in another light. More striking than the differences are the elements of commonality. Eddington's spiritual connection, and appreciation of a greater power, finds parallels with the *numen.* Let us turn to the fourth and final chapter of this thesis to bring together the threads connecting Eddington, the numinous and scientific thought.

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514 Eddington, *The Nature of the Physical World*, 323.

515 Eddington, *The Nature of the Physical World*, 323.

516 Eddington, *The Nature of the Physical World*, 327.

Chapter Four

Eddington, the Numinous and Scientific Thought

Scientific and Religious Freedom

The beginning of the twentieth century in Great Britain was an age of vast change after the Great War. Edward Grey is reported to have said – metaphorically and prophetically – that the lights were going out all over Europe. In postwar Britain there was social unrest and elsewhere there was momentous political change. Communism was established in Russia and fascism reared its head in Europe. Religion was not immune from being caught up in these changes. In fact, quite to the contrary, religion came under attack.

It is against this background that Eddington must be understood. He was a renowned scientist and recognized as such. No one questioned his scientific credentials. But Eddington was also deeply religious and this made him the object of polemical attack. Eddington eloquently and publically defended the integrity of his beliefs. He did not hesitate before the challenge of explaining how one could be both a scientist and also religious. He made it possible to think that in the modern age religion and science could co-exist in a positive way. In more recent times there have been quite a few scientists who have been openly religious – Charles Coulson, Arthur Peacock and John Collins, just to name a few of the more prominent ones. But in his day Eddington was virtually alone as a scientist who openly espoused his religious belief.

As we recall from chapter one Arthur Eddington was a product of the myriad of forces in his upbringing. Most significantly he was born into a Quaker family during a period of growth and definition for the faith. His ideas about the world were shaped by leaders of the Quaker Renaissance who valued Quakerism and the advance of science. Though he began as a child of little means his was a life of profound academic success later to become professional success and adventure as he travelled the world in search of astronomical phenomenon. Eddington lived to see dark times; his character was tested during times of war as he stood with the Society of Friends for pacifism. Out of these hardships was forged a strength of conviction towards his faith and a pronounced attitude of freedom towards life.

During the 1930's Eddington advocated pushing the boundaries of science. He did not believe in imposing limits but saw the world as an open expanse ready for exploration. With scientific discoveries occurring during his own lifetime he certainly anticipated that they would continued after his lifetime, as they have. Today the boundaries look quite a bit different than during Eddington's time. There are issues we face in science today that have complex biological, ethical, religious, and medical implications which were not previously envisioned. Eddington had anticipated that scientists might tackle 'the human' in the future and attempt to fully explain our nature. He was not convinced however, that no matter how far we probed, the essential nature of a person could be found. The sanctity of the human being, the purpose of the human being and the transcendent connection of the human being, was quite outside of the boundaries of biology. Our true nature rests outside of our biological origins and circumstances. Assurances of our purpose rests on the relationship we have cultivated with the divine. Considering that Eddington was not affected by biological descriptions of humans we would conclude that our physical, biological stuff, is not the stuff of divinity. It is open for investigation without limit.

Though we certainly cannot know how Eddington would react today we can consider the logic he used and apply his thoughts to issues in the modern world. Considering what he has said about the nature of the world and spirituality, Eddington would not easily have relinquished his claim on ultimate exploration. I tend to think Eddington would have been preoccupied with fulfilling the same spirit of seeking and accepted new research in the name of exploration. It is the exploration itself that would appeal to Eddington. Eddington continually emphasized the value of seeking and to him there is nothing forbidden by God that we should not find.

Eddington's spirituality is essentially flexible and quite encompassing. Like Otto, Eddington is open to religious conceptions as he finds them and takes inspiration wherever it appears, crossing religious boundaries in the process. Eddington is not bothered by the labels that we have put onto the transcendent. He talks about the Spirit,[517] an Absolute Valuer,[518] God, a universal Mind, Logos and a World-Spirit.[519] His openness towards differing conceptions of God is reflected in these many terms. Essentially they all call to mind a being of greatness that is beyond ourselves and yet a part of ourselves. Each has a different connotation with differing but equally valid ways to conceive of our transcendent experiences. This introduces a degree of religious freedom and inspires tolerance through flexibility.

Eddington does not 'water down' religion to an abstract concept whereby it becomes socially acceptable and is without conflict. Eddington has rather come to the core of religious experience and cast aside the rest. This core is not simplistic but rather deep in that it moves beyond most thought and rational assertions, and continues to be insightful today.

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517 Eddington, *Science and Religion*, 130.

518 Eddington, *The Nature of the Physical World*, 318.

519 Eddington, *The Nature of the Physical World*, 324.

Essentially there are many ways to experience the numinous, or transcendent, and this was Eddington's particular path. There are many people who hold strong religious convictions based on particular dogmatic beliefs that they consider absolute and uniquely valid. Eddington has moved beyond the specifics of the nature of God and focuses on the core of religious experience. Such an attitude today might inspire increased religious tolerance and freedom.

Though scripture may be insightful, and a trigger to awaken numinous passion in people, our everyday experiences can have the same effect. This puts Eddington's faith into the here and now. Eddington advocates appreciating and fulfilling our human nature today by doing things that enrich and please us. It is a lesson to respect our intuitive desires because they come from a higher source. The personal connection that Eddington feels towards the transcendent is not inflexible in conception and therefore widely appealing.

Extending this idea to science there are things outside of observational knowledge, outside of a rational, scientific assessment that make up our experience. Not all experience can be observed, measured, or classified. Given this difference, though the scientific paradigm may seem at odds with a religious perspective, they find common ground in an experiential journey of seeking. Silent communion with God in a Quaker Meeting hall is as real as an experiment in a laboratory. We are free to discover, and according to whichever way our Inward Light directs us, that may lead to scientific as well as spiritual discoveries.

Religion and Science

Along his journey of seeking Eddington's own experiences had been ambiguous. He seemed torn between having an accurate, scientific description of the world and having an

aesthetic appreciation. For Eddington it is to this deeper reality that we are called and where we belong. The world is not just a collection of data to be measured scientifically, nor is it just a world to be lived in and experienced at the everyday level. Experiences include both of these, however we are also called to access and experience reality outside of conventional boundaries. Eddington is the everyman, sitting at a wooden table. He is also the scientist, sitting at a table of mostly empty space. In the end, the everyman and scientist come together at a higher level. In appreciating both of these perspectives, Eddington has a self awareness that allows for a complex, multi-level analysis of life.

Eddington believes that firsthand knowledge and experience of God is the foundation of all religion. The truth about our existence is found in both spiritual and physical experience. Having reviewed these key points, let us keep them in mind during our examination of Eddington's union of scientific and religious thought.

Many people see science and religion as two completely separate domains. They are like two contiguous countries co-existing side by side. Each has its own language, laws and customs. When you cross from one to the other you give up the laws of the country you have left and live with a different language and set of laws. Religion and science, it is argued, are similarly two separate worlds each with their own language and laws. The idea of the two worlds of science and religion originates with Galileo[520] and was endorsed by Francis Bacon.[521] In more recent times this idea has been espoused by scientist and Christian, Michael Faraday, who divided his religious faith and scientific work. At the other end of the spectrum there is the view that science

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520 *Dialogue Concerning the Two Chief World Systems*. See Galileo Galilei, *Dialogo dei Massimi Sistemi 1632* (Berkerley: University of California Press, 1967).

521 It is interesting that Charles Darwin, in the preface to his *Origin of Species* (1859) quotes approvingly from *Advancement of Learning* where Bacon says: "To conclude, therefore, let no man out of a weak conceit of sobriety, or an ill-applied moderation, think or maintain, that a man can search too far or be too well studied in the book of God's word, or in the book of God's works; divinity or philosophy; but rather let men endeavour an endless progress or proficiency in both."

and religion are not separate domains. Each is united in a common case. To understand reality and human experience there is integration in thinking about science and religion. Physicist and priest, John Polkinghorne, is one such example of a Christian and a scientist who views science and religion as an integrated whole.

After briefly considering what these scientists have said we turn once more to Eddington and where he fits in the spectrum. When talking of science and religion Eddington does not put them on their own separate spheres, so to speak, but through the flexibility and depth of his religious thought, he unites them in a fashion similar to Polkinghorne. Having said that, Eddington, like Faraday, suggests that there are ways in which science and religion do differ and need to be kept separate from one another.

Two Worlds

Michael Faraday was a well recognized 19th century scientist made famous by his work on electricity and magnetism. He was offered the position of President of the Royal Society and a knighthood but he rejected both on the grounds that these were worldly honours.[522] Faraday was more than an accomplished scientist: he also had strong religious beliefs that guided his life. Faraday was a Sandemanian like his parents before him. The Sandemanians practiced Christianity akin to the way of the apostles. They also focused on the teachings of the bible. Here we see a similarity and difference with Eddington. Both are Christians but Eddington's particular

522 Eddington did not have an aversion to being recognized for his scientific achievements. He did consent to being knighted. But he seems to have had an aversion to recognition in religious matters. He did refuse a position of honour at his local Quaker Meeting house. He preferred instead to sit quietly among the other Friends.

sect did not rely on Christian scripture the way Faraday's did. This impacted their respective attitudes towards science.

Sandamanians believed in a separate church and state. Faraday extended that mindset of separation into his life. His scientific work and his religious beliefs were kept separate from each other. Faraday's friend, John Tyndall, made a well known remark that characterized Faraday's thinking about science and religion. He said, "When Faraday opened the door of the oratory, he closed that of the laboratory."[523] These two worlds were separated. For the door of one to open, the other necessarily had to be closed. Eddington was just the opposite because he integrated religious ideas of seeking, *a priori*, and aesthetic appeal into his scientific research.

As a scientist and a Christian Faraday believed that religion and science dealt with completely different sets of data. As a result they were quite separate from one another. Religion dealt with direct interactions with God and one's own soul whereas science dealt with observations in the world. There was a book of scripture to which God belonged and to which our spirituality belonged.[524] Likewise there was a book of nature dealing with the world and science, completely separate from religion. Faraday used a famous example from Galileo here, who also separated science and religion back in the seventeenth century. In his work Galileo had encountered a conflict between what the bible claimed and what his science had revealed. Galileo sought to describe the division between science and religion that would explain the apparent contradiction. He explained that God revealed the world in two books each of which were valid but were written in a different language and were concerned with different truths. The

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523 Raymond J. Seeger, "Faraday, Sandemanian," in *The Journal of the American Scientific Affiliation* 35 (1983): 101.

524 Paul Halsall, "Modern History Sourcebook: Michael Faraday (1791-1867): The Chemical History of A Candle, 1860," http://www.adherents.com/people/pf/Michael_Faraday.html (accessed May 3, 2009).

ideas found in each are ultimately 'compatible' because they have the same author. This effectively separated the natural world from scripture. The bible was not needed to understand nature, only how to live in the world.[525] Faraday, in borrowing this concept of two books, quite obviously was following in Galileo's footsteps. Faraday maintained his faith by closing his eyes to scientific truth and maintained his science by closing his heart to his faith.[526]

For Faraday facts were important in both scientific and religious fields. The difference was that facts were *discovered* in science through experimentation and observation and *revealed* in religion. Where science dealt with theory religion dealt with theology.[527] Eddington, on the other hand, believed that where science dealt with the physical, seen world, spirituality was often concerned with the intangible, unseen world. Science deals with symbols but religion deals with intimate knowledge. Even as scientists people need to use all elements of their personality to analyze and understand the symbols and their backgrounds. Faraday claimed that the overlap between these areas lead to conflict and that such mixing attested to the 'imperfection and incompleteness' of each. [528] If we understood each respective field completely there would be no overlap and no conflict. For Faraday science and religion are truly distinct entities but through our own imperfect understanding we have mixed them.

Faraday recognized some degree of connection between the fields despite this compartmentalization; there were similarities between his thinking on religion and science. For

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525 Robert Crease, "The Book of Nature," http://physicsworld.com/cws/article/print/26529 (accessed April 16, 2009). See also footnote 520 above.

526 This may lead to a "kind of moral schizophrenia" as suggested by Dr. David Hawkin in *The Word of Science: The Religious and Social Thought of C.A. Coulson (*London: Epworth Press, 1989), 26.

527 Seeger, *Faraday, Sandemanian*, 101.

528 Seeger, *Faraday, Sandemanian*, 101.

instance, both were grounded in an 'experimental view of nature.' Faraday even went so far as to suggest that the world of science, as described in the book of nature, was written by God. This echoes what Galileo claimed when he described a common author. This implies unity and coherence between the two books.

For Faraday the world was understandable, beautiful and to be used by people according to the plan of a good God.[529] Even though there were points of connection for Faraday, there would ultimately not be any way in which science and religion could or should come together. In using the book analogy these books can only remain separate from one another just as our attitudes and thoughts towards them should remain separate.[530]

Eddington also believed that science cannot merge with religion in order to support it. This would become an unwieldy burden. The scientific approach must be as freed from prejudice and subjectivity as possible. Imposing a religious mode of thinking, especially when combined with fixed doctrine, would counteract the scientific method. Consequently when scientific theories change religious faith will find itself on unsettled ground. Numinous energy cannot be dependent on the ebb and flow of scientific discovery, nor are its secrets so easily penetrated.

Eddington describes a tidiness of mind in keeping science and religion separate from each other. Science cannot support the conclusions of religion any more than religion can interfere with scientific procedure. It is not the place of science to solidify the connection between the material and spiritual. Furthermore, answers to scientific questions have no bearing

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529 Seeger, *Faraday, Sandemanian*, 101.

530 This separation of science and religion also echoes the beliefs of Bertrand Russell, an anti-Christian polemicist who influenced a whole generation of English intellectuals in the 1920s and 1930s.

on our personal sense of spirituality. As science discovers the physical world, spirituality addresses questions of the transcendent. So we come to fulfill the curious energy and fascination in our natures respectively.[531]

In addition, any scientific description of the world, no matter how precise, will ultimately be incomplete in that it asks and answers only a specific kind of question using a predetermined scientific method. If scientists were to begin to pose questions suited to a non-empirical approach there would be issues on both sides. As science enters the domain of religion it would do more than offer insightful examples. It would attempt to address things like God and the nature of humankind. As Eddington suggested the only sort of God capable of being defined by science is a God of differential equations. For God to be squeezed into the scientific method the resulting entity would be hardly recognizable. In the case of humans the complete scientific analysis of who we are, down to the human genome, would be leaving out an essential part of our existence: our drive for truth and our innate divine connection. That is not to say that Eddington would not be excited by the mapping of the genome because quite likely he would have been. Rather he would not have believed that all of our secrets could be revealed in knowing our exact genetic makeup however exciting it is. As much as it is in our nature to be curious about the world and to devise a way to scientifically measure and describe it, it is also in our nature to be creative, spontaneous, loving and appreciative of non-metrical aspects of life.

Despite the obvious and serious differences between Eddington and Faraday, there *are* ways in which Eddington keeps religion and science separate from each other. Eddington's ideas are much closer to Polkinghorne's in that the majority of his ideas unify religious and scientific thought.

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531 We ought to keep in mind here that this element of separation is dwarfed by the greater element of unification.

One World

On the other end of the spectrum there is John Polkinghorne who seeks to describe science and religion as unified. Polkinghorne was a distinguished quantum physicist and now also an Anglican priest. He was president of the International Society for Science and Religion and helped to organize the Society of Ordained Scientists. Polkinghorne believes that science and religion relate to each other as friends for both seek truth. His book entitled *One World* [532] describes science and religion as belonging to the "same world" as opposed to different worlds. Religion and science both contribute to a complete understanding of the world. They are linked by our desire to know things about our surroundings. This is in line with Eddington's thinking. Our compulsion to seek can be fulfilled by both scientific and religious experiences.

For Polkinghorne science and religion both inquire into the nature of reality. In the case of religion the inquiry is more subtle and put to rational discussion and evaluation. Religion looks for general evidence for the existence of God in the world and then to the nature of God through Christ. In science the inquiry is based on experimentation and theorizing leading to a coherent scientific worldview. The nature of the subject matter determines these differences. God quite obviously cannot be experimented on the way things of the world can. Eddington would agree with these differences of method while still maintaining a connection between the subjects.

Polkinghorne suggests that science explains the way the world works and religion is concerned with why things are as they are.[533] He believes that physics has a language of

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532 John Polkinghorne, *One World: The Interaction of Science and Theology* (London: SPCK, 1896).

533 Christian Cyr, "Science and Religion: Bridging the Divide," http://www.popsci.com/scitech/article/2009-03/science-and-religion-bridging-divide (accessed April 16, 2009).

mathematics while theology works in symbols and revelation. In each case we are pursuing the truth and it is truth that unites science and religion. Despite these differences in method Polkinghorne believes that all knowledge is one because it has been created by One. Even in scientific explorations scientists are beings created by God who engage in discovering his creation.

Polkinghorne cites the motto of the theologian from 1 Thessalonians 5:21, "Test everything; hold fast what is good." The same motto could be used in scientific inquiry. With what we know of Eddington he would tend to agree with the statement. As a scientist he is constantly revisiting and revising theory keeping only what continues to be true. The same is true of religion. Eddington bases his religious belief on experience. He constantly refreshes the picture through his renewed connection with God. Eddington's mystical connection with divinity ensures a current, real-time relationship that grows with him and his changing life.

Polkinghorne suggests that secular knowledge should benefit the religious thinker but not at the expense of religious knowledge or experience. There is a mutual influence between science and religion; each field directly impacts the other. For this reason the dialogue between science and religion needs to be open to new forms of knowledge and thinking. Science is traditionally reductionist however more and more we are seeing that that the whole is more than the sum of its parts. Physics cannot explain all. There is a need for complementary, holistic thinking. [534] This hits a core theme in Eddington who advocates an inclusion of all metrical and non-metrical themes in approaching the world. In holistic thinking an aesthetic, spiritual and metrical perspective would be included in understanding the world.

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534 John Polkinghorne, "The continuing interaction between Science and Religion," *Journal of Religion and Science* 40 no 1 (2005): 43-50.

Unlike Eddington, however, Polkinghorne advocates more of an integration between science and religion. He uses the scientific method to inquire into religious phenomenon. Using his training as a scientist he addresses things like prayer and miracles from a scientific perspective. Eddington repeatedly objected to this kind of mixing of science and religion. Here we see how Eddington moves away from the complete integration of Polkinghorne. He maintains a small degree of separation between science and religion. Using the scientific method to inquire into religious phenomenon lacks a 'tidiness'[535] of thinking that Eddington warned against.

While Faraday separated science and religion, Polkinghorne has worked hard to join them together. Eddington included elements from each though he is much more in line with the unity of Polkinghorne. Let us return to Eddington's perspective of unity between science and religion.

The Complex Interaction of Science and Religion

One of Eddington's role models, an American Quaker Mystic Rufus Jones, explained what it meant to have 'one life.' Jones claimed that there was no inner and outer life but that all were one. "There is no inner life that is not also an outer life. To withdraw from the stress and strain of practical action and from the complication of problems into the quiet cell of the inner life in order to build its domain undisturbed is the sure way to lose the inner life."[536] Eddington, like Jones, had an integrated self. Spiritual belief is not something that can be kept secretly

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535 Eddington, *Unseen World*, 17.

536 Stanley, 38-39.

within and never revealed in the outside world. It is a part of an integrated person, integrated within themselves and with the rest of their lives. This is precisely in line with Eddington's thinking. Our exploration of Eddington's upbringing and adult life show how his beliefs were always of great importance: in his choice of schooling, his career, his stance on the war, and what he ultimately fought for in life.

Eddington could not separate his obligations as a scientist with his beliefs as a Quaker. His personal convictions were at least as strong as his scientific loyalties. Eddington understood the world on many levels and from different perspectives. He did not approach the world solely as a physicist or even solely as a member of the Society of Friends but as a person of varied talents and beliefs. His was a life of freedom: freedom from societal convention and from religious expectation. This is because of his unique religious perspective and spiritual connection.

Let us consider how this concept of unity enabled Eddington's connection between the numinous and science. We consider here the example of his astronomical work.

Eddington's religious experience is both deeply personal and intimate but also reflected in his everyday astronomy. As a practical mystic Eddington does not forsake the world in pursuit of purely 'spiritual' experiences. Eddington engages with the world as a successful scientist; he investigates astronomical phenomenon, the 'laws of nature' and his own concept of Nature. For Eddington the truth was not found in miracles but in an everyday appreciation of the world and through silence. The still, quiet voice of God is heard within Eddington through spiritual and scientific practice.

Though Otto suggests that mysticism is the stressing of the non-rational over the rational Eddington has found outlets for his mystical belief that are grounded in rationality. What might

be considered a non-religious activity, science, is for Eddington an expression of his spiritual beliefs. His work as a scientist is fulfilling his purpose on earth.

In astronomy, like religious experience, there is an overpowering feeling and awe in the face of vastness and our own insignificance. Eddington's chosen field lends itself to such awe filled inspiration. The cosmos has often been a source of divine inspiration. The vastness of nature is at once powerful and awe inspiring. It creates an apprehension of our own createdness. This is a creature consciousness which according to Otto is dependent on the 'numen praesens.' Eddington's astronomical work stirs feelings of aweful majesty and submergence into something greater.

Almost as a confirmation of his efforts in astronomy Eddington discovered much beauty along the way. There is beauty in physics, a beauty that resonates with its simplicity and intricacy of detail. There is a perfection that calls divinity to mind. Beauty is a way for Eddington to move beyond the world and the boundaries of science and tangible reality to something that is other. The beauty of science connects Eddington with God. Beauty is also a means of awakening spiritual potential and a means of recognising the numinous. People have always been trying to capture and preserve this numinous energy for others to encounter and appreciate. Beauty is a gateway to awakening something within ourselves and also connects us with what rests outside of us. Otto would argue that natural triggers can only mirror the true element of the beyond. Eddington however seems convinced that he is crossing boundaries in his appreciation of natural beauty. Specifically it is an "achievement of a divine element in man's nature."[537] Beauty is a unifying force between the transcendent and science as well as nature.

We are drawn towards beauty and are fascinated by it. Seeking out fascinating astronomical phenomenon put Eddington's restless energy of seeking to good use. Otto described

537 Eddington, *The Nature of the Physical World*, 322.

the expression of this energy as passion, excitement and activity. Eddington understands that this energy comes from a greater source and finds fulfillment in earthly activity. To acknowledge that stirring of energy was a way to fulfill his human nature and to connect with a transcendent, perhaps numinous energy. This active energy draws us to God in a number of ways.

Even as a young child Eddington stood before the starry night sky and counted as best he could the number of stars in the sky. True to his dualistic nature he also began to count the words of the bible. Through observation and counting, the very beginnings of the scientific method, Eddington approached stars and also God. Appreciation of beauty sometimes involves creativity on the part of the beholder whereby we give particular meaning to what we see. Eddington is not opposed to this creativity and suggests that scientists act likewise when they take liberties in their work. Without an element of creativity and personality scientific and religious thought would suffer.

When Eddington explores astronomical phenomenon he is free to discover. He does not have to consider the religious implications of his work nor is he subject to breaking some immutably established religious laws. In fact, whatever his results are, they will be in line with his religious thought as they have been guided by his Inner Light. More than just a scientist or a Quaker, Eddington embodies the spirit of a Seeker. He honours the divinity within himself by maintaining a connection with the transcendent, in his personal life and scientific career. The *Mysterium Tremendum* of the numinous seems a part of that connection.

Conclusion: Seek and Ye Shall Find Fulfilment

Eddington was an individual whose religious thought was altogether profound and all-encompassing. It is because of the depth of his spirituality that he was able to find unity in his

life and work. The numinous has been an essential key in allowing us to appreciate the sophistication of Eddington's religious thought, which can get lost as a footnote to his scientific accomplishments. This thesis has intended to highlight the forward-thinking spirituality that characterized Eddington's worship, beliefs and life. Even as a person rooted in his own time Eddington continues to be an example today of successful harmonization of one's life and beliefs. Given his work in astrophysics, that harmony extended to religion and science, fields renown for being in conflict.

Seeking has a long standing tradition of being placed at the forefront of the Quaker faith. Religion and religious seeking continues to be important to many people today. Less common is the attitude that the destination is not the focal point. As we orient ourselves towards the good, our experiences along the way are most significant. In Eddington's case seeking gives meaning to scientific and religious journeys allowing for ongoing discovery and growth, even in the absence of a final destination. The anxious energy that compels us to have absolute answers is replaced by the calm energy of a long term commitment to appreciate the journey. It is the experience of God that is the foundation of all religions and it is the experience of the world that is the foundation of science. The seeking that leads to experience links together different facets of our lives. The tentative acceptance of knowledge is freeing in that it can make way for deeper truths as they are discovered. In the same way that scientific research improves, so too our relationship with the transcendent finds new levels of meaning with continued perseverance.

Eddington has been able to accomplish unity in his life by deepening his concept of religion and spirituality. He believes in the significance of that which we cannot see or know intellectually but can sense and feel. Those feelings are not dismissed as non-metrical, and therefore non-meaningful. Eddington has allowed himself to be sensitive to elements of the

world that his spirit appreciates. He is guided by an Inward Light that bids him to fulfill his life in a way that he recognizes intuitively as meaningful. Eddington has elevated an appreciation of beauty to the level of spiritual experience. Beauty touches him so deeply that it becomes a connection to divinity. Eddington has accepted responsibility for finding truth in his life, forming a personal relationship with the other, and building a world that is a little less divisive. Like Otto, Eddington is emphasizing a spectrum of religious experiences. He is beyond titles, beyond dogma, and is reaching for the core of all religions in quiet reflection and in mystical appreciation. There is a force beyond our consciousness which is also beyond conception but which is still a part of us. We are all connected to that unseen world and its power. The unseen world can be found quietly, every day, in one's own time, thereby cultivating an appreciation of the divine. During moments of silence we can connect with the deeper parts of numinous religious experience in a way that is not intellectual or rational but beyond conventional understanding and intelligibility.

In the modern world there is much conflict and tension surrounding religious practice. Often such conflicts can become hostile having far reaching, negative consequences. There are many who view religious thought as archaic and problematic [538] and scientific thought as purely progressive and positive. [539] Eddington's life and work is an inspirational example of someone who was able to see that religion and science can coexist and that both religious activity and the scientific enterprise can contribute positively to life in the modern world. We do not need to make a choice between one or the other; we can have both. Eddington's liberal emphasis on

538 For example see Christopher Hitchens, *God is not Great: How Religion Poisons Everything* (Toronto: McClelland and Stewart, 2007); See footnote 2 above for Dawkins.

539 For example C.H. Waddington claimed that, "Science by itself is able to provide mankind with a way of life which is firstly self consistent and harmonious and secondly, free for the exercise of that objective reason on which our civilization depends." See C.H. Waddington, *The Scientific Attitude* (London: Hutchingson Educational, 1941; 2nd ed. 1968), 144.

freedom allowed him to see science not as something to be feared, but rather as something to be embraced and as contributing to a better understanding of the world. His emphasis on tolerance and non-dogmatic belief enabled him to describe religion in terms which were deeply personal and very positive. We in the modern world can learn much from Sir Arthur Stanley Eddington.

Lex Orandi, Lex Credendi, Lex Vivendi

Bibliography

Abbot, Andre Delano. *Methods of Discovery: Heuristics for the Social Scientists.* New York: W.W. Norton and Co., 2004.

Almond, Philip. *Rudolf Otto: An Introduction to his philosophical theology.* Chapel Hill: University of North Carolina Press, 1984.

Asad, Talal. *Genealogies of Religion: Discipline and Reasons of power in Christianity and Islam.* Balitmore: John Hopkins University Press, 1993.

Bastow, D. "Otto and Numinous Experience." *Religious Studies* 12 (1976): 176.

Batten, Alan. "A Most Rare Vision: Eddington's Thinking on the Relation between Science and Religion." *Q.J.R. Astronomical Society* 35, (1994): 249-270.

Batten, Alan. "Eddington's Philosophy of Science." *The Royal Astronomical Society* 35, no. 3 (1997): 252-269.

Batten, Alan. "What Eddington Did Not Say." *Journal of the History of Science in Society* 94 (2003): 656-659.

Bennett, Charles. "Religion and the Idea of the Holy." *The Journal of Philosophy*, Vol. 23, No. 17 (Aug. 19, 1926), pp. 460-469.

Brooke, Rupert. *The Poems of Rupert Brooke.* Edited by Timothy Rogers. London: Black Swan, 1987.

Bruce, Steve. *Religion in Modern Britian.* Oxford: Oxford U.P., 1995.

Butler, John Francis. "Psychology and the "Numinous." *The Journal of Religion*, Vol. 13, No. 4 (Oct., 1933), pp. 399-414.

Cantor, Geoffrey. *Quakers, Jews, and Science.* Oxford: Oxford U.P., 2005.

Casement, Ann; Tracey, David. *The Idea of the Numinous : Contemporary Jungian and*

Psychoanalytic Perspectives. London ; New York : Routledge, 2006.

Chandrasekar, S. *Eddington: The Most Distinguished Astrophysicist of his Time.* Cambridge: Cambridge U.P., 1983.

Collins, Francis. *The Language of God: A Scientists Presents Evidence for Belief.* USA: Pocket Books, 2007.

Comstock, Richard. "A Behavioural Approach to the Sacred: Category Formation in Religious Studies." *Journal of the American Academy of Religion*, Vol. 49, No. 4 (Dec., 1981), 625-643.

Coulson, Charles. *Christianity in an Age of Science.* Oxford: OUP, 1953.

Cox, James. *A Guide to the Phenomenology of Religion: Key Figures, Formative Influence and Subsequent Debates.* London; New York: T & T International, 2006.

Crease, Robert. "The Book of Nature." Available from http://physicsworld.com/cws/article/print/26529. Internet; accessed 16 April, 2009.

Cupitt, Donn. *Sea of Faith.* London: SCM, 1984.

Cyr, Christian. "Science and Religion: Bridging the Divide." Available from http://www.popsci.com/scitech/article/2009-03/science-and-religion-bridging-divide. Internet; accessed 16 April, 2009.

Darwin, Charles. *On the Origin of Species*. New York: Gramercy Books, 1979.

Davidson, Robert. *Rudolf Otto's Interpretation of Religion.* Princeton: Princeton U.P., 1947.

Dawkins, Richard. *A Devil`s Chaplain: Reflections on Hope, Lies, Science and Love.* Boston: Houghton Mifflin Co., 2003.

Dawkins, Richard. *The Blind Watchmaker*. New York: Norton, 1986.

Dawkins, Richard. *The God Delusion.* Great Britain: Bantam Press, 2008.

Dawkins, Richard. *The Selfish Gene*. Oxford: Oxford U.P., 2006.

Dawkins, Richard. *Unweaving the Rainbow: Science, Delusion and an Appetite for Wonder*. Boston: Houghton Mifflin Co., 1998.

Dingle, Herbert. "Sir Arthur Stanley Eddington." *The Observatory* 824, no. 66 (February 1945).

Dingle, Herbert. *The Sources of Eddington's Philosophy.* Cambridge: Cambridge U.P., 1954.

Douglas, A. Vibert. "Arthur Stanley Eddington." *The Journal of The Royal Astronomical Society of Canada* 340, vol. xxxix no. 1 (January, 1945).

Douglas, Vibert A. *The Life of Arthur Stanley Eddington.* London: Thomas Nelson and Sons Ltd., 1956.

Eddington, Arthur. *New Pathways in Science.* Cambridge: Cambridge U.P., 1935.

Eddington, Arthur. "Chapter IX: Professor Sir Arthur Eddington." In *Science and Religion.* Edited by Joseph Needham. London: Gerald Howe Limited, 1931.

Eddington, Arthur. *Science and the Unseen World.* London: George Allen & Unwin Ltd, 1929.

Eddington, Arthur, "The Domain of Physical Science." In *Science, Religion and Reality* edited by Joseph Needham, 187-219. New York: Kennikat Press, 1970.

Eddington, Arthur. *The Nature of the Physical World.* London: J.M. Dent and Sons Ltd., 1935.

Eddington, Arthur. *The Philosophy of Physical Science.* Great Britain: Cambridge U.P, 1939.

Freud, Sigmund. *The Future of an Illusion.* London: Hogarth Press and the Institute of Psychoanalysis, 1968.

Gadamer, Hans Georg. *Plato und die Dicher*. Frankfurt/Main: Klostermann, 1934.

Galilei, Galileo. *Dialogo dei Massimi Sistemi* (1632), ET: *Dialogue Concerning the Two Chief World Systems*. Berkerley: University of California Press, 1967.

Gigerenzer, Gerd and Peter M. Todd and the ABC Research Group. *Simple Heuristics that Make*

us Smart. Oxford: Oxford U.P, 2001.

Gilbert, Alan D. *The Making of Post Christian Britain.* New York: Longman, 1980.

Gooch, Todd A. *The Numinous and Modernity: An Interpretation of Rudolf* Otto*'s Philosophy of Religion.* New York: Walter de Gruyter, 2000.

Graham, William. *Evolution and Empire*. London: Headley Brothers, 1912.

Graham, William, "The Meaning of Quakerism," [1990] unknown source.

Groner, Rudolf et al. *Methods of Heuristics.* New Jersey: Laurence Erlbaum Associates, 1983.

Gnuse, Robert. "Contemporary Evolutionary Theory as a New Heuristic Model for the Socioscientific Method in Biblical Studies." *Journal of Religion and Science*, Vol. 25, no. 4 (2005): 405-431.

Halsall, Paul. "Modern History Sourcebook: Michael Faraday (1791-1867): The Chemical History of A Candle, 1860." Available from http://www.fordham.edu/halsall/mod/1860Faraday-candle.html. Internet; accessed 16 April, 2009.

Hastings, Adrian. *A History of English Christianity1920-1990.* London: S.C.M Press, 1991.

Hawkin, David and Eileen. *The Word of Science: The Religious and Social Thought of C.A. Coulson.* London: Epworth Press, 1989.

Hitchens, Chritsopher. *God is not Great: How Religion Poisons Everything*. Toronto: McClelland and Stewart, 2007.

Hutchingson, Ian H. *Astrophysics and Mysticism: the life of Arthur Stanley Eddington*. Accessed 18 March, 2008; available from http://silas.psfc.mit.edu/eddington/

James, William. *Varieties of Religious Experience*. London: Routledge, 2002.

Jones, Rufus. *A Service of Love in Wartime*. New York: Macmillion, 1920.

Jung, Carl. *The Psychology of the Unconscious.* London: Kegan Paul, 1911.

Kennedy, Thomas. *British Quakerism 1860-1920.* Oxford: Oxford U.P., 2001.

Lewis, Clive S. *The Problem of Pain.* New York: Macmillion, 1962.

Lonergan, Bernard. *Method in Theology.* London: Longman & Todd Limited, 1971.

McCutcheon, Russell. *Manufacturing religion: the Discourse on Sui Generis Religion and the Politics of Nostalgia.* New York: Oxford University Press, 1997.

McRoberts, Omar M. "Beyond Mysterium Tremendum: Thoughts toward an Aesthetic Study of Religious Experience." *Annals of the American Academy of Political and Social Science* Vol. 595, (Sept., 2004), pp. 190-203.

Miller, Arthur. *Empire of the Stars.* New York: Houghton Mifflin Co., 2005.

Morton, Kelsey. *Healing and Christianity: A Classic Study.* Philadelphia: Fortress Press, 1999.

Oman, J. *The Natural and the Supernatural.* Cambridge: Cambridge University Press, 1931.

Otto, Rudolf. *Das Gefühl Des Uberweltlichen.* München: C.H. Beck'sche Verlagsbuchhandlung, 1932.

Otto, Rudolf. *A Supplement to The Idea of the Holy.* Oxford: Oxford U.P., 1931.

Otto, Rudolf. *Mysticism East and West.* New York: Macmillion, 1970.

Otto, Rudolf. *Naturalism and Religion.* London: Williams & Norgate Ltd., 1907.

Otto, Rudolf. *The Idea of the Holy.* London: Oxford University Press, 1977.

Otto, Rudolf. *The Philosophy of Religion.* London: Williams and Norgate Ltd., 1931.

Otto, Rudolf. *Autobiographical and Social Essays.* Berlin: Mouton de Gruyter, 1996.

Peacock, Arthur. *Creation and the World of Science.* Notre Dame: University of Notre Dam Press, 1979.

Peacock, Arthur. *God and the New Biology.* London: G.M. Dent and Sons, 1994.

Plato's Republic [encyclopedia definition on-line]; available from http ://www.fact-

archive.com/encyclopedia/Plato's_Republic; Internet: accessed 20 November.

Peacock, Arthur. *Intimations of Reality: Critical Realism in Science and Religion.* Notre Dame: University of Notre Dame Press, 1984.

Poland, Lynn. "The Idea of the Holy and the History of the Sublime." *The Journal of Religion*, Vol. 72, No. 2 (Apr., 1992), pp. 175-197.

Polkinghorne, John. *One World :The Interaction of Science and Theology.* London: SPCK, 1986.

Polkinghorne, John. "The continuing interaction between Science and Religion." *Journal of Religion and Science* 40, no 1 (2005): 43-50.

Polkinghorne, John. *The End of the World and the Ends of God: Science and Theology on Eschatology*. Harrisburg, PA: Trinity Press International, 2001.

Polya, George. *How to Solve It.* Princeton: Princeton U.P., 1945.

Proudfoot, Wayne. "Religious Experience, Emotion and Belief." *The Harvard Theological Review*, Vol. 70, No. 3/4 (Jul. - Oct., 1977), pp. 343-367

Pruyser, Paul. "Lessons from Art Theory for the Psychology of Religion." *Journal for the Scientific Study of Religion*, Vol. 15, No. 1 (Mar., 1976), pp. 1-14.

Raphael, Melissa. *Rudolf Otto and the Concept of Holiness*. Oxford: Clarendon Press, 1997.

Ritchie, A. D. *Reflections on the Philosophy of A.S. Eddington.* Cambridge: Cambridge U.P., 1948.

Ritschl, Albrecht. *The Christian Doctrine of Justification and Reconciliation.* Edinburgh: W.F. Henderson, 1900.

Rosetti, Dante Gabriel. *Collected Poetry and Prose.* Edited by Jerome McGann. New Haven: Yale University Press, 2003.

Rowntree, John Wilhelm. "The Rise of Quakerism in Yorkshire." In *John Wilhelm Rowntree: Essays and Addresses*, ed. Joshua Rowntree. London: Headley Bros, 1906.

Russell, Henry. "Sir Arthur Stanley Eddington 1882-1944." *The Astrophysical Journal* 101, no. 2 (March 1945).

Schafer, Robert Jones et al. *A Guide to Historical Method.* Homewood Illinois: Dorsey Press, 1980.

Scott, John. *Religion in Modern Britain.* Oxford: Oxford U.P., 1995.

Seeger, Raymond J. "Eddington Mystic Seeker." *The Journal of American Scientific Affiliation* 36 (March 1984).

Seeger, Raymond J. "Faraday, Sandemanian" in *The Journal of the American Scientific Affiliation*, 35 (1983): 101. Available from http://www.asa3.org:16080/ASA/PSCF/1983/JASA6-83Seeger.html. Internet; accessed 23 April 2009.

Sharpe, E. *Nathan Soderblom and the Study of Religion.* Chapel Hill, NC: University of North Carolina Press, 1990.

Shuster, Arthur. "International Science." *University Review*, 1906.

Stace, Walter T. "Naturalism and Religion." *Proceedings and Addresses of the American Philosophical Association*, Vol. 23, (1949 - 1950), pp. 22-46.

Stanley, Matthew. *Practical Mystic.* Chicago: University of Chicago Press, 2007.

Stebbing, Susan. *Philosophy and the Physicist.* London: Methuen, 1937.

Streetman, Robert. "Some Later Thoughts of Otto on the Holy." *Journal of the American Academy of Religion*, Vol 48, No. 3 (Sept., 1980) pp. 365-384.

Sullivan, J. W. N. "Review of Science, Religion and Reality." *Times Literary Supplement* Nov.

12 (1925) 748.

Sykes, S.W. "Theology." In *Twentieth Century Mind*, ed. C.B. Cix and A.E. Dyson. Oxford: Oxford University Press, 1972.

Troeltsch, Ernst. *The Absoluteness of Christianity and the History of Religions.* London: SCM Press, 1902.

Wach, Joachim. "Rudolf Otto and the Idea of the Holy." *Types of Religious Experience*, 1951.

Waddington, C.H. The Scientific Attitude. London: Hutchinson, 1941; 2nd ed. 1968.

Weber, Max. *The Methodology of Social Sciences*. New York: Free Press, 1949.

Wittaker, Edmund. *Eddington's Principle in the Philosophy of Science.* Cambridge: Cambridge U.P., 1951.

Youlton, John W. *The Philosophy of Science of A.S. Eddington.* Netherlands: The Hague, 1960.

Appendix A: Eddington's Scientific Works

Book List

1914 *Stellar Movements and the Structure of the Universe*. Macmillan.

1918 *Report on the relativity theory of gravitation*. Physical Society of London.

1920 *Space, Time and Gravitation: An Outline of the General Relativity Theory*. Cambridge University Press.

1923 *The Mathematical Theory of Relativity*. Cambridge University Press.

1926 *The Internal Constitution of Stars*. Cambridge University Press.

1927 *Stars and Atoms*. British Association.

1928 *The Nature of the Physical World*. MacMillan.

1929 *Science and the Unseen World*. Macmillan.

1933 *The Expanding Universe: Astronomy's 'Great Debate', 1900-1931*. Cambridge University Press.

1935 *New Pathways in Science*. Cambridge University Press.

1936 *Relativity Theory of Protons and Electrons*. Cambridge University Press.

1939 *Philosophy of Physical Science*. Cambridge University Press.

1946 *Fundamental Theory*. Cambridge University Press.

Selection of Scientific Papers[540]

Eddington, A.S. "Systematic Motions of the Stars." *MNRAS* 67, 34-63 (1906).

Eddington, A.S. "On the Mathematical Theory of Two Star-drifts, and on the Systematic Motions of Zodiacal Stars." *MNRAS* 68, 588-613 (1908).

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540 For a complete list please see 'Miscellaneous Papers' Douglas, 193.

Eddington, A.S. "The Distribution in Space of the Bright Stars." *MNRAS* 73, 346-58 (1913).

Eddington, A.S. "The Dynamics of a Gobular Stellar System." *MNRAS* 74, 5-16 (1913) and 75, 366-76 (1915).

Eddington, A.S. & W.E. Hartley. "A Determination of the Systematic Motions of the Stars from the Radial Velocities." *MNRAS* 75, 521-30 (1915).

Eddington, A.S. "The Dynamics of a Stellar System. Third paper: Oblate and Other Distributions." *MNRAS* 76, 37-60 (1915).

Eddington, A.S. "The Pulsation Theory of Cepheid Variables." *Observatory* 40, 290-93 (1917).

Eddington, A.S. "On the Radiative Equilibrium of the Stars." *MNRAS* 77, 16-35 (1916) and 77, 596-612 (1917).

Dyson, F.W., A.S. Eddington, & C. Davidson, "A Determination of the Deflection of Light by the Sun's Gravitational Field, from Observations Made at the Total Eclipse of May 29, 1919." *Philosophical Transactions of the Royal Society of London* A220, 291-333 (1920).

Eddington, A.S. "The Internal Constitution of the Stars." Presidential Address to Section A of the British Association at Cardiff 42 Aug 1920, 34-49 (1920). Reprinted in *Nature* 106, 14 (1920).

Eddington, A.S. *The Theory of Relativity and its Influence on Scientific Thought* [Romanes Lecture, 1922] Clarendon Press, Oxford, 1922.

Eddington, A.S. "Applications of the Theory of the Stellar Absorption Coefficient." *MNRAS* 83, 98-109 (1922).

Eddington, A.S. *The Mathematical Theory of Relativity*. Cambridge: Cambridge U. P., 1923.

Eddington, A.S. "On the Relation between the Masses and Luminosities of the Stars." *MNRAS* 84, 308-332 (1924).

Appendix B: Poems Cited by Eddington

The Dead (IV) by Rupert Brooke[541] and The Blessed Damozel by Dante Gabriel[542]

THE DEAD (IV)

By: Rupert Brooke

These hearts were woven of human joys and cares,
Washed marvellously with sorrow, swift to mirth.
The years had given them kindness. Dawn was theirs,
And sunset, and the colours of the earth.
These had seen movement, and heard music; known
Slumber and waking; loved; gone proudly friended;
Felt the quick stir of wonder; sat alone;
Touched flowers and furs and cheeks. All this is ended.

There are waters blown by changing winds to laughter
And lit by the rich skies, all day. And after,
Frost, with a gesture, stays the waves that dance
And wandering loveliness. He leaves a white
Unbroken glory, a gathered radiance,
A width, a shining peace, under the night

541 Rupert Brook, *The Poems of Rupert Brooke* ed. Timothy Rogers (London: Black Swan, 1987), 8.

542 Dante Gabriel Rossetti, *Collected Poetry and Prose,* ed. Jerome McGann (New Haven: Yale University Press, 2003), 3.

THE BLESSED DAMOZEL

By: Dante Gabriel Rossetti

The blessed damozel leaned out
From the gold bar of Heaven;
Her eyes were deeper than the depth
Of waters stilled at even;
She had three lilies in her hand,
And the stars in her hair were seven.

Her robe, ungirt from clasp to hem,
No wrought flowers did adorn,
But a white rose of Mary's gift,
For service meetly worn;
Her hair that lay along her back
Was yellow like ripe corn.

Herseemed she scarce had been a day
One of God's choristers;
The wonder was not yet quite gone
From that still look of hers;
Albeit, to them she left, her day
Had counted as ten years.

(To one, it is ten years of years.
...Yet now, and in this place,
Surely she leaned o'er me -her hair
Fell all about my face...
Nothing: the autumn-fall of leaves.
The whole year sets apace.)

It was the rampart of God's house
That she was standing on;
By God built over the sheer depth
The which is Space begun;
So high, that looking downward thence
She scarce could see the sun.

It lies in Heaven, across the flood
Of ether, as a bridge.
Beneath, the tides of day and night
With flame and darkness ridge
The void, as low as where this earth
Spins like a fretful midge.

Around her, lovers, newly met
Mid deathless love's acclaims,
Spoke evermore among themselves
Their heart-remembered names;
And the souls mounting up to God
Went by her like thin flames.

And still she bowed herself and stooped
Out of the circling charm;
Until her bosom must have made
The bar she leaned on warm,
And the lilies lay as if asleep
Along her bended arm.

From the fixed place of Heaven she saw
Time like a pulse shake fierce
Through all the worlds. Her gaze still strove
Within the gulf to pierce
Its path; and now she spoke as when
The stars sang in their spheres.

The sun was gone now; the curled moon
Was like a little feather
Fluttering far down the gulf; and now
She spoke through the still weather.
Her voice was like the voice the stars
Had when they sang together.

(Ah sweet! Even now, in that bird's song,
Strove not her accents there,

Fain to be hearkened? When those bells
Possessed the midday air,
Strove not her steps to reach my side
Down all the echoing stair?)

"I wish that he were come to me,
For he will come," she said.
"Have I not prayed in Heaven? -on earth,
Lord, Lord, has he not prayed?
Are not two prayers a perfect strength?
And shall I feel afraid?

"When round his head the aureole clings,
And he is clothed in white,
I'll take his hand and go with him
To the deep wells of light;
As unto a stream we will step down,
And bathe there in God's sight.

"We two will stand beside that shrine,
Occult, withheld, untrod,
Whose lamps are stirred continually
With prayer sent up to God;
And see our old prayers, granted, melt
Each like a little cloud.

"We two will lie i' the shadow of
That living mystic tree
Within whose secret growth the Dove
Is sometimes felt to be,
While every leaf that His plumes touch
Saith His Name audibly.

"And I myself will teach to him,
I myself, lying so,
The songs I sing here; with his voice
Shall pause in, hushed and slow,
And find some knowledge at each pause,
Or some new thing to know."

(Alas! we two, we two, thou sayst!
Yea, one wast thou with me
That once of old. But shall God lift
To endless unity
The soul whose likeness with thy soul
Was but its love for thee?)

"We two," she said, "will seek the groves
Where the lady Mary is,
With her five handmaidens, whose names
Are five sweet symphonies,
Cecily, Gertrude, Magdalen,
Margaret and Rosalys.

"Circlewise sit they, with bound locks
And foreheads garlanded;
Into the fine cloth white like flame
Weaving the golden thread,
To fashion the birth-robes for them
Who are just born, being dead.

"He shall fear, haply, and be dumb:
Then will I lay my cheek
To his, and tell about our love,
Not once abashed or weak:
And the dear Mother will approve
My pride, and let me speak.

"Herself shall bring us, hand in hand,
To Him round Whom all souls
Kneel, the clear-ranged unnumbered heads
Bowed with their aureoles:
And angels meeting us shall sing
To their citherns and citoles.

"There will I ask of Christ the Lord
Thus much for him and me: -
Only to live as once on earth
With Love, -only to be,
As then awhile, for ever now
Together, I and he."

She gazed and listened and then said,
Less sad of speech than mild, -
"All this is when he comes." She ceased.
The light thrilled towards her, filled
With angels in strong level flight.
Her eyes prayed, and she smiled.

(I saw her smile.) But soon their path
Was vague in distant spheres:
And then she cast her arms along
The golden barriers,
And laid her face between her hands,
And wept. (I heard her tears.)

Appendix C: Photos of Eddington

Eddington Senior Wrangler, Cambridge 1905[543]

Eddington's Garden: Eddington and Einstein, 1930

543 Plate 3 and Plate 11, from Douglas facing pages 3 and 115.