"One of the great regrets of history occurred in the seventeenth century's split of science and religion between Galileo and the church. It has been said that without this split we would have had better science and better religion. Heidi Russell not only offers us the best of science and religion of the twenty-first century but recasts for us their whole relationship. Instead of contending their truths, she engages the rich analogies that each has to offer in the pursuit of relationality/love. This is an utterly pastoral approach to science and theology, 'rejuvenating what it means to be the body of Christ as inherent connectedness to all of creation impacting our understanding of social and environmental justice.'"

— Bob O'Gorman
Professor Emeritus
Loyola University Chicago

"Heidi Russell's book *Quantum Shift* is an engaging, informative, and often profound glimpse into the way in which the worldview produced by quantum physics can alter and invigorate our conceptions of God and creation. Charting a course between innovation and tradition, Russell offers novel vocabulary and fresh perspectives for theologians, pastoral ministers, and other persons of faith seeking to navigate the implications of the new sciences for religious belief. Eminently readable and replete with examples to concretize sometimes abstract concepts, Russell's work is sure to whet the reader's appetite for more science and to slake the reader's thirst for the more expansive and dynamic insights into God and the God-world relationship afforded by this scientific worldview. *Ephphata*—and enjoy!"

— Gloria L. Schaab
Barry University

"In *Quantum Shift*, Heidi Russell provides an insightful look into the implications of contemporary scientific research for theology and ministry. This work helps to advance the important idea that it is possible to be a deeply committed person of faith and still appreciate contemporary scientific inquiry. The pastoral application of scientific and theological insights that she offers are also a particularly valuable contribution for both theologians and pastoral ministers and stands out among other recent works on the relationship between theology and science."

— Theodore James Whapham
Dean, School of Ministry
Associate Professor
University of Dallas

"In his revolutionary encyclical, *Laudato Sì*, Pope Francis called everyone on Earth to conversion at the level of conscience to a connected way of being and acting, because to do otherwise is to live in a false reality: 'Everything is connected' (90). In this book, Heidi Ann Russell builds on the important academic premise, as articulated in the foreword, that 'there is a universal basis for our understanding and, since that basis cannot be self-contradictory, the understanding one has from one discipline should complement that which one has from all other disciplines.'

"Russell's work is exemplary in that she models this converted way of thinking in every chapter. In so doing, she opens compelling new insights into traditional tenets of the Christian faith. In her hands, complex concepts of science—quantum mechanics, chaos theory, modern cosmology, etc.—are made accessible and the portal of entry into dialogue with the Christian tradition. Russell's engaging, dynamic, infectious dialogue draws the reader toward religious renewal that supports a connected lifestyle. It is a must-read—for the sake of God's people and the planet!"

— Dawn M. Nothwehr, OSF
Erica and Harry John Family Endowed Chair in Catholic Theological Ethics
Catholic Theological Union
Chicago, Illinois

Quantum Shift

Theological and Pastoral Implications of Contemporary Developments in Science

Heidi Ann Russell

Foreword by
George V. Coyne, SJ

A Michael Glazier Book

LITURGICAL PRESS
Collegeville, Minnesota

www.litpress.org

A Michael Glazier Book published by Liturgical Press

Cover design by Monica Bokinskie. Illustration courtesy of Thinkstock.

1 2 3 4 5 6 7 8 9

Library of Congress Cataloging-in-Publication Data

Russell, Heidi, 1973–
Quantum shift : theological and pastoral implications of contemporary developments in science / Heidi Ann Russell.
pages cm.
"A Michael Glazier book"
ISBN 978-0-8146-8303-3 — ISBN 978-0-8146-8328-6 (ebook)
1. Religion and science. 2. Pastoral counseling. I. Title.

BL240.3.R8765 2015
261.5'5—dc23

2015006950

For Daniel James Damarion Russell,
the center of my universe

Contents

Foreword

The supposition that underpins this book is that there is a universal basis for our understanding and, since that basis cannot be self-contradictory, the understanding one has from one discipline should complement that which one has from all other disciplines. One is most faithful to one's own discipline, be it the natural sciences, the social sciences, philosophy, literature, theology, etc., if one accepts this universal basis. This means in practice that, while remaining faithful to the strict truth criteria of one's own discipline, we are open to accept the truth value of the conclusions of other disciplines. And this acceptance must not only be passive, in the sense that we do not deny those conclusions, but also active, in the sense that we integrate those conclusions into the conclusions derived from one's own proper discipline. It is that active integration of science with theology that characterizes this book. Such an integration is of particular importance when we are addressing fundamental and ultimate questions and their meaning for our Christian faith. Does the existence of intelligent beings in the universe have any significance for understanding the universe as a whole? Does our knowledge of God depend on our understanding of the universe? In fact, a very strong piece of evidence that there is a universal basis for understanding is the persistent drive of the human being for meaning. This is seen clearly from the very dawn of human history where, with even a very primitive collection of data, our ancestors sought for the meaning of life in the physical universe as well as in the events of their personal lives and those of society in general.

Our modern society is one in which science, and not just technology, is dominant. In fact, technological progress is almost always a

result of progress in fundamental science, in our understanding of the physical universe in which we live and to which we are intimately related. And yet there is a persistent widespread attitude among religious believers that much of science is in conflict with their religious tenants. This book not only jumps into that fray but turns it upside down by actively showing that the results of science, correctly understood, can become a source of enrichment for religious beliefs. It succeeds because, on the one hand, it presents a correct and clear summary of some of the principal areas of modern science and, on the other hand, it preserves the independence of religious belief and science while employing the latter through the use of analogy to enrich our theological understanding. Analogy is the key to the author's bold pursuit at integrating these two dominant areas of modern culture without conflating them.

By analogy we attempt to get some rational understanding of God and our relationship to God, who is ultimately mystery, by the use of images drawn from our lived experiences that may give us a glimmer of the divine. In a masterful way, the author uses images drawn from a vast array of the fields of modern science to bring about a deeper understanding of some of the principal areas of Catholic theology. In so doing, she avoids the persistent temptation of the religious believer to make God primarily a source of explanation rather than a source of love. For many, God becomes the tool to try to explain things that we cannot otherwise explain. How did the universe begin? How did we come to be? We seize upon God, especially if we do not feel that we have a good and reasonable scientific answer to such questions. God is brought in as the Great God-of-the-Gaps. In fact, the author does just the reverse in seeking a deeper meaning of religious beliefs through an understanding of science.

The science presented ranges from the notions of space and time, through quantum mechanics and chaos theory to modern cosmology and attempts to unify our understanding of gravity in general relativity and quantum mechanics. This adventure through science results in a number of challenging new insights into classical theological themes, such as: the human as body and soul, as free, sinful, and redeemed; death and resurrection; cocreators in a universe of which we have been born and to which we are intimately related; the future of the universe and Christian eschatology. The fundamental theme that unifies the various chapters is the unity of the cosmos, that no

element in the universe from the micro to the macro can be understood except as a part of the whole. And the whole is more than an assembly of parts. It is rather a dynamic and future-directed creature of a loving Creator who continues in us his loving care of the whole. The pastoral implications of such a vision are breathtaking and, although they are not the principal intention of the author, they always lie in wait to call us to action.

To journey with the author through this book is a rather heady endeavor as to both the science and the theology, but it is masterfully written for a general audience. It is directed, as the author says, to "the people in the pews." The effort of those people to venture into this intellectual adventure will, I am convinced, be very well rewarded.

George V. Coyne, SJ
McDevitt Chair in Physics
Le Moyne College
Director Emeritus
Vatican Observatory

Acknowledgments

A book is never the work of one person alone, and I am so grateful to be a part of the network of relationships that enabled this book to emerge. I truly do believe that God works in and through our relationships, and I feel so blessed to have experienced God's love in the interconnectedness of my life with countless others.

I owe a great debt of thanks to all of my family and friends who have supported me and encouraged me through the writing process. First and foremost, I am grateful to my son DJ who kept me both grounded and inspired. I am indebted to my mother, Janie Russell, who patiently read through drafts of every chapter, offering extremely helpful questions, suggestions, and corrections. I am thankful to my father, Dan Russell, who was a science teacher and wanted me to be more interested in science when I was young. Hopefully I have made up now for my lack of interest then! From my parents, I learned to see God in and through the beauty of creation and the interconnectedness of love.

I am very grateful to Fr. George Coyne, SJ, who graciously agreed to read this work and write the foreword for it. I am thankful to my colleagues from the Institute of Pastoral Studies at Loyola University Chicago who talked through some of these ideas with me at research seminars. I am especially thankful to Bob O'Gorman and Tim O'Connell who read through early drafts of chapter 2 as it went from being a CTSA talk to an article in *Theological Studies* to the chapter in this current volume. I am thankful to the science and theology group at the Catholic Theological Society of America for listening to papers I have presented, asking helpful questions, and offering key insights through our discussions. I am deeply thankful to the late William

Stoeger, SJ, who always took the time to talk with me at CTSA, encouraged me in my work, and was a wonderful mentor.

I would like to thank our IPS research assistant, Layli Carsi, who painstakingly edited the footnotes for several of the chapters, looking up citations when I did not have the complete information recorded. All of my students at IPS have also contributed to this book by keeping me excited about theology and engaged in the world of pastoral ministry. I would also like to thank my friend John Mand for his interest in science and religion and our great discussions. John also read through the entire draft of the book, catching many typos and grammatical errors that needed to be fixed while offering support and encouragement for the project with each chapter he read.

Finally, I would like to thank the people at Liturgical Press: Hans Christoffersen for enthusiastically supporting the project, Lauren L. Murphy for patiently answering all of my questions, and Patrick McGowan for being a wonderful copy editor.

Introduction

Theology is the art of bringing our religious tradition into dialogue with our changing or evolving worldviews. The early Christians grappled with Greek philosophy. Aquinas engaged the newly rediscovered works of Aristotle. The transcendental Thomists of the twentieth century brought Aquinas into dialogue with the philosophies of Kant, Hegel, and Heidegger, among others. Twentieth-century theologians also engaged the positivistic worldview of the scientific and industrial revolutions. Liberation and contextual theologies of the current time have since embraced a postmodern worldview that focuses on the particular rather than the universal and trades the optimistic worldview of the modern era for the reality of oppression that resulted from industrialization and colonialism.

To all of these developments in theology, we see today another dynamic engagement—the dialogue between science and religion. There has been a new movement in science in recent decades aimed at helping people who are not scientists understand the vast revision of our worldview that has occurred through scientific research. For example, books by scientist Brian Greene became PBS *Nova* specials *The Elegant Universe* and *The Fabric of the Cosmos*. The Carl Sagan *Cosmos* series was remade into the new series featuring the astrophysicist Neil DeGrasse Tyson. At the time of the writing of this book, Tyson is doing a live tour, "An Evening with Neil DeGrasse Tyson," to sold-out crowds. We see posts and re-posts from popular Facebook pages such as "Science Alert," "Everything Is Physics," "Science Cosmos," "Science Is Awesome," "I f*&#ing love science," etc. The last of these pages currently has 19,677,440 "likes" on Facebook.[1]

[1] "I f*&#ing love science," Science Website, Facebook, https://www.facebook.com/IFeakingLoveScience (title edited).

People today are cognizant of developments in our scientific worldview, and if theology and pastoral ministry fail to engage these developments, we run the risk of becoming irrelevant in the contemporary world.

Klaus Nürnberger declares:

> Experts are laypersons in fields other than their own. Physics, especially, has become too complex and inaccessible for the untrained layperson to understand. Fortunately excellent popularizations have been written that unlock these mysteries, at least to some extent, for the nonexpert. Similarly, much of academic theology presents, to the nontheologian, a conceptual and logical jungle that is extremely hard to penetrate. Because of its lack of critical thought, the vast devotional literature does not make things any easier. As the example of the new atheists demonstrates, puzzlement easily turns into dismissal and contempt. We owe our contemporaries a lucid and consistent account of "the hope that is in us" (1 Pet. 3:15).[2]

We lose a critical point of engagement with contemporary society if we leave this conversation to fundamentalist Christians and fundamentalist atheists such as Richard Dawkins and Lawrence Krauss. People's image of the relationship between science and religion too often comes from newspaper headlines about yet another creationism and evolution debate by a local school board. The superficial and false image of the relationship between science and religion is often caricatured by the icon of the Catholic Church's condemnation of Galileo.

At the same time, however, in most mainstream, nonfundamentalist denominations of Christianity, theologians have been taking part in a very serious dialogue with scientists to understand the implications for our theological tradition of a radical revision of our understanding of all that exists. In a letter to George Coyne, SJ, the director of the Vatican Observatory at the time, Pope John Paul II wrote:

> If the cosmologies of the ancient Near Eastern world could be purified and assimilated into the first chapters of Genesis, might

[2] Klaus Nürnberger, "Eschatology and Entropy: An Alternative to Robert John Russell's Proposal," *Zygon* 47, no. 4 (December 2012): 273.

> not contemporary cosmology have something to offer to our reflections upon creation? Does an evolutionary perspective bring any light to bear upon theological anthropology, the meaning of the human person as the imago Dei, the problem of Christology—and even upon the development of doctrine itself? What, if any, are the eschatological implications of contemporary cosmology, especially in light of the vast future of our universe? Can theological method fruitfully appropriate insights from scientific methodology and the philosophy of science?[3]

Yet somehow that call for theology to incorporate new insights from contemporary scientific developments is still not reaching the people in the pews. While science is more accessible than ever due to the ability to look things up online and the existence of a vast amount of popularized literature available everywhere, there nonetheless seems to be a disconnect between science and people of faith. "The MIT Survey on Science, Religion, and Origins" summarized:

> We find a striking gap between people's personal beliefs and the official views of the faiths to which they belong. Whereas Gallup reports that 46% of Americans believe that God created humans in their present form less than 10,000 years ago, we find that only 11% belong to religions openly rejecting evolution. This shows that the main divide in the origins debate is not between science and religion, but between a small fundamentalist minority and mainstream religious communities who embrace science. The fact that the gap between personal and official beliefs is so large suggests that part of the controversy might be defused by people learning more about their own religious doctrine and the science it endorses, thereby bridging this belief gap.[4]

[3] John Paul II, "Letter of His Holiness John Paul II to Reverend George V. Coyne, SJ, Director of the Vatican Observatory," Libreria Editrice Vaticana, 1988, http://www.vatican.va/holy_father/john_paul_ii/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne_en.html.

[4] Eugena Lee, Max Tegmark, and Meia Chita-Tegmark, "The MIT Survey on Science, Religion, and Origins: The Belief Gap," MIT (February 11, 2013), http://space.mit.edu/home/tegmark/survey/survey.pdf; cites Frank Newport, "In US, 46% Hold Creationist View of Human Origins," Gallup, June 1, 2012, http://www.gallup.com/poll/155003/hold-creationist-view-human-origins.aspx.

Theologians and ministers have a responsibility to the faithful to make sure they first and foremost understand the teaching of their own religious tradition. The survey notes that "the Roman Catholic Church endorses evolution, but nonetheless, no more than 58% of US Catholics believe that evolution is the best explanation for life on Earth."[5] Americans also tend to perceive hostility between science and religion (55%) even when they don't feel it conflicts with their own personal religious beliefs (61%).[6] Perhaps most disturbingly, "whereas Gallup reports that 18% of Americans believe that the Sun revolves around Earth, 0% belong to religions supporting this view."[7] While the religious institutions are clearly not at fault for this ignorance in the American public, how much are they actively doing to help alleviate it? The study also positively correlates a high level of religious observance with likelihood of seeing science in conflict with religious beliefs and notes:

> About four-in-ten (42%) of those who attend religious services at least once a month say the clergy at their place of worship have spoken about science or scientific findings; more than half (56%) say the topic has not been raised. . . . A smaller share of Catholics (35%) say science has been raised at church. Of those who say their clergy occasionally speak about science or scientific findings, three-in-ten (30%) say the clergy at their church are usually supportive of science, while 11% say they are critical of science. A majority (52%) say the clergy's references to science are neither positive nor negative.[8]

[5] Lee, Tegmark, and Chita-Tegmark, "The MIT Survey," 1. Cites The Pew Forum on Religion & Public Life, "US Religious Landscape Survey" (February 2008), http://religions.pewforum.org/pdf/report-religious-landscape-study-full.pdf.

[6] David Masci, "Public Opinion on Religion and Science in the United States," Pew Research Center (November 5, 2009), http://www.pewforum.org/2009/11/05/public-opinion-on-religion-and-science-in-the-united-states/. Masci notes, "More than half of the public (55%) says that science and religion are 'often in conflict.' Close to four-in-ten (38%) take the opposite view that science and religion are 'mostly compatible.' Yet the balance is reversed when people are asked about science's compatibility with their own religious beliefs. Only 36% say science sometimes conflicts with their own religious beliefs and six-in-ten (61%) say it does not."

[7] Lee, Tegmark, and Chita-Tegmark, "The MIT Survey," 7.

[8] A. Kohut et al., "Scientific Achievements Less Prominent than a Decade Ago: Public Praises Science; Scientists Fault Public, Media," The Pew Research Center for the People & the Press (July 9, 2009), http://www.people-press.org/files/legacy-pdf/528.pdf.

This book is an attempt to bridge that gap. It will take the insights from the scientists trying to make science accessible to the average person and match that effort with a theological exploration that is grounded in academic theology but made pastorally relevant. This book also attempts to offer the people of God a more sophisticated theology that can stand up against the claims of writers such as Richard Dawkins who tend to build up a straw man of religion as the enemy of science that can be easily torn down. Rather than seeing science as a threat, theology can engage science in such a way as to help us to develop our theological insights, look at the healthy challenges these insights offer our religious worldview, and think about God and our religious tradition in new and exciting ways.

Furthermore, this book is meant to be a resource to theologians, ministers, and laity to open up new frontiers of thought in terms of spurring our theological imaginations to contemplate God in new and marvelous ways. I am indebted to Fr. George Coyne, SJ, for the way in which I have thought about this project. On November 17, 2011, Fr. Coyne gave the Albertus Magnus lecture at Dominican University in Chicago, Illinois.[9] In that lecture, he talked about the fact that science does not prove the existence of God. We do not come to believe in God because of what we learn from science. He went on, however, to note that if we believe in God, and if we believe that God is Creator, science can tell us something about the God in whom we believe. Herein lie Bonaventure's vestiges of God in the Book of Creation. In a similar text available online, Coyne elaborates:

> I have never come to believe in God, nor do I think anyone has come to believe in God, by proving God's existence through anything like a scientific process. God is not found as the conclusion of a rational process like that. . . . I have never come to love God or God to love me because of any of these reasoning processes. I have come to love God because I have accepted the fact that he first made the move towards me. If that is the case, why should I not use my best knowledge of science to try to get an idea of what God is like? It will be only a glimmer, a shadow, but it is the one thing I have to go on, and I have a passionate desire to want to know more about this person who loves me so

[9] George V. Coyne, "Children of a Fertile Universe: Chance, Destiny, and a Creator God" (Albertus Magnus Lecture, Siena Center at Dominican University, River Forest, IL, November 17, 2011).

> much. And that is what I am going to try to do now. I am going to try to present in broad strokes what I think is the best of our modem understanding of the universe, and then ask the question at the end: What does this say about the God who loves me and who made this universe?[10]

The physicist and Anglican priest John Polkinghorne makes a similar point:

> Theology has often to proceed by careful appeal to analogy, making use of, and seeking to extend, concepts formed in the course of human experience, in order to guide and control its attempts to use finite human language to speak of the infinite reality of God. What is being suggested here about hints of the Creator discerned in the form of creation encourages the belief that human descriptive language is not totally powerless to convey something of the nature of God. Images drawn from science, such as mutual entanglement, may provide a modest analogical resource, however pale they may be in comparison with the brightness of divine reality. The discourse will be qualified by the warnings of apophatic theology concerning the inaccessible mystery of the divine, but surely something must be said, even if human language is necessarily being used in some open and "stretched" sense when it is applied to God.[11]

Inspired by Fr. Coyne, this book will try to look at our modern understanding of physics and cosmology and ask what it might say to us about the God who loves us and created the cosmos of which we are a part. Even more so, the insights of the sciences can give us new ideas about humanity and our relationships with one another and the God who created us. Jesuit theologian Karl Rahner has an axiom that theology is anthropology and anthropology is theology. In other words, we never say something about God that does not also say something about what it means to be human, and we never talk about

[10] George V. Coyne, "The Dance of the Fertile Universe," 6, Universidad Interamericana de Puerto Rico, AAAS Dialogue on Science, Ethics, and Religion (DOSER), Public Lecture, March 27, 2006, http://www.metro.inter.edu/servicios/decanatos/academicos/documentos/HandoutCoyne.pdf.

[11] John C. Polkinghorne, "The Demise of Democritus," in *The Trinity and an Entangled World: Relationality in Physical Science and Theology*, ed. John C. Polkinghorne (Grand Rapids, MI: W. B. Eerdmans Publishing, 2010), 11–12.

what it means to be human without implicitly saying something about the God we believe created humanity. What we believe about God has implications for the way we live our lives; the way we live our lives says something about the God in whom we believe.

In unexpected developments, whether in science or in our lives, one finds exciting opportunities to learn something new. Mystery has a depth that is inexhaustible. We experience that depth of mystery in the explorations of science, in human life, and in God. In both science and theology, every answer leads us to new questions. Rather than try to fit what we know and discover of the world into a predetermined idea of God, we need to let what we discover teach us new things about God, creation, and our relationship to both. In order to do so, we must adopt an openness to scientific discovery rather than defensiveness. Science offers theology no threat. Indeed, it offers the possibility of further revelation.

The Changing Landscape

The development in physics in the twentieth century involved a major shift in worldview that was as significant as the Copernican revolution leading to the understanding that the earth revolved around the sun instead of vice versa. As Brian Greene notes, "Newton's rigid and unchanging scaffolding of space and time collapsed into Einstein's unified whole that warps and curves."[12] The physics of Isaac Newton, which has proven to be incredibly successful in describing the world in which we live and move on the scale of our own experience, understood the world to be a static background against which the drama of our everyday lives played out. The universe was understood to function like a clock with all of the pieces working together in perfectly designed harmony. If we just had enough information, we would be able to plug that information into the proper formulas and predict the movement of every single atom in that universe. Atoms were understood as the individual building blocks that collectively made up everything that exists, the components of the machine, so that our entire view of nature was based on

[12] Brian Greene, *The Fabric of the Cosmos: Space, Time, and the Texture of Reality* (New York: A. A. Knopf, 2004), 10.

a fragmentary view of reality.[13] The universe and everything in it was understood in terms of the sum of its parts.

One of the key revolutions of the twentieth century in both relativity theory and quantum theory is that the world can no longer be understood in the fragmentary way. Instead, we now have a view of reality that is entirely relational. In relativity theory, we come to understand time and space, or rather space-time itself, to be something that is not an absolute void or a static scaffolding but rather relation itself. In quantum mechanics, atoms can no longer be understood as individual parts but rather are understood in the context of fields and as aggregate systems. John Gribbin explains, "Such truth as there is in any of this work lies in mathematics. . . . And what those mathematical laws describe are fields of force, space-time curved and recurved back upon itself in fantastic complexity, and a reality that fades away into a froth of virtual particles and quantum uncertainty when you try to peer at it closely."[14]

The understanding of materialism[15] breaks down in a world governed by quantum mechanics, relativity, and field theory, yet most

[13] Panos Ligomenides, "Scientific Knowledge as a Bridge to the Mind of God," in *The Trinity and an Entangled World: Relationality in Physical Science and Theology*, ed. John C. Polkinghorne (Grand Rapids, MI: W. B. Eerdmans Publishing, 2010), 75.

[14] John Gribbin, *The Search for Superstrings, Symmetry, and the Theory of Everything* (Boston: Little, Brown, 1998), 52.

[15] Philip Clayton, "Unsolved Dilemmas: The Concept of Matter in the History of Philosophy and in Contemporary Physics," in *Information and the Nature of Reality: From Physics to Metaphysics*, ed. Paul Davies and Niels Henrik Gregersen (New York: Cambridge University Press, 2010), 38. Clayton explains the concept of materialism as follows:

> Materialism consist[s] of five central theses:
>
> (1) Matter is the fundamental constituent of the natural world.
>
> (2) Forces act on matter.
>
> (3) The fundamental material particles or "atoms"—together with the fundamental physical forces, whatever they turn out to be—determine the motion of all objects in nature. Thus materialism entails determinism.
>
> (4) All more complex objects that we encounter in the natural world are aggregates of these fundamental particles, and their motions and behaviors can ultimately be understood in terms of the fundamental physical forces acting on them. Nothing exists that is not the product of these same particles and forces.
>
> (5) Materialism is an *ontological* position, as it specifies what kinds of things do and do not exist. But it may also become a thesis concerning what may and may not count as a scientific explanation [e.g., excluding top-down causation].

people still live in a world conceptualized by the myth of matter.[16] What we think of as reality is not reality. That is to say, things are not the way they seem—at least not the way we experience them in this world. That statement holds true both on the quantum level, the level of the very small, and on the level of cosmology, the level of the very large.

Each chapter in the book will outline various new theories and developments in science and then explore the possible theological and pastoral implications of those theories. As an important caveat, this book is not an effort at dialogue—it is not a reciprocal endeavor. I am limiting myself to discovering the insights we can gain from science as theologians, ministers, and believers. I am also not trained in any scientific field, so I am very dependent on those scientists who have popularized scientific concepts for the masses. I have made every effort to stay true to the science and not draw theological conclusions based on scientific evidence. As such, the theology presented here primarily uses the scientific images as analogies and metaphors for theological concepts. In other words, the new images of reality taken from a contemporary scientific worldview give us new images for thinking about God, humanity, sin, grace, and other theological concepts. I am not equating any of these theological concepts with the scientific concepts being articulated.

Chapter 1 will delve into the developments in our concepts of time and space from the time of Einstein's theories of special and general relativity. From the perspective of the block universe, one can understand a unity to all that exists and will exist, even while we live out our lives and decisions on a day to day and moment to moment basis. The understanding that we live our lives into the future becoming the people we were created to be will then be discussed in light of the contemporary debate between pluralism and relativism. I will suggest that the framework of relativity and relationality provides an alternative perspective.

Chapter 2 outlines the development in quantum mechanics known as particle-wave complementarity and the results of the double slit experiment. Using the analogy of particle/wave, we will ask what

[16] The phrase "myth of matter" is taken from Paul Davies's book, *The Matter Myth: Dramatic Discoveries that Challenge Our Understanding of Physical Reality* (New York: Simon & Schuster, 2007).

it means to be body/spirit. We will reimage the human person as having infinite potential that is lived out in actualized choices conditioned by probabilities based on freedom, grace, and sin. We will also briefly examine the meaning of resurrection in light of a world that is less material than we might have imagined.

Chapter 3 further investigates the world of quantum mechanics through the phenomenon of entanglement, also known as nonlocality. With the new understanding of the inherent relationality of nature and a view that looks to particles as part of a larger unified system, we will rejuvenate our understanding of what it means to be the Body of Christ. When one understands the Body of Christ in a way that encompasses the inherent connectedness of humanity and then connects humanity to creation itself, the practical implications of that connectedness impact our understanding of social and environmental justice.

Chapter 4 enters the world of chaos theory. It looks at concepts such as fractals and strange attractors to discover the emergence of life and complexity on the edge of chaos. In light of these theories, we will explore the idea of creation out of chaos and the complexity in our human lives. Can we image God as a strange attractor inviting us to live on the edge of chaos and find within the deeper complexity a new fractal sense of beauty?

Chapter 5 moves us into the realm of cosmology. There we will explore the origin of our universe in the big bang. In looking at how our universe began and how it evolved, we will continue to discuss the concepts of creation and causality. On a personal level, our understanding of our utter dependence on God for our very existence and a belief in a God that sustains us even when we do not see a way forward is at the core of our spiritual lives.

Chapter 6 investigates the question of a possible multiverse. What are the implications for theology if our universe is not the only one that exists? How do we understand our relationship with God if there are possibly infinite other universes out there? For insight we turn to the stories of Scripture and the pattern of how God has worked in salvation history in and through the least and the smallest.

Chapter 7 turns from the beginning of the universe to its possible end. What does science say about the end of our universe? Given the rather grim outlook for the universe, is there a place for hope? Some scientists suggest that new universes might be born in and through

the death of our universe. Theologically we have a concept for understanding new life emerging from death—the concept of resurrection. We will explore the possible resurrection of the universe itself in the context of our hope in the re-creation of a new heaven and a new earth.

Finally, chapter 8 will investigate some of the most intriguing ideas that attempt to reconcile relativity and quantum mechanics in string theory and loop quantum gravity. String theory envisions a world of possibly eleven dimensions, a world where we live on a three-dimensional "brane" (think membrane) oblivious to the existence of these other dimensions. Loop quantum gravity envisions a world where space itself emerges from the relationship between events and processes occurring in the universe. The image of hidden dimensions can give us a way to think about God as the hidden incomprehensible mystery who nonetheless encompasses and influences our lives. As science grapples with the inability to have certainty or definitive proof of these theories, so too do we grapple in our lives with the inability to have certainty. As in science, preconceptions must be let go (for example, the idea that there are only three dimensions) in order to make progress developing new theories. So also in our lives must we let go of preconceived images of God when they no longer help us understand and make meaning out of the often tragic events in our lives. When we do so, we find that like the spatial network of loop quantum gravity that creates nonlocal connections, love is what holds us together. Love is the inherent relationality of the world that connects us to the God who is Love and to one another.

While each of these chapters stands alone, common themes thread them together. The major underlying theme is relationality—from the microcosm to the macrocosm, from the triune nature of God to the core of what it means to be human. All of the recent developments in physics and cosmology seem to indicate that reality, in its most fundamental form, is not about individual objects but rather relationships and interactions. These relationships and interactions thus give reality to and tell us something about that which is relating and interacting. John Polkinghorne explains the balance one must maintain:

> The physical world is not so atomized that we can understand it fully by an examination conducted constituent piece by constituent piece. Nor is it so inextricably relationally integrated that

> until one is able to comprehend the totality, one cannot understand anything at all. Physical science needs to wrestle with the issue of how it may both acknowledge the substantial degree of relationality manifested in phenomena such as quantum entanglement and the mutuality of space, time, and matter, while at the same time being able to do justice to our everyday experience of a significant degree of separability between objects in the macroscopic world. Like theology in its different sphere, science has to struggle with the problem of reconciling unity with diversity. In fact, all theoretical engagement with issues of relationality has to find some way of combining connection with separation, since it is only to the extent that one can recognize a distinction between two entities that one can also speak of their being in mutual relationship.[17]

Such a shift in our understanding of reality itself as inherently relational must have an impact on the way in which we image our God who is triune relationality and how we understand what it means to be human in this vast and mysterious cosmos that God created.

[17] Polkinghorne, "The Demise of Democritus," 13.

Chapter One

Relativity and Our Understanding of Space and Time

Scientific Developments—Relativity

What is space? What is time? Augustine famously says of time: "We surely know what we mean when we speak of it. We also know what is meant when we hear someone else talking about it. What then is time? Provided that no one asks me, I know. If I want to explain it to an inquirer, I do not know."[1] Space and time form the context of our entire lives, but when we try to put into words what we mean by space and time, the concepts can defy definition. To further complicate matters, the scientific understanding of space and time has changed drastically since Einstein in a way that few of us can truly comprehend. In Newtonian physics, space provides the background, the stage, on which everything that exists plays out its history (time). Space and time are understood as absolute and unchanging.

With Einstein's theories of relativity, there is a shift in scientific thinking from the idea that space and time form some type of rigid scaffolding on which everything is built to the idea that "space and time no longer provide a fixed, absolute background. Space is as dynamic as matter; it moves and morphs. As a result, the whole universe

[1] Augustine, *Confessions*, trans. Henry Chadwick (Oxford: Oxford University Press, 1991), 11.14.17.

can expand or shrink, and time can even begin (in a Big Bang) and end (in a black hole)."[2] Einstein's theory of special relativity deals with the fact that the speed of light is constant and, therefore, all other motion is relative.[3] In other words, what does not change is the speed of light. Length can contract (called Lorentz transformations) and time can slow down (called time dilation), but the speed of light stays constant.[4] Our frame of reference affects our measurement such that two people with different frames of reference will not get the same spatial (length) and temporal (duration) measurements.[5] Within different frames of reference, space-time is experienced differently. Einstein's theory of special relativity, however, did not take gravity into account, and so he later developed the theory of general relativity which does account for gravity. General relativity has to do with the fact that not only is space-time not an absolute static reality but also that it can actually curve like a fabric due to the mass of objects.[6] To think of space and time as dynamic rather than constant, as relational and relative rather than fixed, can boggle our minds because in our day to day experiences, we generally share the same frame of reference (the earth) and move at speeds much slower than the speed of light. Consequently, we do not notice the dynamism of space and time. To us, they do seem to be constant and fixed.

One of the key lessons of relativity is the importance of our frame of reference. Our frame of reference impacts both our experience of time and our experience of space, particularly our sense of "now" and our perception of motion, due to the dynamic and relational nature of space-time. Lee Smolin points out that these concepts about

[2] Lee Smolin, *The Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next* (Boston: Houghton Mifflin, 2006), 4.

[3] Sean Carroll notes that what is important is not the fact that light travels at this speed, but the fact that there is "unique preferred velocity," a speed limit, that cannot be exceeded. It just so happens that light travels at that speed through empty space because photons do not have mass. Sean M. Carroll, *From Eternity to Here: The Quest for the Ultimate Theory of Time* (New York: Dutton, 2010).

[4] Ibid.

[5] Note that the reference frames involved must be traveling at a constant velocity, and so they may also be referred to as inertial frames. George F. R. Ellis and William R. Stoeger, "Introduction to General Relativity and Cosmology," in *Quantum Cosmology and the Laws of Nature*, ed. Robert J. Russell, Nancey C. Murphy, and Chris J. Isham (Vatican City: Vatican Observatory, 1993), 2.

[6] Brian Greene, *The Fabric of the Cosmos: Space, Time, and the Texture of Reality* (New York: A. A. Knopf, 2004), 46–47.

time and space as dynamic arise in part due to the relationship between reality and observation. In science, reality is described as that upon which all observers agree.[7] It turns out that one of the things observers need not agree on is the concept of "now" in the sense of whether or not two events are happening at the same time. This concept is called the relativity of simultaneity.[8] Smolin explains, "What Einstein showed is that our natural intuition that it's meaningful to talk about what's happening right now far from us is mistaken. Two observers who move with respect to each other will disagree about whether two distant events are simultaneous. . . . Thus, there can be nothing objectively real about simultaneity, nothing real about 'now.' "[9] Whether or not we observe two events as simultaneous depends on our frame of reference. Two events that may be simultaneous in one frame of reference may not be simultaneous from another frame of reference.

This lack of agreement about the concept of "now" is related to another issue that observers do not agree about: motion. If you and I are both moving at a constant speed, it is impossible to say who is in motion relative to one another. Picture yourself sitting in an airplane. From your frame of reference—the constant speed of the airplane—you are at rest (so long as there is no turbulence which would cause a change in speed). As you look out your window while flying over Chicago, you are sitting still in your seat watching my office building move past you. From your frame of reference, you are at rest and I am in motion. From my frame of reference—the constant speed of the earth—I am at rest sitting in my office. As I look out my window at your plane flying overhead, I am at rest, and you are in motion.

Were we to agree on a common frame of reference, say the earth (which of course, we generally do), we can then both agree that you are moving, and I am sitting still. If we do not share a common frame of reference, however, there is no objective way to determine who is in motion and who is at rest. There is no objective way to determine which observation, yours or mine, constitutes reality. Both observations are correct in their respective frames of reference. Resist the temptation to think, "But we *know* the airplane is *really* in motion."

[7] Lee Smolin, *Time Reborn: From the Crisis in Physics to the Future of the Universe* (Boston: Houghton Mifflin Harcourt, 2013), 56.

[8] Ibid.

[9] Ibid., 57–58.

We only know that from the frame of reference of the earth. From the frame of reference of Mars, a Martian would say that both of us are in motion and she is sitting still with me moving past Mars on the earth and you moving past Mars in the earth's atmosphere.

When we think of motion, we tend to think of motion through space, but space and time are interconnected. When you stand still in space, you are still moving in time.[10] Einstein's theory of special relativity taught us that they have an inverse proportion. The more you move through one, the less you move through the other. Matt Tweed explains, "Everything is moving at the speed of light. We are hurtling through time at light-speed even if sitting reading a book. If we start to move through space, our velocity through time slows to make the combined space and time velocities still equal to the speed of light."[11] If your movement through space increases, your movement through time decreases. Brian Greene explains this relationship with an analogous illustration. Imagine you are traveling north at 60 mph. If you turn northwest, going the same speed, suddenly some of your northward motion is diverted westward; you will not get as far north now.[12] Similarly, Greene tells us, motion through time is diverted by motion through space so that the more you move through space, the less you move through time. The speed of light is the constant, so that "the combined speed of any object's motion through space and its motion through time is always precisely equal to the speed of light."[13]

[10] Note that technically, you cannot sit still in space; we are moving all of the time. As a Facebook post on September 4, 2013, on the page "Universe Amazing Facts" noted: "Right now you are simultaneously hurtling around the sun at 66,600 mph while sitting on a rock that is spinning at 1,070 mph. On top of that, our whole solar system is rocketing through space around the center of the Milky Way at around 559,234 mph. On top of that, our galaxy is hurtling through space at around 671,080 mph, with respect to our local group of galaxies. On top of that, for all we know, our entire universe is hurtling through some unknown medium at some other ridiculous speed." https://www.facebook.com/UniverseAmazingFacts/posts/359838074148471. We can directly observe this motion of the earth when we watch the sun rise and set, appearing and disappearing over the horizon.

[11] Matt Tweed, "The Compact Cosmos," in *Scientia: Mathematics, Physics, Chemistry, Biology, and Astronomy for All*, ed. John Martineau (New York: Walker Publishing, 2005), 366.

[12] Greene, *Fabric of the Cosmos*, 48. In addition, see the PBS *Nova* Special based on the book online, http://www.pbs.org/wgbh/nova/physics/fabric-of-cosmos.html.

[13] Ibid., 49. Conceivably, if you were able to move at the speed of light, which you cannot do because your mass would increase requiring an infinite amount of energy

Therefore time passes more slowly for someone in motion when compared to someone standing still. The key phrase in that sentence is "when compared to," because the person who is in motion does not experience time as moving more slowly. It is only in the comparison of the two frames of reference that a difference is measured. The key insight about the relativity of time is the fact that the experience of time depends on one's frame of reference. Time is not absolute.[14] Remember that in our day to day experiences, we do not notice the effects of special relativity because we move so slowly through space compared to the speed of light that we do not directly experience the impact our motion has on time.

Greene explains, however, that we can understand the fact that time is a relative concept even without experiencing this phenomenon known as time dilation when moving near the speed of light. Greene uses the historic example of trains, which he notes influenced the young patent clerk Albert Einstein. Initially, cities all set their own times based on when the sun was at the highest point in the sky. But that time was different for different cities depending on their geographical location. Trains ran on the time of the city from which they departed. Coordination became necessary when trains started using the same tracks because cities in different geographical areas, today

---

for you to move, time would actually stop for you. While a photon (a particle/wave of light) may take eight billion years to travel from a distant star to earth from our frame of reference, from its own frame of reference, it took no time at all. Note that photons can travel at the speed of light because they have no mass.

[14] The famous example of this phenomenon known as time dilation is the twin paradox. Consider twins, where one twin travels on a rocket ship at a speed close to the speed of light, while the other twin remains on earth. When the traveling twin returns home, she will be younger than the twin who remained on earth. Having moved through greater amounts of space, she will have moved through less time than her twin, and so she will not have aged as much as the twin who remained on earth. To put it another way, time passed more slowly for the twin who was in motion than it did for the twin who remained on earth. Her motion through time was diverted by her motion through space. Again, think about the fact that there is an inverse proportion, so as someone's movement through space increases, his movement through time decreases. Someone standing still has decreased her movement through space, so her movement through time increases. These effects, however, are not noticeable unless one is moving at very great speeds. Traveling at near the speed of light not only causes time to slow down but also causes length to contract in a phenomenon known as Lorentz transformations. As mentioned above, the speed of light stays constant and time and space shift in order to maintain that constant velocity.

called different time zones, did not experience noon at the same time. Einstein realized that everyone has his own time; time is relative.[15] Avoiding train wrecks required communication and coordination.

In 1915, Albert Einstein proposed his general theory of relativity which incorporated the concept of gravity into the relationship between space and time. He suggested that space-time is not passive, absolute, and unchanging but rather is like a fabric (only three-dimensional rather than two-dimensional) that warps around objects based on their mass and thus affecting the motion of the objects moving through space-time.[16] The two-dimensional image frequently used to illustrate this concept is that of a stretchy piece of fabric. Stretch the fabric taut and roll a marble across it. The marble should roll in a relatively straight line across the fabric (albeit causing a slight indentation in the fabric due to the marble's own mass). Now place a bowling ball in the center of the fabric and once again roll the marble across. The path of the marble is dramatically altered by the presence of the bowling ball. Space-time similarly curves around massive objects. Brian Greene explains the effects of gravity as follows: "Right now, according to these ideas, you are anchored to the floor because your body is trying to slide down an indentation in space (really, spacetime) caused by the earth."[17]

The Block Universe and the Arrow of Time

Time can be thought of in two ways: from the perspective of its unity or its diversity. As a unity, we can think of the possibility of what scientists call "block time" or the "block universe."[18] From the

[15] See *Nova* Special with Brian Greene, *The Fabric of the Cosmos: The Illusion of Time* (A NOVA Production by The Film Posse in association with ARTE France and National Geographic Channel), PBS video, 53:02. WGBH Educational Foundation. PBS Airdate: November 9, 2011, http://www.pbs.org/wgbh/nova/physics/fabric-of-cosmos.html#fabric-time.

[16] Brian Greene, *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos*, EPUB eBook ed. (New York: A. A. Knopf, 2011), loc. 22–23 of 347.

[17] Ibid., loc. 23 of 347.

[18] Note that not all scientists and theologians accept this concept of a block universe. See Chris J. Isham and John C. Polkinghorne, "The Debate over the Block Universe," in *Quantum Cosmology and the Laws of Nature*, ed. Robert J. Russell, Nancey C. Murphy, and Chris J. Isham (Vatican City: Vatican Observatory, 1993), 135–44.

perspective of diversity, we can think of the way in which we experience a direction to time moving from past to future. From Einstein's theories of relativity, some scientists have developed a theory of space-time referred to as the block universe or block time.[19] This theory is based on a mathematical or geometrical understanding of time as another dimension like space. Thus past, present, and future all exist as equally real and valid, and we can think of time in terms of its unity. Just as all space exists "out there," all time exists "out there." Every moment in time already exists.[20] Part of the reason for this belief is that, from a mathematical perspective, the laws of physics work the same forward and backward.[21] We experience time as sequential as we move through it in a similar manner to how we move through space. The main difference is that we can change direction in space at will, moving forward and backward, left and right, up and down, but we can only move one direction in time—forward. We experience time as diversity. Time moves past in a succession of moments. We remember the past and change the future, but we cannot change the past or remember the future. Why? Why do we experience time as moving only in one direction, if mathematically, it should be able to move in either direction?

One commonly held theory is that we experience the sense of time flowing due to entropy. The second law of thermodynamics tells us that entropy or disorder or information always increases. As will be discussed further in chapter 4, entropy only works one way. Things do not move from disorder to order or from more information to less information. Our experience of time's arrow, or time asymmetry, may come from the tendency of nature to evolve toward disorder. Time is the construct we use to measure that change.

Paul Davies explains that despite our experience of time as something that flows, it does not make sense to think of "time" itself as

[19] For a comprehensive treatment on the "arrow of time," see Carroll, *From Eternity to Here*. For a strong critique of the block universe, see George F. R. Ellis, "Physics in the Real Universe: Time and Space-Time," in *Relativity and the Dimensionality of the World*, ed. Vesselin Petkov (Dordrecht, The Netherlands: Springer, 2007), 49–79.

[20] Paul Davies, "That Mysterious Flow," *Scientific American* 15, no. 3 (February 2006): 82–88.

[21] Think in terms of the commutative property of addition 2+5 = 5+2 or multiplication 2(5) = 5(2). Note that subtraction and division are noncommutative: 2-5 ≠ 5-2 and 10/2 ≠ 2/10.

flowing.[22] Think about the fact that a river flows. A river is a substance, water, experiencing motion. Time is not a substance and therefore cannot move. Davies goes on to explain that the "arrow" of time, similar to spatial directions, does not indicate motion but rather direction:

> By convention, the arrow of time points toward the future. This does not imply, however, that the arrow is moving toward the future, any more than a compass needle pointing north indicates that the compass is traveling north. Both arrows symbolize an asymmetry, not a movement. The arrow of time denotes an asymmetry of the world in time, not an asymmetry or flux of time. The labels "past" and "future" may legitimately be applied to temporal directions, just as "up" and "down" may be applied to spatial directions, but talk of the past or the future is as meaningless as referring to the up or the down.[23]

In other words, time doesn't move; we do. We move in a direction through time. The experience of only being able to move in one direction through time is related to the experience of causality. Craig Callender notes that causality is what makes time distinct from space, as spatial relations are noncausal.[24] We experience a progression of events in our lives that are related to one another. Callender suggests that time may be an emergent property, "just as a table feels solid even though it is a swarm of particles composed mostly of empty space. Solidity is a collective, or emergent, property of the particles. Time, too, could be an emergent property of whatever the basic ingredients of the world are."[25]

Lee Smolin disagrees. As we will see in chapter 8, he suggests that time is the most fundamental aspect of reality and space is the emergent property. For Callender, however, time can be seen as an artificial construct that gives us a global standard for relating events to one another in a similar way to how money is used as an artificial con-

[22] Davies, "That Mysterious Flow," 84. Davies notes the absurdity of the question, "How fast does time pass?" and the unhelpful response of "one second per second."

[23] Ibid., 85.

[24] Craig Callender, "Is Time an Illusion?," *Scientific American* 302, no. 6 (June 2010): 61.

[25] Ibid., 60.

struct that replaces bartering.[26] He shows that we could relate events directly to one another rather than to time. Instead of measuring how many times a heart beats in a minute and how many minutes pass during one rotation of the earth, we could simply measure how many heartbeats occur in one rotation of the earth.[27] Such a system quickly proves rather unwieldy, though, as more and more variables are added, so time simplifies and unifies our measurements of change and the relationships between events that occur.

The key point we want to highlight in the understanding of time from this perspective is that time itself is about relationship. The very fabric of the cosmos is ultimately relationality. From Einstein on, we understand that our existence is governed by relativity and relationality. These two concepts can help us navigate a theological impasse between pluralism and relativism.

Theological and Pastoral Implications

God as Our Constant

Just as space-time provides the context for our very existence—although we struggle to put the reality of it into words and concepts—the God in whom "we live and move and have our being" (Acts 17:28) is our ultimate context and yet defies definition. Yet we do believe that creation itself reveals something of God to us. As was noted in the introduction, George Coyne suggests that studying the world/cosmos/reality in which we live doesn't prove that God is Creator,

[26] Ibid., 65. See graphic on p. 63.

[27] Ibid., 63, see graphic. In this graphic, Callender shows that we can measure the speed of light, the number of heart beats per minute, and the rotations of the earth according to time, but we could also correlate them directly to one another, so that we measure the number of heartbeats per rotation of the earth and how far light travels in one heartbeat, just as we can pay for coffee, shoes, and a car with money, or we can figure out how many cups of coffee would equal the cost of a car or a pair of shoes. Time, like the money we use in place of bartering, may be an artificial construct that simply makes measurement easier. Note that Callender bases this idea of a timeless reality on the theories of Carlo Rovelli and loop quantum gravity. In one of the intriguing twists and turns of developing scientific thought, when we turn to the theory of time as the fundamental reality, we will look at the work of Lee Smolin, another proponent of loop quantum gravity who concludes that space is emergent and time is primary.

but if we believe that God is Creator, then the cosmos should reveal something about the God we believe created all of reality. Likewise, John Polkinghorne states, "There is, of course, no simplistic way in which to translate science's discoveries about the character of the physical universe into implications for an understanding of the infinite reality of God. . . . Yet a cautiously expressed theology of nature might be expected to offer some insight into the manner in which the divine creation reflects, however palely, the character of its Creator."[28] Science made a shift from conceiving of space and time as a static scaffolding to understanding space-time as dynamic and relational. Similarly, notions of God that are static and monolithic give way to images that are dynamic and relational. That shift in our image of God does not imply any change in God. The change is in our perception of God. If we understand that reality is ultimately one, whole, and interconnected, that understanding should reveal something of the divine to us. When we combine this insight into the created world through science with what we believe of God in and through revelation and most primarily/primordially through the incarnation of God's Word in Jesus Christ, we understand a God for whom relationality is central. In Christian terms, we speak of this relationality as Trinity. As was mentioned in the introduction, Karl Rahner has an axiom that theology is anthropology and anthropology is theology—that what we say about God impacts our image of humanity and vice versa. So when our image of God gains new depths of dynamism and relationality, our image of what it means to be human and to be relational should also take on a new depth.

When we start to think about time and space in terms of relationality, new images arise for the triune God whose very being is relationality. Theology tells us that God is not *a being*. God is Being itself, the source of all that is. That source of all is Love. Coyne and Omizzolo suggest,

> The immense richness of the world revealed by the sciences from the microcosm to the macrocosm, the passionate, insatiable desire we have to understand it, the mysteries and the paradoxes that

[28] John C. Polkinghorne, "The Demise of Democritus," in *The Trinity and an Entangled World: Relationality in Physical Science and Theology*, ed. John C. Polkinghorne (Grand Rapids, MI: W. B. Eerdmans Publishing, 2010), 11.

> continuously arise in our search, the haunting sensation that our quest may never end, all of these experiences may be leading us to a source that transcends understanding and is most fittingly approached as Love. This Love is self-revealing in all aspects of creation and is drawing us not only, or even primarily, to understand, but rather to love in turn.[29]

This love connects the events of our lives together; it weaves space and time to unify all humankind and history into an interconnected whole. Love both emerges from relationship and makes relationship possible. Like the speed of light, God as Love becomes our constant in all frames of reference.

Living Out Time

We experience that love in time as both unity and diversity. On the one hand, it is block time in that there is a wholeness to our story, and the totality of who we are is embraced by God's love. The individual moments in which we live out our lives in love cannot be understood apart from the whole. On the other hand, our experience of time, the living out of life, is also sequential. Our lives unfold as stories. The connections between the events and the relationships within which those events are embedded are what make the story. As Smolin points out, we are not objects; we are processes.[30] The story that we are unfolds in time.

That story becomes more complex as it unfolds. As was noted above, the arrow of time is connected to the concept of entropy in the sense that entropy involves an increase in information. We move through life always gaining more information, more memories in our sense of time passing from one moment to the next. There is always more to know. We can never know less (putting aside neurological conditions that involve memory loss). Life could be much easier at times if we could "unknow" something, but it is not possible to unknow something once we know it.[31] Information always increases.

[29] George V. Coyne and Alessandro Omizzolo, *Wayfarers in the Cosmos: The Human Quest for Meaning* (New York: Crossroad, 2002), 169.

[30] Lee Smolin, *Three Roads to Quantum Gravity* (New York: Basic Books, 2001), 50–52.

[31] Scientists actually experiment with the idea of being able to treat PTSD by erasing or reducing traumatic memories.

Therefore situations grow more complex, not less. The more we know, the more disordered and the less black and white our world becomes. The desire to cling to a world that is more black and white may be part of the reason people often stubbornly cling to false information and refuse to know something new. In Coyne and Omizzolo's words, in the increasing complexity we may find ourselves with less understanding but called to love more. We are called to let go of the comfort of certainty and surrender to the vulnerability of love.

In these risky acts of choosing love over certainty, we live out of the whole—past and future. We touch the eternity of God. As Karl Rahner puts it, "The present action of a human being embodies his whole past: his knowledge obtained through effort or through suffering, the depth of his experience, the revolutions of his life, his joys and sorrows. . . . By all these influences, the present action is given its direction, its depth and resonance."[32] In addition to bringing the depth of who we are in and through our life experiences to any act, we also bring our hopes, promises, and plans for the future. Rahner gives the example of marriage vows or ordination vows, though he recognizes that in our freedom we still must live out those hopes and promises on a day-to-day basis. Rahner suggests that by bringing to each act the "whole sum of [our] existence" and by seizing the possibilities open in our future, we realize what is eternal in us.[33] For Rahner, the very nature of being human and having freedom is to act in such a way as to become who we are and who we were created to be. In other words, we become that person who will be definitive in eternity, but we do so in and through our successive loving acts. In this sense, our very being is a unity connected to God's perspective which sees the whole of our lives, the story in its entirety, and yet we live out that story in a causal sequence.

Rahner explains that this balance between the unity and wholeness of our being and our living out our freedom moment to moment imbues the entire process of our lifetime. He explains, "Again and again, our anticipation will seize upon only a fraction of the whole, but we will not cease in our efforts to gather up past and future into

[32] Karl Rahner, *The Content of Faith: The Best of Karl Rahner's Theological Writings* [Rechenschaft des Glaubens], ed. Karl Lehmann and Albert Raffelt, trans. Harvey D. Egan (New York: Crossroad, 1993), 107.

[33] Ibid.

that one decision of freedom from which our life will receive its final and definite truth and reality."[34] In this sense, we live into our death. Death then becomes that moment when our story is complete. Rahner states, "In death the human person completes his own pattern by dying his own death. In the moment of death he is what he has made of himself, freely and finally. The actual result of his life and what he wanted to be, freely and finally become one."[35] It is in this moment of wholeness that "we can see with both horror and supreme delight the immense grandeur, depth, and density of those acts in which our whole life is involved."[36] Rahner notes that not every moment of our lives carries this kind of weight in which we sum up our entire existence in a single act of love. He maintains the hope and belief, however, that

> where an ultimate responsibility is assumed in obedience to a person's own conscience, where ultimate selfless love and fidelity are given, where an ultimate selfless obedience to truth regardless of self is lived out, and so on, at this point there is really in our life something that is infinitely precious, that of itself has the right and reality not to perish, that is able to fill out an eternity.[37]

In these moments of our lives, we touch eternity. We live out block time. In other words, we experience the wholeness, oneness, and unity of all that is, or as Rahner puts it, "Whenever life is lived in faith, hope, and love, eternity truly occurs."[38]

The very definition of who we are and who we are to be is, for Rahner, one who loves. Love of God and one another becomes the grace that holds together the patterns of our lives into a unified whole. Yet Rahner would be the first to admit that we fail regularly at this task of loving God and one another.[39] Sin is a reality in our lives. Sometimes it is a destructive force that ruins our own lives and

[34] Ibid., 111.

[35] Ibid., 110.

[36] Karl Rahner, "Eternity from Time," in *Theological Investigations*, vol. 19, *Faith and Ministry*, trans. Edward Quinn (London: Darton, Longman & Todd, 1984), 176.

[37] Ibid., 177.

[38] Ibid.

[39] Karl Rahner, *The Practice of Faith: A Handbook of Contemporary Spirituality* [Praxis des Glaubens], ed. Karl Lehmann and Albert Raffelt (New York: Crossroad, 1983), 107–14.

others' lives. Sometimes it is merely a mediocrity, a failure to love or take risks, choosing our own comfort over what we know is right and good. Rahner further notes that all the factors of our life and culture make us more or less culpable of these sins.

The complexity and entropy of life do not lend themselves to objective black and white judgments. Just as our frame of reference affects motion through time and space, our individual frames of reference make a difference in terms of our culpability for sin without thereby eliminating a necessary sense of responsibility and accountability. Rahner notes that some people who commit only minor or venial sins ultimately fail to live lives of love, whereas some people who commit grave sins are ultimately loving, selfless individuals. The constant against which we can measure all lives is God's love, just as the speed of light provides a constant of motion in any frame of reference.

Rahner uses the example of one of the Boxer Rebellion martyrs who was an opium addict and who had been refused absolution by his parish priest to illustrate this point. Rahner asks, "Yet, if this man longed for martyrdom, really knew and admitted before God how miserable and wretched he was and asked God to free him from his self-imposed imprisonment, may we not ask if, even before his martyrdom, his life was not really rooted and founded in the love of God—more perhaps than that of the parish priest who rightly refused absolution?"[40] Rahner notes that rather than congratulating ourselves for all of the ways in which we have not sinned (often while pointing out the sins of those around us), we should remember that we are not justified because we have not sinned but rather because God's love and grace embraces our sinfulness and empowers our goodness.

God's grace, which is God's love poured out into our hearts, is our constant for measurement. Rather than meditating on sin in a way that leads us to be more judgmental of ourselves and others, our meditation on sin should always hold in tension both our responsibility and accountability and God's gratuitous and unconditional love. Rahner maintains that in the context of such love, our meditation on sin then becomes a meditation on the source that allows us to transcend the limitations of our sinfulness, to sacrifice what we cannot

[40] Ibid., 112.

sacrifice by our own strength, and to do what we cannot do by our own resources.[41] Then Rahner concludes, "We can always act in virtue of our powerlessness, jump while absolutely dreading the leap, because God is with us, because—without our being able to observe and as it were enjoy it in advance—our impotence, our weakness, and our cowardice, are always surpassed by God's power and mercy, by his grace."[42]

Relativism vs. Relativity and Relationality

One objection frequently raised to Rahner's view of sin, grace, freedom, and fundamental option is that it leads to relativism.[43] When we talk about the interface between the church and the secular world or between faith and reason or religion and science, one word that often comes up is relativism. Relativism is most frequently a concern in two areas: interreligious dialogue and morality. Within interreligious dialogue, the fear is that if one does not hold for the supremacy of Christian belief, all revelation is denied. The unfortunate result can be a Christian triumphalism that does not lend itself to dialogue or even relationship with those of other religious traditions. Within the realm of morality, the fear is an "anything goes" mentality that lets each individual person decide right from wrong. The unfortunate result can be a Christianity that at best can seem out of touch with people's experience and at worst utterly lacking in compassion. Within both of these realms, it is often fear that drives these theological perspectives. Like the scientists with a Newtonian worldview, we cling to the idea of a stable scaffolding, whether that scaffolding be an objective and literal sense of revelation or hard definition of moral behavior. A world that is understood as a unified whole that warps and curves is frightening, and it can be very hard to find our balance. The more we fight the fabric that warps and curves, the more unbalanced we become.

In a postmodern world, our rigid scaffolding of God and revelation has collapsed to an understanding of God as mystery revealed in the

[41] Ibid., 113.

[42] Ibid.

[43] See Peter Joseph Fritz, *Karl Rahner's Theological Aesthetics* (Washington, DC: CUA Press, 2014), 32.

warping and curving of human lives that are shaped by our history and our context, just as our experience of space-time is shaped by the mass of nearby objects.[44] As our understanding of the very reality of space-time has changed to become dynamic and relational, so too has our understanding of the human person in a postmodern world shifted to prioritize a dynamic and relational context to human acts.

Even if one does not accept the concept of postmodernism or believes that we have moved beyond the era of postmodernism, we should reflect on the lessons learned from this era. Postmodernism's main critique is that the modern metanarrative, the universal, overarching story at best overlooks and at worst suppresses or oppresses the stories of those on the margins of society and history. The movement critiques the concept of "Truth" with a capital "T" and the idea that there is such a thing as objectivity. The concept of religious truth or revelation has been questioned within this context. A frequent charge is made that all religious truth is both historically and culturally conditioned and represents the sociopolitical concerns of the dominant groups. The response to this critique is often a countercharge of relativism and the concern that without any standard or universal truth, we end up with a moral collapse in which each individual gets to decide for him or herself what is true and what is right or wrong.

The science of relativity, space, and time illustrates another perspective besides the false certainty of objective truth and the false autonomy of relativism. In the new possible conceptions of space and time, we find a world of relativity (as opposed to relativism) and relationality. While relativity helps us appreciate the importance of one's frame of reference for any experience, the inherent relationality

[44] For example, we have moved from a historically literal reading of Scripture to one that takes into account the historical, cultural, and narrative context, but Scripture is no less revelation for that reason. It is God revealing God's self in human experience and interpretation. What we "know" about God can be real without being definitive. Our knowledge can always be deepened by God being revealed in new ways in new experiences and encounters with the other. While the canon of Scripture is considered to be closed and revelation complete in the sense that God has revealed God's self fully in the person of Jesus the Christ, our interpretation and living out of that experience of Christ is ongoing. For an extensive description of these developments, see the document published by the Pontifical Biblical Commission, *The Interpretation of the Bible in the Church* (Vatican City: Libreria Editrice Vaticana, 1993).

of time and space itself helps us understand that there is no such thing as an autonomous individual and that all persons and decisions are interconnected and interrelated. As Brian Greene notes, the reality described by Newtonian physics turned out to be false, revealing instead a reality that is relativistic.[45] Relativity indicates the interconnectedness of all things, of the very "fabric of the cosmos." It teaches us that all is interrelated—including time and space. Relativity teaches us about perspective and point of view. Relativity is what is most "real" in our world. Even space and time exist as a result of relationship.

Nevertheless, Thomas Greenlee warns us not to confuse relativity with relativism. He notes, "In relativity we say that observers in different reference frames see things differently. They see different lengths for the same objects, see different times for the same events, and if one observer sees two events as simultaneous, the other will not see them as simultaneous. There is no reference frame that is more correct than any other. When we use language like this, it is not surprising that some people will apply the language to the moral realm."[46] He argues, however, against those who would use the science of relativity to argue for a position of moral relativism: "There are frame-independent absolutes in relativity theory. In special relativity, the laws of physics, correctly expressed, are the same in all inertial frames. The speed of light is the same in all inertial frames. In general relativity, the laws of physics, correctly expressed, are the same in all reference frames, whether accelerated or in gravitational fields or inertial frames. Therefore, there are absolutes in relativity theory, and attempts to justify moral relativism by appealing to relativity theory are mistaken."[47] Frame of reference and relationality are essential to how we understand reality, and yet there are also laws of nature that we understand to be true in all frames of reference. Therefore, in relativity theory we have a both/and—both absolutes, such as the speed of light, and relativity, such as our experiences of time and motion.

[45] Greene, *Fabric of the Cosmos*, 10.

[46] Thomas Greenlee, "General Relativity, the Cosmic Microwave Background, and Moral Relativism," in *Science and Religion in Dialogue*, vol. 1 (Oxford: Wiley-Blackwell, 2010), 93–96.

[47] Ibid., 96.

Todd Salzman and Michael Lawler define relativism as the idea "that there are no universal truths, moral truth and moral terms are defined either socially or individually."[48] They go on to explain, "Both social and personal relativism deny that the good can be defined universally; they therefore assert that there is no objective basis on which to justify claims to universal truth and absolute norms or intrinsically immoral acts."[49] In his article "Truth with a Capital T," Joseph Wooddell argues that our popular culture professes a belief in moral relativism, the idea that there is no objective standard by which to judge right and wrong. At the same time, however, people live by the assumption that there are, in fact, universal norms of right and wrong.[50] He explains that people may say that there is no such thing as absolute moral truth, but when confronted by a specific example of an atrocity, they find themselves quite willing to describe the act as universally morally unacceptable.[51] In theology, the role of human experience has gained much legitimacy in recent decades, which is a vast improvement over a theology that ignored human experience. Human experience, however, does not trump all. We must recognize that human experience is subjective, and this realization should engender in us the virtue of humility, the openness to conversion, and the sure knowledge that we might be wrong. In other words, we should embrace a certain degree of uncertainty. The subjectivity of human experience and human interpretation can lead the Westboro Baptist "church" or certain terrorist organizations to use religious rhetoric in order to propagate hatred and violence in the world. While we no longer live in a modern worldview that believes an absolutely objective viewpoint is a possibility, we must neverthe-

[48] Todd A. Salzman and Michael G. Lawler, "Method and Catholic Theological Ethics in the Twenty-First Century," *Theological Studies* 74, no. 4 (December 2013): 907.

[49] Ibid., 908.

[50] Joseph D. Wooddell, "Truth with a Capital T: Does it Really Matter? Public Discussion of Social and Economic Questions in a Relativistic Age," *Criswell Theological Review* 11, no. 2 (Spring 2014): 8–9.

[51] Ibid. Wooddell uses the examples of 9/11 and a news story about a man who had abducted three young women and kept them imprisoned for a number of years, subjecting them to sexual abuse and murdering the babies they conceived as a result of that abuse. His argument holds that even when people profess a moral relativism, when given specific examples such as these, they feel that the acts described are objectively evil.

less not accept all human experience as equally valid. Somehow we must develop criterion on which we judge human acts.

Salzman and Lawler offer an alternative viewpoint of perspectivism that is congruent with the notion put forth by relativity and relationality. They suggest that Catholic theological ethics does hold for a "metaethics" or universal concept of what is "good" and "right" as being that which contributes to human dignity and flourishing.[52] Conflict arises because of disagreements over definitions of human dignity and understandings of what best lends itself to human flourishing. Consequently, Salzman and Lawler turn to Bernard Lonergan's notion of perspectivism and the idea that these different definitions arise due to different perspectives. Relativism, in this view, disavows the possibility of truth and judgment, whereas perspectivism allows for the complexity of situations and allows for judgment but notes that all judgment is based on partial truth.[53] The authors note Lonergan's three factors of perspectivism:

> First, human knowers are finite, the information available to them at any given time is incomplete, and they cannot attend to or master all the available data. Second, knowers are selective, given their different socializations, personal experiences, and ranges of data offered them. Third, knowers are individually different, so we can expect them to have different interpretations of the available data.[54]

Put in simpler terms, as finite, unique human persons, we simply cannot ever know all there is to know about a situation and will not agree on how to interpret what we do know. We all have different frames of reference.

Each one of us is limited in our perception. What we observe about the world around us is colored by our own presuppositions. Keenan Osborne describes the limits of human perception in a similar manner. Each one of us carries what Osborne refers to as a "sedimentary history," the layers of experience that have shaped who we are and

[52] Salzman and Lawler, "Method and Catholic Theological Ethics," 908.
[53] Ibid., 910.
[54] Ibid.

how we think.[55] This sedimentary history affects what we perceive and the significance we place on that which we perceive.[56] That sediment can be connected to the accumulating information of entropy as well, the information that accrues in those layers of experience as time goes by. In other words, people see and experience the world differently, and they interpret what they see and experience differently. That difference occurs both in how two people interpret the world differently and also in how we interpret the world differently at different points in our lives as we grow and change. Thus the judgments we make are always going to be limited by our perspective, and our perspective is not static.

Lee Smolin makes similar observations about the role of the observer in physics, explaining that the observer always has a partial view. He argues that the "hardest thing about science is what it demands of us in terms of our ability to make the right choice in the face of incomplete information."[57] Such a statement is true not only of science but also of life in general. As Smolin explains, we all split the world into two parts, dividing the world between ourselves as observer and that which we observe.[58] Thus each of us observes the world differently, from a different frame of reference, and each of us has blind spots in our observations. Salzman and Lawler suggest that these different perspectives are similar to viewing the world from different floors of the Empire State Building: "Each gets a different, and less partial, view of all that lies outside the window. We could expect that if they ascended to a higher story, they would get a different, and, again, still partial view."[59] They argue, however, that the "necessarily limited nature of human sensations, understandings, judgments, and knowledge" is not a source of falsity but rather a source of partial truth.[60] The fact that we see from our own frame of reference does not make our observation false; it simply makes it necessarily incomplete.

[55] Kenan B. Osborne, *Christian Sacraments in a Postmodern World: A Theology for the Third Millennium* (New York: Paulist Press, 1999), 148–49.

[56] Ibid.

[57] Smolin, *Three Roads to Quantum Gravity*, 146.

[58] Ibid., 47.

[59] Salzman and Lawler, "Method and Catholic Theological Ethics," 910.

[60] Ibid.

Smolin notes, "Here in the real world, we almost always reason with incomplete information" and in the face of the necessity of making decisions without all of the information suggests an ethical principle in which "different observers report what they see honestly."[61] We come to the most complete picture by combining our observations, our partial truths. We can only avoid catastrophic train wrecks through communication and cooperation. We have different frames of reference, but our shared constant is love, the Love that Christians call God. When our understanding falters, we are called to love more. Smolin goes on to explain that in this way we can come to agreement on common ground while accepting that there are questions we cannot answer. We come to that common ground by listening to one another's stories and learning from one another's experiences.

When we think of the dilemmas we face today, there are two possible approaches. The church historically has built its approach on the work of Aristotle and the idea of objective truth. There is a fear that embracing new approaches will lead to relativism, in the sense that anything goes, but what Smolin's scientific model can teach us is not relativism in the sense that any person's truth is legitimate but rather a process of shared truth through dialogue and relationship. When we look at thorny issues the church faces in the complex world today, such an approach would suggest that the first step among the faithful should be to listen. We are called to listen to those who have experiences that are different from ours. We are not called to judge. We are called to hear the observations of those whose "light cone," i.e., what they are able to see, is different from our own. Smolin argues that the most important thing about persons and cultures is history or story.[62] We gain wisdom only when we share our stories, listening and learning from one another.

The lesson of relativity with the understanding of time and space that emerges from relationship is that we cannot subtract relationship from our understanding of morality. If we look at the history of the early church, we see that in fact relationality has always been at the heart of morality, thus in the earliest Christian communities, the acts that were seen as most sinful and at times unforgivable were the ones

[61] Smolin, *Three Roads to Quantum Gravity*, 31.
[62] Ibid., 49–50.

that tore at the fabric of the community. The sacrament of reconciliation was developed to heal rifts in the community caused by heresy, apostasy, adultery, and murder, because these sins were the ones that created breaks in the bonds that formed the community. In our current culture of autonomy and individualism, we have lost this corporate meaning of sinfulness. The biblical view is much more organic than Newtonian. We are not all parts in a machine where, when the machine breaks, you find the broken piece and replace it. Rather, we are all parts of a body, and when one member suffers, the whole suffers. We seek healing and wholeness.

In a fabric of reality that warps and curves, the one constant is change. Like a person standing still in space but moving through time, even when we try to resist change, change happens. Furthermore, the fabric of my life changes due to the mass of the events I encounter. Anyone who has felt the rush of new love, for example, falling in love or becoming a parent, has experienced this disruption where suddenly one's entire life is pulled into orbit around another being. Everything changes—priorities, friends, how time is spent. Some events are so massive and cataclysmic that, like a black hole, they can draw one's entire being into their horizon so that one's light can no longer emerge.

When we are dealing with our day-to-day lives and our communities, objective standpoints give way to people's lives—real people within real relationships. We encounter the grieving man in the hospital sitting at the bedside of his dying partner of thirty years. We sit with the grieving mother of a black son killed in an encounter with the police. We sit with the grieving widow of a police officer killed in the line of duty. There are numerous examples in our lives and in the headlines of the newspaper that demonstrate the incredible moral complexity of our lives. To acknowledge that complexity is not to deny any possibility of a "metaethic," but it does recognize that there can and will be genuine disagreement about how we determine what defines human dignity and flourishing. It recognizes that we can only negotiate those disagreements when we understand life as story rather than autonomous events. In doing so, we not only encounter brokenness in the complexity of human life but also joy and hope, forgiveness and love.

We share our stories, our frames of reference, our own observations and partial truths, and in that sharing we all become more preciously

and fragilely human. Even when, from our respective frames of reference, we disagree on the best course of action to protect and promote life, we hold that core value in common. We hold on to what is constant in all our frames of reference—the love of God and the preciousness of life.