Framing Research in the Sciences and Mathematics by the "Big Questions" of Meaning and Value[*]

Project P.I.

Thomas M. Nordlund, Dept. of Physics, University of Alabama at Birmingham

Project Title*:*

Impact of modern physics on the training and mindset of American ministers of religion

Big Question

What impact does basic understanding of the physical universe and its laws have on the preparation and mindset of students planning to become ministers in mainline American churches? Are formal religions and the physical sciences becoming more and more distant from each other even as their regimes of overlap increase?

Research Question

The basic structure and dynamics of the universe, from elementary particles to the expansion of the universe, can be increasingly well described by a small number of principles from modern physics—quantum mechanics and cosmology. Physical principles are designed to explain how matter changes with time, subject to *conserved quantities* and usually described in terms of three spatial and one time dimension. Does such understanding and analysis have any impact on the mindset and world view of future ministers of mainline religions (e.g., their understanding of God), or is this science irrelevant to their planned ministry to people?

Hypothesis: The American science-religion "debate" remains inhibited, unproductive and unconnected to society in general because of the weak physical science requirements of seminaries and schools of theology.

Project Summary

The "Big Bang" picture of the universe and the quantum theory of microscopic matter has been taught in mainstream colleges and universities for 100 years. During the first four decades, the subject consisted of research and debate among professors of physics, chemistry and math and their graduate students. Though details are still undergoing vigorous discussion, the main features of modern physics have been taught to undergraduate science students of American universities since the 1950's. The approach taught to such students attempts to explain how matter changes with time, subject to *conserved quantities* and usually described in terms of three spatial dimensions and a time dimension. Equations based on the principles predict the outcomes of certain events and experiments are designed to confirm or disprove the prediction. Experiment has often contradicted prediction, but the issue has usually been a faulty equation or assumption—e.g., ignorance of electron spin in an atom's angular momentum—and not the principle itself (e.g., conservation of angular momentum). The quantum view of the micro-world and the cosmological view of the universe has had profound impact on attitudes and actions of physical scientists, as well as on society in general. Experiences, technology and devices derived from modern physics direct, if not dictate, our everyday lives.

---

[*] Summary of a subproject funded by the Teagle Foundation; primary award to Samford University, extended to the Birmingham Area Consortium for Higher Education, including the University of Alabama at Birmingham.

The emerging mechanistic view of astronomy and cosmology had a profound impact on mainline religious leaders hundreds of years ago and, as a result, on the congregations they taught. Some church ministers were also numbered among the scientific elite. In contrast, quick surveys of training programs for 21st-century, mainstream religious ministers does not reveal a significant scientific preparation for "religious" implications of modern physics, though the implications are many. Future ministers focus on history, literature, languages, speaking, managing, and counseling.

This project aims to measure the time, effort and importance attached to modern physics by students preparing for the ministry and their teachers. We will

(i) Search seminary and schools of theology websites, compiling physical science academic entrance and graduation requirements and related course syllabi.
(ii) Identify American centers for training in ministry and science, including Vatican (Catholic Church) centers.
(iii) Develop seminary student and faculty surveys that assess physics/cosmology knowledge and understanding, interest and the considered importance of those areas to their careers or service.
(iv) Develop these data and tools for publication in scientific and religious education journals (e.g., The Physics Teacher, J. Sci. Stud. Relig., Christ. Today).

Project Description

Connection between physics and religion.

Physics and religion have been closely associated up until about the middle of the 19th century. The scientists who studied the moon, stars, water, soil and light were, in fact, some of the same people who taught moral behavior and godly faith in churches and mosques.*

The rather startling insights of the *physicist* Saint Augustine (AD 354-430) into the nature of time, space, causality and the origin of the universe were closely connected, in his mind, to his moral experiences and the pleadings of his mother. His *Confessions*,[1] though not originally in the form of one book as we have it now, places chapters on the nature of time and creation just after extensive descriptions of his moral battles and failings and interactions with friends, teachers and mother. In fact, Augustine appeared to understand mundane moral issues through appeals to principles of physics:

> *Augustine … his memory of his past life, his present experience, and his ardent desire to comprehend… leads him to the questions of the mode and time of creation. He ponders the mode of creation and shows that it was de nihilo and involved no alteration in the being of God. He then considers the question of the beginning of the world and time and shows that time and creation are cotemporal. But what is time? To this Augustine devotes a brilliant analysis…* [2]

In *The Literal Meaning of Genesis*, Augustine laments

* The lag of scientific knowledge in the "Dark Ages" of Europe were partly compensated for by the preservation of science by Islam, China, India and isolated centers of western religious learning.

> *It not infrequently happens that something about the earth, about the sky, about other elements of this world, about the motion and rotation or even the magnitude and distances of the stars, about definite eclipses of the sun and moon, about the passage of years and seasons, about the nature of animals, of fruits, of stones, and of other such things, may be known with the greatest certainty by reasoning or by experience, even by one who is not a Christian.* ***It is too disgraceful and ruinous, though, and greatly to be avoided, that he [the non-Christian] should hear a Christian speaking so idiotically on these matters, and as if in accord with Christian writings, that he might say that he could scarcely keep from laughing when he saw how totally in error they are****. – The Literal Meaning of Genesis 1:19–20, Chapt. 19 [408].*

Augustine, one of the "Church Fathers" of the Christian religion, is revered by Baptists, Catholics and everyone in between, but his discourses on time and space are rarely discussed today in churches, especially in direct connection with moral behavior, as he did.[3]

The invention of the telescope in the 1600s led to a strain in the historically-comfortable association when it became clear that some "issues" were emerging between what certain scientist-theologians saw in the sky and the historical assumptions and understandings of religious leaders, as well as common folk.

> *This vast increase in the size and age of the perceived cosmos set the stage for an angst as deep as that caused by the displacement of the ancient human-centred cosmology: what significance do rational, observing mortals have in the wilderness of a near-infinite space-time continuum? This existential question has been simmering for decades ....*[4]

Additional "size and time" angst was introduced by Charles Darwin in 1859 by his discussion of a view of "creation" of organisms over more than a period of 144 hours. There are minor exceptions, but the 21st –century order appears to be a rather final divorce between the formal structures of physics and religion. They no longer fight: they ignore one another. The vigorous "discussions" that still take place largely involve physicists who are closet Christians (or other)—not appointed leaders of either churches or physics organizations— at least when one excludes the highly publicized bouts called "debates" that occur yearly in many American universities.

Historical evidence for a constructive educational and economic role of ministers trained in the physical sciences can be found in many places. Jacob and Reid describe the role of mechanical and technical knowledge in the making of the industrial revolution. Focusing on Manchester, England, from 1790 to 1820, they find the chapel life of Unitarians as providing a site for the inculcation of religious values compatible with an ethic for both innovators and workers.[5]

<u>Centers for study of science and religion in the 21st century.</u>

Well-known institutes for the study of science and religion* include

---

* We explicitly exclude programs in *philosophy*, because they rarely have direct connections to training of ministers for mainline or popular religions. I am aware of the local Samford University Center for Science and Religion and other smaller-scale centers for study of these issues, but have not included them in the present list.

- The Vatican Observatory, http://vaticanobservatory.org/, Castel Gandolfo, Italy (outside Rome)— one of the oldest astronomical research institutions in the world, with its dependent research center, the Vatican Observatory Research Group, at the Steward Observatory at the University of Arizona, Tucson, USA;
- The Faraday Institute for Science and Religion, www.faraday-institute.org, St. Edmund's College, Cambridge, GB;
- The Center for the Study of Science and Religion (CSSR), www.columbia.edu/cu/cssr/, The Earth Institute, Columbia University, New York.

There other centers, but the list is not long. Neither are these institutes integral parts of minister-training programs.* In contrast, the list of formal and informal debates in European and American society over the merits, legitimacy and roles of religion and science is immense, extending over centuries, accelerated especially by Galileo's 1632 *Dialogue Concerning the Two Chief World Systems* and the 1859 publication of Darwin's *On the Origin of Species*.

In the U.S. there are also a number of "science and religion" centers or institutes, existing outside the normal auspices of seminaries or accredited colleges of higher education, that function as advocates for specific issues or points of view. These are usually related to evolution/creation. The Institute for Creation Research is an example. While such centers should not be ignored, they do not, in the proposer's opinion, seriously impact the education and training of ministers for their careers. They also tend to focus on controversial biological issues of evolution and do not design well-rounded physical science educational programs. We also *must needs* exclude consideration of the hundreds of "new age educational centers" that occasionally associate themselves with all sorts of religions. They involve about 0.4% of the U.S. population,[6] and so confuse the boundaries between tested physical science and wishful imagination that they should be considered, at best, an aberration of both science and religion.

Americans are religious. 83% of American adults identify an affiliation with an organized religion; 6% more identify with a religion but have no formal affiliation, according to the Pew Forum Survey.[6] The American religious landscape is very dynamic. Under a heading of *A Very Competitive Religious Marketplace*, the Pew survey finds that,

> *… constant movement characterizes the American religious marketplace, as every major religious group is simultaneously gaining and losing adherents. Those that are growing as a result of religious change are simply gaining new members at a faster rate than they are losing members. Conversely, those that are declining in number because of religious change simply are not attracting enough new members to offset the number of adherents who are leaving those particular faiths*.

The Catholic affiliation rate has remained nearly constant at 25% since 1972. On the other hand, 10% of American are ex-Catholics, their departure from the Catholic faith offset by immigration additions: even the "stable" Catholic number involves rapid turnover. This is of interest to the present proposal because the Catholic church has maintained (by far) the most stable, organized scientific research efforts of any western religion.

What Americans state on a religious survey is, of course, only loosely connected with their behavior. The percentage regularly attending a religious service or education program is only about half the number claiming an affiliation,[7] ranging from 58% in Alabama,

---

* Some seminaries have loose associations, such as Union Theological Seminary with CSSR.

Louisiana and South Carolina to 24% in New Hampshire and Vermont; a national average of 42%.[*] *Nevertheless, somewhere between 42% and 83% of Americans lend some credence to, or at least regularly hear, the teaching of trained ministers of some church.* This is a far higher percentage of the population than regularly hears the teachings of science professors at accredited institutions of higher education.

Personnel notes:

1. Philip Markham, student. A first-year Beeson Divinity school student, Philip was chosen because of his background and understanding of the physical sciences, his direct interest in the relationship between the physical sciences and religion, and a recommendation from a trusted student. A true undergraduate student would have little understanding of the expectations and demands of a seminary or divinity school and a future career in the ministry. I request a waiver of any normal expectations for undergraduate status.
2. Thomas Nordlund, faculty. A faculty member of the UAB Dept. of Physics since 1990, Tom has research/publishing credentials in biological physics (molecular biophysics and structural dynamics, rapid energy transfer in photosynthetic and DNA systems, sunscreen excitation dynamics), publishing (Assoc. Editor of the Biophysical Journal, author of forthcoming textbook *Quantitative Understanding of Biosystems*, Taylor & Francis, 2010) and running undergraduate academic programs and high school physics workshops.

References

[1] Augustine of Hippo. *The Confessions of St. Augustine* (AD 397-398). May be found online at http://www.ccel.org/a/augustine/confessions/confessions.html

[2] Augustine, of Hippo, comments and translation by A.C. Outler, 1955. *Confessions and Enchiridion*. Westminster Press (paper), Philadelphia. http://www.ccel.org/ccel/augustine/confessions.xiv.html

[3] My own experience in a semester-long Presbyterian church class on Augustine's *Confessions* involved a teacher who said (more or less) "I don't know quite what to say about this chapter on time and space…". When I said that Augustine was talking "physics" and tried to further explain what he was talking about, I received polite smiles and an extended period of silence. The teacher was a university professor, though in the medical field.

[4] Gingerich, O. *Year of astronomy: Mankind's place in the Universe*. Nature 457:28-29, 2009.

[5] Jacob, M., and D. Reid. 2001. *Technical knowledge and the mental universe of Manchester's early cotton manufacturers.* Can. J. Hist. 36:283-304.

[6] The Pew Forum on Religion and Public Life, *U.S. Religious Landscape Survey*, http://religions.pewforum.org/reports, accessed 22 Feb, 2010.

[7] http://www.gallup.com/poll/22579/church-attendance-lowest-new-england-highest-south.aspx

[*] U.S. attendance is nearly 3 times higher than in the U.K. and most other EU countries.