

Cosmology: Scientific, Philosophical, and Theological

Theo TBA

St. John Vianney Theological Seminary Date TBA

Instructor:

Rm TBA

Meeting Times: TBA

Course Description: This is an introductory course in cosmology for seminarians. It is team taught by a philosopher and a theologian. By ‘cosmology’ we mean the study of the universe considered as a whole together with the study of its principle parts and operations. The achievements of scientific cosmology in the last 100 years have been extraordinary and include what has been called the recovery of the very notion of ‘universe’. We will present and discuss some of the most important characteristics of this cosmology and the evidence supporting its model of the structure and dynamics of the universe. In addition, modern scientific cosmology increasingly draws upon and includes the other physical sciences and, thus, offers a profoundly broad, varied, and unifying vision of the universe. It also raises fundamental questions that go beyond the sciences. Cosmologists themselves also make different philosophical and theological assumptions. Thus, the course situates modern scientific cosmology within what *Fides et Ratio* calls a *sapiential* horizon. Consequently, we will undertake our study from theological, philosophical, scientific, and historical viewpoints.

This horizon includes philosophy because in Catholic thought philosophy plays an important and necessary role in discussions of faith, science, and reality. We will consider Aquinas’ understanding of the relation of perfection to the universe and of the importance of intellectual creatures to that perfection. We will compare and contrast cosmology in myth with cosmology in Christian revelation and theology. We will give a brief history of cosmology that describes atomistic, Aristotelian/Ptolemaic, Copernican, Newtonian, and Steady State cosmologies and considers various philosophical and theological responses to them. We will also discuss two important points of contact between Big Bang Cosmology and the Catholic Church: the formulation of the first version of the Big Bang Theory by Fr. Georges Lemaître and an important and somewhat controversial episode involving Pope Pius XII and Fr. Lemaître as well. By reading a brief history and overview of Big Bang Cosmology as of 1990 (The “Introduction” to Lightman’s and Brawer’s *Origins*) and then spending more time on a recently written work (deGrasse Tyson’s and Goldsmith’s, *Origins*), we aim to illustrate the progressive but often tentative and sometimes stumbling nature of science. The result should be a further appreciation of scientific methodology.

Historically, cosmologies have not only reflected the desire to understand the universe in which we live but also have been a source of meaning for human beings and societies by showing who we are, where we’ve come from, where we are going, and what our place is in the scheme of things. In light of this important function of cosmology, we will guide our study with the question of meaning and especially the question of finding meaning in the universe as understood by modern scientific cosmology. With this in mind, we will read interviews drawn from Lightman’s and Brawer’s *Origins: The Lives and Worlds of Modern Cosmologists* to gain some insight into scientific cosmologists, the ways they think, and their individual differences. We seek to do this by respecting the integrity of the different intellectual disciplines involved in our study and by appreciating the distinctiveness of natural science from philosophy, theology, and myth. We aim for a thoughtful and challenging engagement of the seminarian’s

faith, his philosophical and theological education, and the scientific study of the universe. We aim for the seminarian to gain a wonder and an appreciation for the greatness of the universe, a greatness expressed in Cardinal Newman’s claim that “The idea of the universe is so great that only the idea of its Maker is greater.”

Significant use will be made of visual aids. Powerpoint presentations will be made available on the Library website.

Course Objectives: We expect the seminarian to become familiar with basic features of modern scientific cosmology within a historical, philosophical, and theological context so that he can engage in dialogue with people whom he is likely to meet as a Roman Catholic priest.

Seminarians will be able to describe Bouyer’s account of how the Christian revelation superseded and corrected mythic and rational approaches to the cosmos while preserving what is good in them.

Seminarians will be able to describe Bouyer’s account of the relation of the angels to the cosmos and his account of the relation of the cosmos to Christ.

Seminarians will be able to describe Atomistic, Aristotelian/Ptolemaic, Copernican, Newtonian, and Steady State cosmologies and explain their historical deficiencies and strengths.

Seminarians will be able to explain how the notion of perfection is related to the universe in the thought of St. Thomas Aquinas and how, on this notion of perfection, embodied spirits (e.g., human beings) are a necessary and integral part of the universe.

Seminarians will be able to describe and explain a basic, general account of Big Bang Cosmology that includes the structure and dynamics of the universe considered as a whole and with respect to its principle parts. They will be able to describe the basic lines of evidence supporting Big Bang Cosmology and describe outstanding problems that it faces.

Seminarians will give an account that compares and contrasts the ways in which modern scientific cosmology, philosophy, and theology approach and study the cosmos.

Seminarians will describe basic philosophical and theological questions that are raised by cosmology and by Big Bang Cosmology in particular. In particular, they should describe some problems that life in the universe may pose for Christian faith.

Seminarians will explain how various cosmologies are or are not sources of meaning for human beings and societies. In particular, seminarians will discuss problems for meaning posed by Big Bang cosmology and will describe several different responses given by modern scientific cosmologists to Steven Weinberg’s claim that “the more the universe seems comprehensible, the more it seems pointless.”

Prerequisites: No prerequisites. However, the course does draw upon the seminarians’ previous coursework in philosophy and theology.

Credit Hour Value: 2 Credit Hours.

Grading:	Class Participation	15%
	Field Trip and Paper	30%
	Homework	15%
	Final Exam	40%

Grades will be calculated according to the scale given in the current St. John Vianney Theological Seminary Catalog. The policy for giving an incomplete for a grade is also given in the catalog.

Class Participation: Class discussion is expected throughout the course. Connecting with the material is especially important. Read the assignments before class and be prepared to discuss them. Class Participation helps bring about personal engagement with the material, which in turn greatly facilitates learning. Since the course goals include being able to enter into dialogue about cosmology, the seminarian is expected to exercise and practice this ability during the class meetings.

Field Trip and Paper: Classroom considerations of science are best supplemented with more direct encounters of scientific work and scientific understanding. The purpose of this assignment is to provide a closer and more tangible encounter with the results of modern science and to see how those results are presented to the public in a permanent institutional setting. Class lectures will also occasionally use examples taken from the field trip locations. The seminarian will have several options for completing this assignment and need only choose one: the exhibits at Denver Museum of Nature and Science, especially the Space Odyssey Exhibit; a cosmology talk given at the Denver Museum of Nature and Science or attending the museum's monthly "60 Minutes in Space"; a meeting of the Denver Astronomical Society at the University of Denver's Historic Chamberlin Observatory. Seminarians will answer some questions based on information available at the site and will write a three page paper about their visit that involves applying ideas discussed in the course. Details for the assignment will be handed out on the first day of class.

Homework: There will be four homework assignments. Seminarians will be given a question related to the readings and will be required to write a brief reflection in response to the question. Homework assignments are intended to help seminarians better understand the material and to facilitate class discussions. Homework will be collected at the beginning of the class day for which it was assigned. The instructor will hand out homework assignments at least two class meetings prior to the date on which an assignment is due. Do not wait until the evening before class to begin working on the homework. Each assignment should observe proper rules of grammar, punctuation, spelling, and style. The *St. John Vianney Style Guide* is the standard in these matters. You are encouraged to see the writing tutor as needed.

Final Exams: The final will be a comprehensive oral exam and will emphasize the student's integration of the material and ability to dialogue concerning it. Details will be given later in the semester.

Office Hours: TBA

Academic Integrity: The policy on academic integrity is given in the current St. John Vianney Theological Seminary Catalog. Seminary students are expected to follow a strict honor code in taking examinations and in preparing papers, presentations, and class assignments. All work submitted by students must represent their own work or their own research into the work of others. When an assignment calls for research, students must give proper credit to the persons

whose work they consult. Violation of the honor code is a serious offense, which can result in the loss of academic credit or dismissal from the seminary. Every member of the Philosophy Department takes any form of cheating or plagiarism very seriously and the burden is on students to determine whether an action constitutes cheating or plagiarism prior to submitting work to the faculty.

- Texts:** Louis Bouyer, *Cosmos: The World and the Glory of God* (Petersham, MA: St. Bede's Publ., 1988).
- Edward Harrison, *Cosmology: The Science of the Universe*, 2nd (Cambridge, UK: Cambridge Univ. Press, 2000).
- Neil deGrasse Tyson and Donald Goldsmith, *Origins: Fourteen Billion Years of Cosmic Evolution*, 1st (W.W. Norton & Co., 2014).
- Alan Lightman and Roberta Brawer, *Origins: The Lives and Worlds of Modern Cosmologists* (Cambridge, MA: Harvard Univ. Press, 1990).
- Pope Pius XII, "Un'ora" and "Discourse to Astronomers" in P.J. McLaughlin, ed., in *The Church and Modern Science* (New York: Philosophical Library, 1957).
- Józef Turek, "Georges Lemaître and the Pontifical Academy of Sciences" *Vatican Observatory Publications* (1986) Vol.2, No.13 pp. 167-75.
- Oliva Blanchette, *The Perfection of the Universe According to Aquinas* (University Park, Penn, The Pennsylvania State Univ. Press, 1992).
- The Book of the Cosmos*, ed. Dennis Danielson (Cambridge, Perseus Publishing, 2002).
- Helge Kragh, "The Beginning of the World: Georges Lemaitre and the Expanding Universe" *Centaurus* 32 (1987), 114-139.
- Steven Weinberg, *The First Three Minutes*, Updated Ed. (New York: Basic Books, 1993), pp. 154-55.
- Steven Weinberg, *Dreams of a Final Theory* (New York: Vintage Books, 1992), pp. 255-57.
- Roch A. Kereszty, *Jesus Christ: Fundamentals of Christology*, 3rd ed. revised and updated (New York: Alba House, 2011), pp. 443-65.
- Dennis R. Danielson, "The Great Copernican Cliché" *American Journal of Physics* 69 (2001), pp. 1029-35.
- Dennis R. Danielson, "Copernicus and the Tale of the Pale Blue Dot" Address to the annual meeting of the American Scientific Affiliation at Colorado Christian University, Lakewood, CO, July 2003.
<http://faculty.arts.ubc.ca/ddaniels/docs/bluedot.RTF>
- St. Thomas Aquinas, *Summa Contra Gentiles*, Bk. III.22, trans. Vernon J. Bourke (Notre Dame: Univ. of Notre Dame Press, 1975).
- Stanley L. Jaki, "Thomas and the Universe," *The Thomist* 53 (1989), pp. 545-572.
Encyclopedia of Cosmology (Routledge Revivals), Norriss S. Hetherington, ed. (Revivals, 2014).
- <https://exoplanets.nasa.gov/>
- <http://phl.upr.edu/>
- http://www.esa.int/Our_Activities/Space_Science/Planck

Schedule and Readings

Class 1: Introduction

Syllabus
Overview of Course

Class 2: The Nature of Cosmology I

Danielson, *Book of the Cosmos*, "Introduction", pp. xxv-xxxiii
Harrison, *Cosmology*, Preface and Introduction, pp. ix-x and 1-2.

Class 3: The Nature of Cosmology II

Harrison, *Cosmology*, Ch.1, pp. 13-26.
deGrasse Tyson and Goldsmith, *Origins*, Preface, pp. 15-21.
Weinberg, *The First Three Minutes*, pp. 154-55.
Weinberg, *Dreams of a Final Theory*, pp. 241-61.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 466.

Class 4: From Cosmic Myth to Creative Word

Bouyer, *Cosmos*, Chs. 1-3, pp 3-36.
Danielson, *Book of the Cosmos*, Ch. 1, pp. 2-10.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 66.

Class 5: The Fall in Myth and Scripture

Bouyer, *Cosmos*, Chs. 4-6, pp. 37-61.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 83-4.

Class 6: Redemption

Bouyer, *Cosmos*, Chs. 7 and 10, pp. 62-71 and 86-96.
Danielson, *Book of the Cosmos*, Ch. 1, pp. 10-11.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 100-101.

Class 7: Angels

Bouyer, *Cosmos*, Chs. 19-20, pp. 194-217.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 119.

Class 8: The Atomists

Danielson, *Book of the Cosmos*, Ch. 4, pp. 23-30.
Harrison, *Cosmology*, Ch.2, pp. 33-34.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 135.

Class 9: Aristotle and Ptolemy

Harrison, *Cosmology*, Ch.2, pp. 30-33.
Danielson, *Book of the Cosmos*, Ch. 11, pp. 68-74.
Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 152-53.

Class 10: Aquinas and the Perfection of the Universe

Blanchette, *Perfection of the Universe According to Aquinas*, Introduction, pp.4-31 and Ch.2, pp.75-105.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 168-69.

Class 11: Aquinas and Man

Blanchette, *Perfection of the Universe According to Aquinas*, Ch.6, pp.258-66 and Ch.7, pp. 267-85.

Aquinas, *Summa Contra Gentiles*, Bk. III.22

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 185.

Class 12: Dante

Guest Speaker

Class 13: Copernicus and Newton

Harrison, *Cosmology*, Ch.2, pp. 37-39 and Ch.3, pp. 54-61.

Danielson, *Book of the Cosmos*, Ch. 18, pp. 104-117 and Ch.34, pp. 220-228.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 200 and 213.

Class 14: Wright, Kant, Herschel, and Olbers

Harrison, *Cosmology*, Ch.4, pp. 66-73 and Ch.16, pp. 323-26.

Danielson, *Book of the Cosmos*, Ch. 35, pp. 229-32, Chs.41-42, pp. 259-271, and Ch.47, pp. 294-297.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 231.

Class 15: The Expanding Universe: Big Bang and Steady State Theories

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp.1-49.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 248-49 and 265.

Class 16: Pope Pius XII and the Big Bang Theory

Kragh, "The Beginning of the World: Georges Lemaître and the Expanding Universe"

Pope Pius XII, "Un'ora" and "Discourse to Astronomers"

Turek, "Georges Lemaître and the Pontifical Academy of Sciences"

Class 17: Origin of the Universe I

deGrasse Tyson and Goldsmith, *Origins*, Chs.1-3, pp. 33-63.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 283-84 and 305.

Class 18: Origin of the Universe II

deGrasse Tyson and Goldsmith, *Origins*, Chs.4-6, pp. 64-107

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 322-23 and 340.

http://www.esa.int/Our_Activities/Space_Science/Planck

Class 19: Origin of Galaxies and Cosmic Structure I

deGrasse Tyson and Goldsmith, *Origins*, Chs.7, pp. 111-121.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 358 and 376-77.

Class 20: Origin of Galaxies and Cosmic Structure II

deGrasse Tyson and Goldsmith, *Origins*, Chs.8, pp. 122-143.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 398.

Class 21: Origin of Stars I

deGrasse Tyson and Goldsmith, *Origins*, Chs.9-10, pp. 147-179.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 409.

Class 22: Origin of Planets I

deGrasse Tyson and Goldsmith, *Origins*, Chs.11-12, pp. 183-203.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 433-34.

Class 23: Origin of Planets II

deGrasse Tyson and Goldsmith, *Origins*, Chs.13, pp. 204-221.

<https://exoplanets.nasa.gov/>

<http://phl.upr.edu/>

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 449-50.

Class 24: Origin of Life I

deGrasse Tyson and Goldsmith, *Origins*, Chs.14-16, pp. 225-273.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, p. 480.

Class 25: Origin of Life II

deGrasse Tyson and Goldsmith, *Origins*, Chs.17 and Coda, pp.274-95.

Danielson, *Book of the Cosmos*, Ch. 73, pp. 438-47.

Lightman and Brawer, *Origins: The Lives and Worlds of Modern Cosmologists*, pp. 489-93.

Class 26: Cosmology and the Christocentric Universe

Kereszty, *Jesus Christ: Fundamentals of Christology*, pp. 443-65.

Final Exam (Date to be announced)