HISTORY 104B

Reading the Heavens:
The Coevolution of Christian and Scientific Understandings of the Universe in the West

Revision 7 – 3/9/22

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Semester and Year: TBD

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Description:

This course examines the co-evolution of western science and Christian theology from the vantage point of intellectual history. This co-evolution begins with an ancient Hellenic conceptual framework uniquely central to both science and Christian theology: The relation of "concrete physical" and "abstract conceptual" as a **duality** of *mutually implicative* categories of reality. We will study the historical origins of this *dipolar* categorical framework in 6th century Milesian observational natural philosophy as a shift away from the previous *bipolar* paradigm of "natural" vs. "supernatural"—a **dualism** of *mutually exclusive* categories of reality.

Part of our work will be to compare and contrast the ways in which diverse religious traditions have historically formalized phenomena via each of these two paradigms. To that end, we will emphasize the importance of contextual diversity as a central thesis throughout the course, both in terms of gender perspective and non-western religious and cultural frameworks. Among the non-Christian traditions we will study are: Advaita (*non-dualistic*) and Dvaita (*dualistic*) Hinduism, Mahāyāna Buddhism, and Islam.

These comparisons and contrasts will contextualize our study of the historical evolution of the new "concrete physical/abstract-conceptual" paradigm and its historical centrality to both science and Christianity, from (1) the paradigm's origins in Hellenic natural philosophy and early Christian theology in Late Antiquity, through (2) its refinement by way of Islamic modifications of Aristotelian natural philosophy in medieval natural philosophy and scholastic Christian theology, to (3) early modern empirical science and its contrasting relation to Catholic, Orthodox, and Protestant Christian theologies, and finally, (4) to today's fundamental physical theories of quantum mechanics and relativistic cosmology.

From the vantage point of intellectual history, we will see that our current fundamental theories in physics and cosmology entail a profound rehabilitation of the ancient Hellenic definition of "abstract conceptual object"—one which, for many Christian theological traditions, entails new routes of exploration toward a constructive relation of science and religion more broadly, inclusive of a diversity of religious traditions.

Expected Learning Outcomes (ELOs):

- **ELO #1:** Students will achieve the ability to **describe and discuss** the intellectual history of science and Christian theology by **analyzing** their co-evolution from the ancient period, through early modernity, to the present day.
- **ELO #2:** Students will achieve the ability to **identify** and **differentiate** the methods by which fundamental concepts are validated in both science and systematic Christian theology—from *observational experience*, to *logical formalization* originating in the Hellenic period, to the *hypothetico-deductive "scientific method"* developed in early modernity.
- **ELO #3:** Students will achieve the ability to **explain** and **illustrate** the formal deductive and inductive logical framework introduced by Aristotle and **assess** its fundamental role in the historical development of mathematics, astronomy, and physics, alongside the historical development of systematic Christian theology.
- **ELO #4:** Students will achieve the ability to **recognize** foundational scientific questions that remain unsettled today, and **create** scientific framings of their own foundational questions, tracing the historical roots of these questions in ancient science and Christian theology.
- **ELO #5:** Students will achieve the ability to critically **evaluate** and **apply** literary and material evidence in studying the intellectual history of science and Christian theology and their co-evolution.

GE Area B5 Expected Learning Outcomes:

Students will be able to do one or more of the following:

- **ELO #B5-1:** Cite critical observations, underlying assumptions and limitations to explain and apply important ideas and models in the physical sciences and mathematics.
- **ELO #B5-2:** Recognize evidence-based conclusions and form reasoned opinions about science-related matters of personal, public and ethical concern.
- **ELO #B5-3:** Discuss historical or philosophical perspectives pertaining to the practice of science and mathematics.

Course Requirements

This is a **traditional lecture and discussion course**, therefore **attendance is mandatory**. Careful attention to the readings and class participation will be crucial for a lively course.

To access this course on Canvas you will need access to the Internet and a supported Web browser (Chrome, Firefox, Safari). To ensure that you are using a supported browser and have required plug-ins, please visit the "Which browsers does Canvas support (Links to an external site.)" website.

You will use your Saclink account to login to the course from your My Sac State (Links to an external site.) account and click on the Canvas button or login directly through the Canvas Login Page.

Examinations and Papers:

There will be two examinations--one take-home mid-term and one final. There will be one 6-8 page paper. All due dates are given in the reading and lecture schedule below. Late submissions are not accepted.

Attendance*:*

It is impossible to succeed in this course if you miss the lectures. To encourage attendance, students are permitted only 2 unexcused absences for the semester. Class participation is weighted at 10% of your final grade. 3 or more unexcused absences results in a 0%. The only exception to this rule is if you are severely ill (e.g., diagnosed with symptomatic COVID19) or are experiencing some similar long term emergency.

Required Texts and Materials:

All required readings are included in the **HIST 104B Course Pack**. Readings for each week are specified in the Lecture Schedule below.

Grading

Class Participation:	10%	3 or more absences results in 0%	ELOs: 1-4, B5-3
Weekly Reading Quizzes:	10%	Due prior to Class Meeting 1 each week	ELOs: 1-2, B5-2
Midterm Exam:	25%	Due TBA by 5 pm	ELOs: 1,4,5, B5-1, B5-3
Essay:	25%	Due TBA by 5 pm	ELOs: 1,2,4,5, B5-1,2,3
Final Exam:	30%	Due TBA by 5 pm	ELOs: 1-3, B5-1, B5-3

A-level work: All students begin this course with an A. In order to maintain it, all written work (paper, mid-term, and final exams) must exhibit complete, well-argued responses to the questions asked. This requires reference to the readings and lectures. For this reason, on-time attendance of all lectures and completion of all scheduled readings are requirements for success in this course.

A	93-100%	Excellent work
A-	90-92%	Nearly excellent work
B+	87-89%	Very good work
B	83-86%	Good work
B-	80-82%	Mostly good work
C+	77-79%	Above average work

C	73-76%	Average work
C-	70-72%	Mostly average work
D+	67-69%	Below average work
D	60-66%	Poor work
F	0-59%	Failing Work

Academic Standards: All sources in papers must be cited and given appropriate credit. The author of any information from the Internet must be given credit; using such information without indicating the source constitutes plagiarism, as it would with print publications. Students are allowed to discuss lectures and even assignments with each other, but they must do their own work. Students are required to read the University policy on academic honesty, which can be found **here**: https://www.csus.edu/umanual/student/stu-100.htm

Services to Students with Disability (SSWD): Sacramento State is committed to ensuring an accessible learning environment where course or instructional content are usable by all students and faculty. If you believe that you require disability-related academic adjustments for this class, please immediately contact Services for Students with Disabilities (SSWD) to discuss eligibility. A current accommodation letter from SSWD is required before any modifications, above and beyond what is otherwise available for all other students in this class will be provided."

Student Health and Counseling Services: Your physical and mental health are important to your success as a college student. Student Health and Counseling Services (SHCS) in The WELL offers medical, counseling, and wellness services to help you get and stay healthy during your time at Sac State. SHCS offers: Primary Care medical services, including sexual and reproductive healthcare, transgender care, and immunizations; urgent care for acute illness, injuries, and urgent counseling needs; pharmacy for prescriptions and over-the-counter products; mental health counseling, including individual sessions, group counseling, support groups, mindfulness training, and peer counseling; athletic training for sports injury rehabilitation; wellness services, including nutrition counseling, peer led health education and wellness workshops, and free safer sex supplies; violence and sexual assault support services. Most services are covered by the Health Services fee and available at no additional cost.

Crisis Assistance & Resource Education Support (CARES): If you are experiencing challenges with food, housing, financial or other unique circumstances that are impacting your education, help is just a phone call or email away. The CARES office provides case management support for any enrolled student.

Reading and Lecture Schedule:

PART I: Hellenic And Hellenistic Natural Philosophy, Astronomy, And Mathematics

In Weeks 1-5, we will begin our historical exploration of the fundamental conceptual foundations shared by both science and Christian theology throughout their co-evolution from the Hellenistic period to the present day. These foundations are all anchored in a unique conceptual innovation introduced earlier in the natural philosophy of the Hellenic period: The abandonment of the *dualism* of "natural vs. supernatural" as *mutually exclusive* categories of a *bifurcated* reality, and the replacement of this dualism with a *duality* of "concrete" and "abstract" as *mutually implicative* categories of a *unified* reality.

Week 1: Introduction: History in Science and Christianity
Hellenic Background - The Milesians, the Pythagoreans, Empedocles, Anaxagoras, and the Atomists (6th – 5th centuries B.C.E.)

We begin with an examination of **the nature of historical inquiry** and how it can help us understand the co-evolution of the conceptual frameworks foundational to both science and Christianity. **Consider the increasing recognition of the importance of history to the enterprise of science: From biology to cosmology, Nature itself is understood today as 'fundamentally historical' in evolutionary terms; and likewise science itself is understood today as a historical, culturally conditioned enterprise.**

Some sociohistorical context: Why Miletus? The nature of the Milesian philosophers' openness to criticism and debate about the *constitution of nature*, in many way, analogous to the increasing centrality of political criticism and debate among citizens of the city-states as they sought to decide the best form of *political constitution*. For example, what are the similarities between the arguments of Thales and Solon? We will explore these and other sociohistorical questions this week.

We trace the origins of modern science to the **Hellenic period**, and the representative thinkers listed in this week's title above, for two reasons: 1) their shift from the "natural/supernatural" paradigm to the "concrete/abstract" paradigm; 2) their method of *reductive reasoning* by which complex concrete objects (and their complex behaviors) are explained in terms of simpler abstract objects (and object forces).

- Concrete objects: *Physical objects* experienced via the senses: 'what *appears* to be.'

  Examples: rocks, soil, trees, oceans, steam, stars

- Abstract objects: *Conceptual objects* experienced via the mind: 'what is *reasoned* to be.'

  Examples: numbers (for the Pythagoreans); earth, air, fire, water (for the Milesians); atoms and void (for the Atomists); *apeiron* (Anaximander); object forces imperceptible directly, but indirectly observable via changes in physical objects (e.g., motion, growth, decay)—e.g. rarefaction & condensation (Anaximenes), attraction & repulsion (Empedocles)

This Hellenic innovation of *reductive relations* of concrete (physical) and abstract (conceptual) objects remains central to modern science. However, in the case of modern science, schemes of

reductive relations (e.g., scientific theories) are *validated via experiments capable of falsifying the schemes* (and their mathematical formalizations). This addition of experimentation is the signature innovation of the Scientific Revolution, which we will cover in Part III of the course.

Prior to this innovation, the abstract concepts and schemes of reductive relations typical of ancient and medieval science were thought to be capable of ***validation via consistent experience alone*—e.g., repeatable observation, consistent measurement—*if* these could be formalized logically or, ultimately, mathematically.** Even *purely speculative* schemes of relation were considered valuable if they could be formalized logically**.** Despite this key distinction in the historical evolution of the term "science" it must be emphasized that throughout this history, from the Hellenic period to the present day, the term "science" has consistently subsumed a number of common definitive concepts: *philosophia* (love of wisdom), *episteme* (knowledge), *theoria* (formal rational speculation), and *peri physeos historia* (inquiry into nature). Thus, so that we can remain careful in our use of the word "science" throughout the course, we will use the following definitions:

Modern Science:	Mathematically formalized, *empirical* natural philosophy (17th century to present)
Ancient & Medieval Science:	Logically formalized, *observational* natural philosophy (6th century BCE – 16th century)

Note: In both the ancient and medieval periods, 'observational natural philosophy' also subsumed the practice of constructing observationally informed but *speculative* conceptual frameworks—so long as these could be formalized coherently (i.e., logically) . The logical formalizations of ancient and medieval science often included mathematical formalizations, but were never fully *reducible* to these as is the case in modern physics, our most fundamental science. Further, the formalization of logic itself would not occur until Aristotle. Prior to this, we can simply define a "logical" conceptual framework as one that is coherent, consistent, and free from internal contradiction.

Week 1 Readings: Barbour, "History in Science and Religion" from *Religion and Science: Historical and Contemporary Issues*, 137-50

Lloyd, *Early Greek Science*, 1-49

Week 2: Plato and Hellenic Astronomy and Mathematics (4th century B.C.E.)

Some sociohistorical context: How did the first institutions of philosophy (Plato's Academy and Aristotle's Lyceum) contribute to the decline of sophistry in Greek *koinos nous* (common sense)? Why did Athens grow to become such an intellectual center in Greece. Why did an initial emphasis on moral and political philosophy in Athens expand to include natural philosophy ('science')? We will explore these and other sociohistorical questions this week.

This week we will explore Plato's disunification of abstract conceptual objects and concrete physical (sensory) objects, and the elevation of the former above the latter. We will also explore how this Platonic worldview informed the work of the 4th century mathematicians and astronomers **Eudoxus** and **Callippus**, who formalized abstract mathematical structures as "real" objects in order to explain problematic astronomical observations. For Plato, abstract conceptual objects are the only real objects, and that reality is separate (and above) the realm of sensory experiences of physical objects. Our understanding of the latter depends upon our knowledge of the former. For example, the nature of our sensory experiences of "earth," "air," "fire," and "water" depend upon our knowledge of these as pure conceptual (mathematical) objects.

LOOKING AHEAD: *In the history of science*, we will revisit this idea when we explore the advent of field theory and quantum theory in Part III of the course. Fields, as we will see, are purely abstract, mathematical structures that not only *model* the dynamics of physical structures, but are understood to *produce concrete physical effects* on these structures. Likewise, quantum wavefunctions are purely abstract mathematical objects that produce concrete, measurable physical effects. M.I.T. physicist Max Tegmark has gone so far as to argue, in his quasi-Platonic *Mathematical Universe Hypothesis*, that all of concrete physical reality is ultimately reducible to abstract mathematical objects and structures.

In the history of Christianity, we will revisit the Platonic worldview and its expansion into spiritual dimensions (Neoplatonism) via the works of **Plotinus**, **Porphyry**, and **Pseudo-Dionysius**. We will examine the influence of Plato and Neoplatonism on early Christian theology via the writings of **Origen**, **Clement of Alexandria**, and **Augustine of Hippo**.

Week 2 Readings: Lloyd, *Early Greek Science*, pp. 66-98
Selections from Book VI of *The Republic*
Selections from *Timaeus* (27e – 58c)

Week 3: Aristotle: The Formalization of Logic, and a Logically Formalized Physics and Cosmology (4th century B.C.E.)

This week we will explore the historical evolution of Aristotelian natural philosophy from its roots in his work with Plato as his student in the Academy. We will focus on the evolution of Aristotle's inductive and deductive conceptual framework, his formalization of logical relations, and the centrality of these achievements to the historical evolution of both modern science and Christian theology. We will also explore the historical evolution of Aristotle's school, the Lyceum, from primarily a teaching center (like the Academy) to a teaching and *research* center.

Some sociohistorical context: How did teaching become an important driver of Greek science? What were the economics of science in this period? How were the Athenian schools (Plato's Academy and Aristotle's Lyceum) funded? Teaching becomes more of a profession (students pay to attend lectures, or are asked to make contributions to the school maintenance). Teaching becomes a supplementary or even primary source of income not only for subjects like politics and rhetoric—but now, even for subjects like astronomy, physics, and biology. We will explore these and other sociohistorical questions this week.

In our study of Aristotle this week, we will give special focus to:

(1) Aristotle's reversal of Plato's separation of abstract conceptual objects and concrete physical objects, re-grounding these once again in a common reality;

(2) Aristotle's logically formalized cosmology;

(3) Aristotle's formalization of physical change (e.g., motion, growth, decay) as process of *initial actual* states giving rise to *intermediate potential* states which yield *novel actual* states—a speciation of reality into two fundamental categories: *actual* and *potential*;

(4) Aristotle's identification of the role of "first principles" in natural philosophy when formalized logically: **The Aristotelian axioms: the principle of non-contradiction, the law of the excluded middle, and the principle of identity**. These are "faith based" presuppositions of logic in that their truth cannot be "proven" (e.g., deduced or demonstrated logically) because their truth is *necessarily presupposed by* logical deduction and demonstration itself.

LOOKING AHEAD: *In the history of science*, we will revisit this idea in Part III of the course when we explore Francis Bacon's critique of the Aristotelian deductive method in science and his failed attempt to 'liberate' science from the presuppositions of logic and mathematics; and in contemporary physics, we will see the role of Aristotle's "faith based" logical presuppositions (the presupposed universality of the principles of identity, non-contradiction, and excluded middle) expressed in the presumed universality of physical laws. We will also see these logical axioms identified as explicit "functional" features of quantum mechanics, our most fundamental physical law. Aristotle's concept of actual and potential states as "equally real" is likewise rehabilitated in quantum mechanics—a rehabilitation first proposed by **Werner Heisenberg**, one of the founders of quantum theory.

In the history of Christianity, we will revisit Aristotelian logic and natural philosophy via the debates of **John Philoponus** and **Simplicius** on topics including the eternality of the world and Aristotle's division of the cosmos into 'celestial' and 'terrestrial.' In Part II of the course, we will also revisit Aristotelian natural philosophy and its incorporation into Christian theology via the work of **Thomas Aquinas**.

Week 3 Readings: Lloyd, *Early Greek Science*, pp. 99-124
Aristotle, Selections from *Prior Analytics*
Aristotle, Selections from *Posterior Analytics*

Week 4: From Hellenistic Mathematics and Astronomy to Ptolemy: The Evolution of Aristotle's Formalized Logical Cosmos to a Mathematized Cosmology (3rd century B.C.E. – 2nd century C.E.)

This week we will study the extension of Aristotle's formalized logic, with its axiomatic first principles, to the formalization of mathematics by **Euclid**. The reality of abstract objects, e.g., geometrical objects, is reinforced by defining their underlying mathematical structural rules. The correlation of concrete physical objects and abstract mathematical objects is exemplified in the

work **Archimedes**, who engineered physical structures in order to solve mathematical problems—his 'mechanical method.' This correlation of concrete and abstract is also exemplified via the work of **Eratosthenes** in his application of mathematics to geography. Finally, we will study this correlation of concrete and abstract in its broadest scope, cosmologically, via the astronomical models of **Aristarchus** (the first heliocentric model), and **Hipparchus** and **Apollonius** who formalized the eccentric and epicyclic structure of the geocentric model. We will then study how these models evolved into the more fully developed and refined mathematical cosmology of **Ptolemy** which would reign as the standard model for over 1000 years until empirically disconfirmed by Galileo over 1000 years later. The work of Ptolemy introduces another correlation of concrete physical and abstract conceptual reality: the correlation of astronomy and astrology.

Some sociohistorical context: To what extent were the natural sciences considered 'important' in Greek society in general? What is the connection between (a) the strong historical evidence that Greeks valued the 'practical' arts (agriculture, ship-building, mining, medicine) and (b) Plato's and Aristotle's arguments about the value of knowledge for its own sake? We will explore these and other sociohistorical questions this week.

Week 4 Readings: Lloyd, *Greek Science After Aristotle*, pp. 33-74; 113-135

Week 5: The Influence of Hellenic and Hellenistic Science on the Christian Theology of Late Antiquity (3rd - 6th centuries C.E.)

Some sociohistorical context: What was the status of natural philosophy in the Roman Empire during the 3rd – 6th centuries? This was a time when many new religions emerged to compete with traditional religions. Philosophical schools were strongly affected by this and formalized their own religions. The most notable example of this is Neoplatonism, founded by Plotinus (ca. 204-269/70).

Throughout the past four weeks in our study of Hellenic and Hellenistic science, we have explored the ways in which the logical and mathematical formalization of the abstract structures of reality were embraced as the key to understanding the concrete physical structures of our everyday, sensory world. This week, we will explore how this methodology—specifically, the philosophies of Plato and Aristotle—was likewise embraced in early Christian philosophical theology by way of the work of **Plotinus** and his Neoplatonist framework, and **Porphyry**, who further refined Neoplatonism by integrating the conceptual frameworks of both Plato and Aristotle.

With respect to the scientific implications: we will study the arguments of **John Philoponus**, a Christian Neoplatonist who rejected many aspects of this integration with Aristotle on scientific-logical grounds—among these, Philoponus argued:

(1) against the Aristotelian concept of a finite but eternal universe, since finite implies a beginning (i.e., a creation).

(2) against the Aristotelian bifurcation of the universe into two distinct realms, each with its own unique material elements and abstract principles of motion: the terrestrial (made of the elements earth, air, fire, water) and the celestial (made of aether, Aristotle's 'fifth element').

(3) that motions in air are due to abstract, impressed forces (the 'impetus') rather than interaction with the concrete medium of air itself, as Aristotle argued.

We will also study the counterarguments of **Simplicius**, a severe critic of Philoponus and a defender of the synthesis of the Platonic and Aristotelian frameworks.

With respect to the Christian theological implications: we will study the idea that logically formalized natural philosophy (science) could serve as a 'handmaid to theology'—i.e., aid in the comprehension of theologically revealed truths. We see this idea introduced very early with **Philo Judaeus** (ca. 25 BCE – 50 CE), and later embraced in the works of **Origen**, **Clement of Alexandria**, and **Augustine of Hippo**. Thus we see theological considerations of topics like the Platonic and Neoplatonic conception of the origin of the universe, the nature of the soul and its relation to the body (and the world-soul and its relation to the world), and the concrete and abstract nature of 'good' contrasted with the purely abstract nature of 'evil' as merely an absence of good, rather than an independent object with a concrete or abstract essence of its own.

With respect to analogs and contrasts in non-Western traditions: Beginning this week, and continuing next week, we will include in our studies two different Eastern philosophical and theological traditions—Hinduism and Buddhism—to explore reflections of the abstract-conceptual / concrete-physical duality and dualism we have been studying in ancient Hellenic philosophy and early Christianity up to this point.

For this week, we will look at the concept of Prajñāpāramitā (the 'perfection of wisdom') in Mahāyāna Buddhism, which began to flourish in 5th century India. Here we see a **strict repudiation of the dualism of abstract conceptual and concrete physical**. We will focus on the earliest known text defining this concept, the Aṣṭasāhasrikā Prajñāpāramitā Sūtra, which dates to at least 75 CE—one of the oldest extant Buddhist texts.

Week 5 Readings: Grant, 52-60
Clagett, *Greek Science in Antiquity*, "Ch. 10 – Science and Patristic Literature" (12 pgs.)
Hoffmann, "Simplicius's Polemics," in Richard Sorabji, ed., *Philoponus and the Rejection of Aristotelian Science*, pp. 72-80
Selections from Simplicius, *Against Philoponus on the Eternality of the World*
Karamanolis, "Early Christian Philosophers on Aristotle"
Van Riel, "Augustine's Plato"
Selections from Williams, Paul, *Mahayana Buddhism: The Doctrinal Foundations*, Routledge, 2008.

PART II: The Evolution of Medieval Science and Christianity: Efforts Toward A Logical Conceptual Framework Relating the Concrete and Abstract Objects of Experience

Week 6: Background: The Influence of Aristotelian Natural Philosophy and Logic on the Philosophical Christologies of *Arianism*, *Nestorianism*, and *Monophysitism* and the Early Christian and Islamic Translations of Aristotle (5th – 13th centuries)

Some sociohistorical context: Greek natural philosophy/science and medicine, especially Aristotle's natural philosophy, were disseminated eastward into Syria and Persia, largely via translations from Greek to Syriac, then Syriac and Greek into Arabic. Religious tensions and animosities were the central drivers of the eastward migration of Greek science and natural philosophy. In an effort to combat paganism, the Roman Emperor Justinian closed the Neoplatonic school in Athens in 529 AD, driving a number of its philosophers, including Simplicius, to relocate to Persia and continue their work under the aegis of the Persian king, Chosroes (Khosrow I). They would ultimately return to the Byzantine Empire under an agreement between Chosroes and Justinian (part of the Treaty of Eternal Peace in 532 AD) guaranteeing that they would not be forced to convert to Christianity. With this tension relieved, the major problem for the Byzantine Empire in terms of its philosophical-theological identity derived from two competing Christian sects, the Nestorians and the Monophysites and their competing philosophical interpretations of the concrete physical and abstract conceptual nature of the Trinity.

This week we will examine the competing logical frameworks of Neoplatonism and Aristotelianism by which early Christians attempted to define and coherently relate the concrete and abstract components of their theology—namely, the triune nature of God, Christ, and the Holy Spirit. Our work this week is divided into three parts:

FIRST: We will see how the Platonic, Aristotelian, and Neoplatonic relation of ***abstract objects*** **(e.g., numbers, souls)** and ***concrete objects*** (e.g., countable physical objects, bodies) we studied last week informed **competing philosophical Christologies**, including **Arianism**, **Nestorianism**, and **Monophysitism**.

SECOND: The early Christian translations of Aristotle that flowed from these debates, from Greek into Syriac, and from Greek and Syriac into Arabic, will be explored in the work of Nestorian Christian **Hunayn ibn Ishaq** (d. 873) and his school of Nestorian translators. We will then examine the final, post-Hunayn phase of Aristotelian translations in Baghdad between 900 and 1020 yielding Arabic versions of all of Aristotle's works on logic, natural philosophy, and metaphysics, as well as works falsely attributed to Aristotle, such as the *Theology of Aristotle*, and the *Book on Causes*—both being Neoplatonic works deriving from Plotinus and Proclus. This foreshadowed the fact that the **'Neoplatonized' Aristotle of Islamic thought**—*where abstract conceptual objects are fundamental to concrete physical objects*—would be radically different from the Aristotle of the Latin, Christian West, where abstract and concrete objects are mutually implicative. Despite this, the Muslim natural philosophers who grounded their work in this Neoplatonized Aristotle would make a major impact on medieval science. Foremost among these were **al-Kindi** (ca. 800-870), **al-Razi** (ca. 854-925), **al-Farabi** (d. 950), **ibn Sina** ('Avicenna' – 980-1037) and **ibn Rushd** ('Averroes' – 1126-1198).

THIRD: We will explore an analogous effort in Hinduism to depict the proper relationship between physical and conceptual objects. Our focus here will be the **Vedanta school of Hinduism**, and the contrast of the **Advaita** (8th century, non-dualistic) and **Dvaita** (13th century, dualistic) traditions of Vedanta. For example, central aspects of Advaita as systematized by medieval philosopher Śaṅkara, are analogous to Platonic and Neoplatonic Christian frameworks, in that abstract, absolute reality (Brahman) is not derivable via logical-observational analysis of the concrete physical world. In contrast, Dvaita, as represented by its founder, Mādhva (1199-1278) is more analogous to the Aristotelian Christian framework; in the Dvaita tradition, for example, the existence of God is logically demonstrable, while God's nature requires faith-based revelation—concepts whose analogs

we will see in the Aristotelian-influenced Christian theology of St. Thomas Aquinas (1225-1274) and the Scholastic tradition of Roman Catholic Christianity.

LOOKING AHEAD: In the coming weeks we will see how, precisely, the work of these natural philosophers influenced the evolution of modern science (i.e., modern empirical natural philosophy) from medieval science (i.e., medieval logical-observational natural philosophy). We will also see how this work informed the relation of science and theology throughout this evolution, where all but al-Razi believed that the proper relation was the **assimilation of theological revealed truth into the framework of natural philosophy**. We will revisit this idea when we study the works of medieval Christian theologians, contrasting it with the approaches of **William of Auvergne**, **Albert Magnus**, and **Thomas Aquinas**, among others.

Week 6 Readings: Grant, 61-90
Selections from Peters, Francis (1968) *Aristotle and the Arabs: The Aristotelian Tradition in Islam*
Selections from Murty, Satchidananda K. (1959) *Revelation and Reason in Advaita Vedanta*, Waltair: Andhra University and New York: Columbia University Press.
Selections from Sharma, B. N. Krishnamurti (2008) *A History of the Dvaita School of Vedānta and Its Literature*, Motilal Banarsidass; 3rd edition

Week 7: The Formalized Integration and Evolution of Natural Philosophy and Christian Theology in the Medieval University (12th – 13th centuries)

This week we will study the origin of the medieval university system and its curricular strategy of *using natural philosophy and logic as the basis of all learning*—i.e., learning across its four faculties: arts, medicine, law, and theology. The natural philosophy studied in medieval universities was primarily based on the works of Aristotle translated from Arabic and Greek into Latin. As an example of early university integration of Aristotelian natural philosophy and Christian theology, we will explore the work of **William of Auvergne** (ca. 1180-1249) at the University of Paris—specifically, his work *De universo* (*On the Universe*) which addresses Christian theological concepts by way of natural philosophy. We will also study the **Catholic Church's initial bans on the teaching of Aristotelian natural philosophy at the University of Paris in 1210 and 1215, their reversal by Pope Gregory IX in 1231, the subsequent ban of 1277 and *its* eventual reversal.**

Some sociohistorical context: Through the 11th and 12th centuries, Europe would become increasingly urbanized. That, combined with the emergence of the university as a unique and vital institution, contributed significantly to the emergence of 'intellectual life' as an integral component of privileged society. The universities established during this period have a continuous history with their sister institutions of today, and their development is anchored in this period, beginning with the cathedral schools and their congregations of teachers and students in cities such as Paris, Oxford, and Bologna where the first 3 universities were established. As these cathedral schools evolved to become universities, they attracted teachers and students throughout Western Europe. *Students and teachers were usually foreigners in the cities where they taught and studied*—and therefore lacking the rights and privileges granted to citizens of that community. To overcome this

obstacle to stability, schools 'incorporated' themselves--i.e., as a corporation in the modern sense, an entity with specific legal rights (*universitas* is the Latin word for corporation.) Incorporation was a practice common among different craft and merchant guilds, now extended to include 'intellectual guilds' as well!

Week 7 Readings: Grant, 146-155

Midterm Exam Prompt Posted (exam due Week 9)

Week 8: The Relation of Natural Philosophy and Theology to Other Medieval 'Sciences' (12th – 13th centuries)

This week we will study the ways in which different medieval 'sciences'—i.e., **logically structured categories of inquiry, each containing its own scheme of relations among concrete and abstract objects**—were classified and organized relative to one another. 'Natural philosophy' was but one of these sciences; others were mathematical (arithmetic, geometry, astronomy), others practical (e.g., medicine). For many medieval scholars, theology as a logically structured framework also counted as a 'science'; for others, it was its own higher category, a combination of ***scientia* (knowledge) concerning temporal, contingent concrete objects** and ***sapentia* (wisdom) concerning eternal, ultimate abstract objects**. Thus the classification and organization of the medieval sciences was a complex enterprise, one that drew heavily from the earlier 10th century masterwork of **al Farabi**, *De scientiis* (*On the Sciences*) translated and augmented by **Dominicus Gundissalinus** (fl. 1140). In particular, we will study the placement of mathematics in the classification of the sciences, and those particular sciences that were deemed 'fundamentally' mathematical (e.g., optics, weights, astronomy, astrology). We will study alternative classifications proposed in the 13th century by **Robert Kilwardby**, **Roger Bacon**, **Albert Magnus**, and **Thomas Aquinas**.

LOOKING AHEAD: The medieval idea that mathematical reality should be studied via its own separate 'sciences' has its roots in the idea that **abstract mathematical objects and structures are as 'real' as concrete physical objects**. This idea was first introduced in Week 2 in our study of Plato and 4th century Hellenic mathematics. In the coming weeks as we move ahead to the early modern period and the Scientific Revolution, we will see the abstract objects and structures of mathematics 'folded into' the enterprise of natural philosophy, redefined as abstract *concepts* generated by the mind, rather than abstract *objects* of nature. Finally, as we move to 20th century physics and the transition from the early modern *mechanical framework* of physics to the modern *field framework and quantum mechanics*, we will see a fascinating rehabilitation of the ancient Hellenic and medieval concept of 'real' abstract mathematical objects and structures. The fields of modern physics are purely abstract, mathematical structures that not only *model* the dynamics of physical structures, but are understood to *produce physical effects* on these structures. Likewise, quantum wavefunctions are purely mathematical objects that produce measurable physical effects.

Week 8 Readings: Grant, 155-170
van den Brink, "How Theology Stopped Being *Regina Scientiarum*—and How Its Story Continues"

Week 9: The Role of Speculative Theories in Medieval Science and Christian Theology: The Occult Sciences, Natural Magic, and the Possibility of Other Worlds (13^{th} – 14^{th} centuries)

This week we will explore the medieval scientific redefinition of the term 'magic,' which was conventionally understood by the Church as the knowledge and practice of invoking supernatural entities (demons) to produce physical effects in the natural world. We will see medieval scholars of scientific natural philosophy and scholars of Christian theology (i.e., 'scholastic' theology) like **Giambattista della Porta**, **Nicole Oresme**, and **Thomas Aquinas** refine the concept of 'magic' by defining it not via the categories of '*natural* reality' and '*supernatural* reality' but instead by the categories of *concrete* and *abstract* objects within a unified reality. In this way, the theological concept of God, angels, and demons acting in the world could be separated from the scientific concept of *consistent* phenomena that exceeded the logical framework of Aristotelian physics—e.g., the way a magnet attracts iron—were attributed to as yet unformalized 'occult' (literally 'hidden') abstract principles of force originating from abstract objects. The medieval science of astrology is another example of 'natural magic' in this regard. While it was possible to formulate logically structured principles by which such hidden forces operated, these principles were purely speculative, which medieval scientists and theologians fully recognized, terming it an activity of *secundum imaginationem* ('according to the imagination') where hypotheses could be guided by logical analysis, but not proven observationally. Examples include these questions:

(1) Whether there is a moment of rest between the end of an upward motion and its decent

(2) Whether the acceleration of falling bodies was due to the concept of 'impetus' (a question that would be central to the work of Galileo as we will see)

(3) Whether the earth is at rest in the center of the universe

(4) Whether the earth has a rotational motion at the center of the universe

(5) Whether the earth moves rectilinearly

As an extreme example, medieval scientists like **John Buridan** and **Nicole Oresme** even proposed the **possibility of multiple universes**.

LOOKING AHEAD: As we will see in Part III of the course, in the case of modern science, schemes of reductive relations (e.g., scientific theories) are validated via experiments capable of falsifying the schemes (and their mathematical formalizations). This is the key distinction between a 'scientific theory' and a 'speculative theory.' A speculative theory might very well be formalizable logically and mathematically, and might be consistent with certain observations; **but if it is incapable of falsification via experiment, it is cannot properly be considered a 'scientific' theory**. Thus, while modern physics has its own 'multiverse' hypotheses, since they cannot be validated experimentally (which, ironically, is a *definitive feature* of most multiverse hypotheses in modern physics), these are not considered 'scientific theories' but rather modern examples of the medieval process of *secundum imaginationem*.

Week 9 Readings: Grant, 170-182; 202-205; 225-234

Selections from Shumaker, *The Occult Sciences in the Renaissance: A Study in Intellectual Patterns* (UC Berkeley Press, 1972), 108-113

Selections from Murdoch, "The Analytic Character of Late Medieval Learning: Natural Philosophy Without Nature," in Lawrence D. Roberts, ed., *Approaches to Nature in the Middle Ages* (Center for Medieval & Early Renaissance Studies, 1982).

Week 10: The Evolution of the Relationship between Science and Christian Theology Thus Far (13th – 14th centuries)

Some sociohistorical context: While the early centuries of Christianity were significant in shaping the relations between natural philosophy and Christian theology in the Middle Ages, the development of these relations in the 12th and 13th centuries was crucial in establishing the basic framework by which natural philosophy (science) and Christian theology would evolve into modernity. When Christianity first emerged within the Roman Empire, pagan culture and literature were already centuries old. Because Christianity was disseminated rather slowly (not until 392 did it become the state religion of Rome, almost 4 centuries after its origin) Christians had centuries to adjust to pagan philosophy and literature and to consider what role these might play in their religion. Two competing approaches to this would emerge in these early centuries of Christianity: (1) that pagan science and philosophy were at best useless to Christian theology, and at worst, harmful; (2) that Greek philosophy was inherently compatible with Christian theology and even more, capable of providing important insights into Christian theology. By the 12th and 13th centuries, it is this latter approach that would prevail.

This week, our work is divided into two parts:

FIRST: We will review and explore in greater detail the evolution of the relationship between natural philosophy and Christian theology we have studied thus far in the course, revisiting certain topics in greater detail. Among these:

(1) Which aspects of Aristotelian natural philosophy were found most problematic to Christian theology. We will revisit (from Week 7) the Catholic Church's initial bans on the teaching of Aristotelian natural philosophy at the University of Paris in 1210 and 1215, their reversal by Pope Gregory IX in 1231, the subsequent ban of 1277 and its eventual reversal.

(2) The interdisciplinary relations between Aristotelian natural philosophy and Christian theology

(3) The role of God in medieval natural philosophy

(4) A cross-section of representative views on the relationship between natural philosophy and Christian theology:

- Latin, Western (Roman Catholic) Perspective: **Albertus Magnus**, **Thomas Aquinas**, and **John Buridan**

- Byzantine, Eastern (Orthodox) Perspective: The debate between **Barlaam of Calabria** and **Gregory Palamas** re: Hesychasm and natural philosophical theology

(5) The ways in which natural philosophy transformed medieval Christian theology into an analytic discipline grounded heavily in logic, linking the axiomatic, 'faith based' first principles of the logic and natural philosophy to the faith based first principles of theology.

SECOND: In preparation for our study of the rise of the mechanical worldview in the 16th century and the fundamental driver of this worldview, the innovation of the scientific method, we must first examine the fact that this worldview's dominant perspectives, inherited from medieval natural philosophy and theology, were those of men. **Why is this gender disparity important?**

For the past four centuries, empirical science has been typically misunderstood as 'purely objective' because it was thought to deal only with objective, quantifiable facts as the ultimate arbiter of subjective, qualifiable opinions (this is a duality we first saw in Plato in Week 2). Today, by contrast, it is widely recognized that no scientific theory is 'value free'—that subjective perspectives heavily influence the nature of our theories and the data these theories deem significant and insignificant.

Likewise, Christian theological concepts informed by Platonic and Aristotelian philosophical frameworks, such as Thomas Aquinas's cosmological argument for the existence of God (Week 8), were thought to entail 'purely objective,' 'value-free' deductive logical relations. But every scheme of deduction is a scheme that relates *dependencies*; the less fundamental category is dependent upon and defined by the more fundamental category. The relation is always governed by the latter. It is not difficult to see how this logicocentric view of nature as an **axiological framework of dependencies** was reflected in the socio-political structures dominating the periods we have been studying.

It is reasonable to argue, then, that if empirical natural philosophy is to progress to its fullest potential, and if philosophical theology is to do the same, they should aim to include the *broadest possible scope of perspectives*—especially those that have been historically and uncritically relegated to lower positions on this axiological framework.

History and Philosophy of Science Professor **Donna Haraway** writes:

> Do feminists have anything distinctive to say about the natural sciences? …Is there a specifically feminist theory of knowledge growing today which is analogous in its implications to theories which are the heritage of Greek science and of the Scientific Revolution of the seventeenth century? Would a feminist epistemology informing scientific enquiry be a family member to existing theories of representation and philosophical realism? Or should feminists adopt a radical form of epistemology that denies the possibility of access to a real world and an objective standpoint? Would feminist standards of knowledge genuinely end the dilemma of the cleavage between subject and object or between non-invasive knowing and prediction and control? Does feminism offer insight into the connections between science and humanism? Do feminists have anything new to say about the vexed relations of knowledge and power? Would feminist authority and the power to name give the world a new identity, a new story?

As a propaedeutic for our transition to the age of modern empirical science and its relation to contemporary Christian theology in Part III of the course, we will retrospectively explore Haraway's thesis as it applies to the history we have covered thus far. With the insights we

discover, we will then equip ourselves for the journey ahead into the modern scientific age, applying these insights as we go.

Week 10 Readings: Grant, 239-273

Selections from Meyendorff, *Byzantine Theology: Historical Trends and Doctrinal Themes*, pp. 128-136

Haraway, Donna. "In the Beginning Was the Word: The Genesis of Biological Theory" in Simians, Cyborgs, and Women: The Reinvention of Nature (1991) 71-80.

PART III: The Evolution of Modern Science and Christianity: Efforts Toward A Logical and Empirical Conceptual Framework Relating the Concrete and Abstract Objects of Experience

Week 11: The Evolution of Medieval Natural Philosophy in the 16th and 17th Centuries

This week we will explore the two primary evolutionary shifts in ideas that drove the transformation of medieval science to what we identify today as "modern science"--a transformation of:

medieval observational, speculative-deductive natural philosophy

to

modern empirical, hypothetico-deductive natural philosophy

The first evolutionary shift in ideas was the **critical reassessment Aristotelian deductive logic as an instrument that could universally demonstrate the truth of abstract concepts and their relations to concrete phenomena**. This reassessment was initially inspired by new observations of celestial phenomena. For example:

(1) **Tycho Brahe**'s observation of a new star in the constellation of Cassiopeia, in violation of Aristotelian cosmology, which held that the realm of the fixed stars was perfect and therefore unchanging;

(2) Tycho's observation of the Great Comet of 1577, revealing it was not a sublunar object thus another violation of Aristotelian deductive cosmology;

(3) **Kepler**'s discovery of the elliptical orbit of Mars (1609) in his analysis of detailed observational data sets compiled by Tycho, yet another violation of Aristotelian cosmology (1609) and supportive of the **Copernican heliocentric cosmological model**.

(4) **Galileo**'s telescopic discoveries of lunar mountains and craters (celestial 'imperfections'), Jupiter's moons, and the phases of Venus (1610). Crucially, the latter was not only additional observational evidence in support of the Copernican heliocentric cosmological model over the

Ptolemaic model; it constituted the first *empirical* evidence for the validity of the Copernican model because while this model predicted the observed phases, the Ptolemaic model did not.

The second evolutionary shift in ideas was the **advent of experimentation** as a way of yielding additional **concrete**, observational evidence that could be used to formulate and validate candidate theories concerning **abstract** objects by disproving competing theories. Galileo's experiments on the nature of uniform and accelerated motion and parabolic trajectories are among the key examples we will examine.

Some sociohistorical context: By the 17th century, Western Europe had undergone a great transformation when compared to the centuries immediately preceding. Beginning with Gutenburg's invention of the printing press around 1450, followed by Columbus's voyage to America in 1492, and in the 17th century, the inventions of the microscope and telescope, the world described by Aristotle's natural philosophy had largely vanished. At the same time, the Protestant Reformation would likewise directly challenge the socio-political culture in which Aristotelian natural philosophy had flourished.

Week 11 Readings: Grant, 274-289

Galileo, *Excerpts from Discoveries and Opinions of Galileo, Including: The Starry Messenger (1610); Letters on Sunspots (1613); Letter to the Grand Duchess Christina (1615); and Excerpts from The Assayer (1623).*

Essay Prompt Posted (due Week 14)

Week 12: The Rise of the Mathematical-Mechanical Worldview (16th – 17th centuries)

This week we will study **Francis Bacon**'s concept of an Aristotle-free, non-deductive, 'purely data driven' inductive scientific method—one that is not, therefore, grounded in mathematics. As we saw last week, empirical natural philosophy is necessarily deductive and mathematical, which is what allows one to formulate hypotheses that generate quantifiable predictions that can, in turn, be formalized mathematically. Bacon's idea of abstract objects as generalized inductions from specific concrete observations was not the model that would be employed by the actual empirical scientists of the 16th and 17th centuries—exemplified most importantly via the work of Galileo and **Isaac Newton**, which we will focus on this week.

We will continue our discussion of Galileo's experiments on uniform and accelerated motion and parabolic trajectories, and the generalization of his conceptual framework by Newton, who would introduce a fully mathematically formalized cosmic structure that would displace the Aristotelian paradigm—Newton's *Mathematical Principles of Natural Philosophy*.

Week 12 Readings: Grant, 307-316

Barbour, *Religion and Science: Historical and Contemporary Issues*, pp. 17-32

Boyle, "Of the Excellency and Grounds of the Corpuscular or Mechanical Philosophy" (1674)

Bacon, Excerpts from the *New Organon*

Week 13: Empirical Science and Christian Theology in the 17th – 19th Centuries

This week we will study the impact of the new empirical, mathematical-mechanical worldview on Christian theology in terms of 4 competing approaches to its proper relation to science evinced by the intellectual history of this period. These 4 approaches are: *independence, dialogue, integration*, and *conflict*.

Independence:

Because the abstract (mathematical) objects of the mathematical-mechanical worldview are essentially assimilated into the world of concrete physical objects, one popular approach to the relation of theological truth and scientific truth was to separate them—i.e., the Book of God and the Book of Nature—each dealing with fundamentally different categories of knowledge. This was the preferred approach of **Galileo** and **Bacon**, among others.

*Integration***:**

An approach favored by scientists including **Robert Boyle** was that of **Natural Theology**, wherein the existence and attributes of God could be induced and abduced via the evidence of nature and its empirical formalizations. The concept of **'intelligent design'** is one example that derives from this approach favored by Boyle. (Ultimately, with the advent of modern evolutionary biology originating in **Darwin's theory of natural selection**, the Catholic Church as well as the majority of Protestant traditions would concede the **scientific *invalidity* of intelligent design** and **the *validity* of evolution**, despite initial hostility to Darwin's work [see the 'Conflict' mode below]). The mode of integration entailed the notion that an understanding of God could be informed by an understanding of Nature because God was understood as revealed through the workings of Nature. Science was not 'antagonistic' to religion therefore, but rather an additional basis for faith.

Dialogue:

Still others, including Newton, advocated a view that seemed to entail **a third, more moderate approach—that the study of nature exemplified the essential goodness and grandeur of God, but *not* in a way that would *inform* scientific principles. Science and theology were both understood to entail limit questions unique to each framework, making a constructive, complementary relation possible in dialogue.** In exploring this approach we will look at his addition of the General Scholium to the second edition of the *Mathematical Principles of Natural Philosophy* (1713).

The 'dialogue' approach was also favored by many Orthodox Christian leaders, largely informed by the work of **Theophilus Korydaleus** (c. 1570-1646) who viewed theology and science as separate enterprises that could be positively related in dialogue via religious humanism.

Conflict:

The examples of **Galileo's advocacy of heliocentrism** and **Darwin's theory of natural selection** being **attacked by the institutional Catholic church** (reminiscent of the medieval bans on Aristotelian

natural philosophy in the 13th century, covered in Weeks 7 and 10) are emblematic of **the 'conflict' mode of relating science and Christianity**. We will study the history of both of these examples and their resolution by reversion back to the 'independence' and 'integration' modes of relating science and Christianity in Catholic, Orthodox, and mainline Protestant theologies. We will also discuss the contrasting, minority approach of **Biblical literalism** in non-mainline Protestant traditions, where the 'conflict' mode of relating science and Christianity is still embraced.

Week 13 Readings: Grant, 293-307

Barbour, *Religion and Science*, pp. 13-24

Nicolaidis, Excerpts from *Science and Eastern Orthodoxy*

Howell, Excerpts from *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science*

Martin, Joel, "Compatibility of Major U.S. Christian Denominations with Evolution," *Evolution: Education and Outreach* (2010) 3: 420-31

Week 14: The Decline of the Mathematical-Mechanical Worldview and the Rise of the Mathematical-Field and Quantum Theoretic Worldview: The Rehabilitation of the Reality of Abstract Objects (19th – 20th centuries)

This week we will briefly examine the fruits of the mechanical view of natural philosophy. Chief among these is the generalized idea that the dynamics of any moving body can be predicted, and its past dynamics retrodicted, as long as its current state and the forces acting upon it are known. Thus, all concrete phenomena can be explained by the action of concrete forces representing either attraction or repulsion, depending only on distance. Abstract mathematical objects and structures are understood as instruments of the mind that allow for the formalization of these general principles governing concrete phenomena.

In the 19th and 20th centuries, however, the mechanical worldview would fail to accommodate new observations in gravity and electromagnetism. As a result we will see an historic rehabilitation of an old idea from ancient and medieval science: the idea of a 'real' abstract mathematical object that has physical effects upon concrete physical objects. Modern physics will empirically demonstrate the reality of such abstract objects via two fundamental examples which together constitute the core of today's fundamental physics:

(1) the **field** (the field theory of electromagnetism formulated by Maxwell, and the field theory of gravity formulated by Einstein)

(2) the **wavefunction** and **potential physical states** in quantum mechanics—Heisenberg's advocation of the rehabilitation of Aristotle's *potentiae*, and Max Born's advocation of the rehabilitation of Anaximander's *apeiron.*

Crucially, both of these mathematical structures presuppose the reality of abstract logical structures and their presupposed, axiomatic 'first principles' we saw first introduced by Aristotle.

Week 14 Readings: Excerpts from Einstein & Infeld, *The Evolution of Physics*

Sigfried, *Science News*, Discussion of R. Kastner, S. Kauffman, M. Epperson, "Taking Heisenberg's Potentia Seriously" *International Journal of Quantum Foundations*, 4:2 (2018) 158-172

Week 15: Relating Modern Science and Christian Theology, and the Special Case of Fundamental Physics (20th – 21st centuries)

As we conclude our historical survey of the relation of the concrete and abstract features of reality as these have been formalized throughout the history of science and the history of Christianity, we return again to the four different categories by which science and Christian theology have been related (Introduced in Week 13). These categories were first proposed by physicist and professor of religion **Ian Barbour** in 1988: Conflict, Independence, Dialogue, and Integration.

For example, in Galileo and Bacon, we saw arguments for the Independence category; in Boyle's 'intelligent design' argument we saw an example of the Integration category; and in Newton, we saw an argument for the Dialogue category.

With respect to modern fundamental physics, we will discuss ways in which these three categories of relation might be applied, as well as the fourth category, 'conflict.' Generally, the conflict category presupposes the preliterate paradigm of "natural" vs. "supernatural" as *mutually exclusive* categories of a bifurcated reality—a dualism we saw abandoned by the Hellenic philosophers of the 6th century BCE. As we saw, that dualism was replaced with a duality of "concrete" and "abstract" as *mutually implicative* categories of a unified reality.

In Week 13, we studied the theological arguments for the 'conflict' mode of relation. This week we will examine a correlate scientific argument for, and against, the conflict mode via the **competing views of two eminent physicists**, one advocating the dualistic "natural" vs. "supernatural" paradigm and Conflict mode (**Lawrence Krauss**) and one advocating the "concrete" and "abstract" duality paradigm (**David Albert**). We will use our extensive work in the history of ideas throughout this semester to inform our assessments of their respective arguments.

Some sociohistorical context: One of the promises of the scientific revolution was to democratize ultimate questions. The **heteronomy** of the medieval period, wherein such questions could only be answered via the privileged **revealed truths** as disseminated by bishops and popes, was replaced with the promise of a fundamental **autonomy**, wherein ultimate questions could be answered with the **reasoned truths** of mathematics and empirical science, in which anyone privileged enough to learn to read and write might freely partake.

In the 21st century, however, there is a sense in which modern theoretical physics and mathematics have become so complex and abstract that they defy even rudimentary comprehension, let alone critical evaluation, by the broader population. Thus, the celebrity physicists of today in many ways play the same role as medieval bishops and popes when it comes to the ultimate questions. The truths of quantum mechanics and cosmology are *revealed* by these authorities, with no expectation that their audience can critically evaluate these revelations. For many, particularly those who are already inclined to believe that science lies beyond their capabilities, this does nothing but squelch any initial attraction to science, and even worse, inspires a proudly professed distrust of science—a sentiment that has become increasingly popular in recent years. This week, we will explore how this has contributed to the revitalization of the 'conflict' mode of relating science and religion in the 21st century.

Week 15 Readings: Barbour, *Religion and Science: Historical and Contemporary Issues*, pp. 77-106

David Albert. "On the Origin of Everything" - Review of A Universe from Nothing by Lawrence Krauss." *New York Times Sunday Book Review* (23 March 2012)

Ross Anderson. "Has Physics Made Philosophy and Religion Obsolete?" Interview of Lawrence Krauss. *The Atlantic Monthly* (23 April 2012)

Final Exam Prompt posted; due by 5 pm Friday of final exam week.