

# USNA 287A

## Perspectives on the Cosmos: From the Ancient Philosophers to Modern Science

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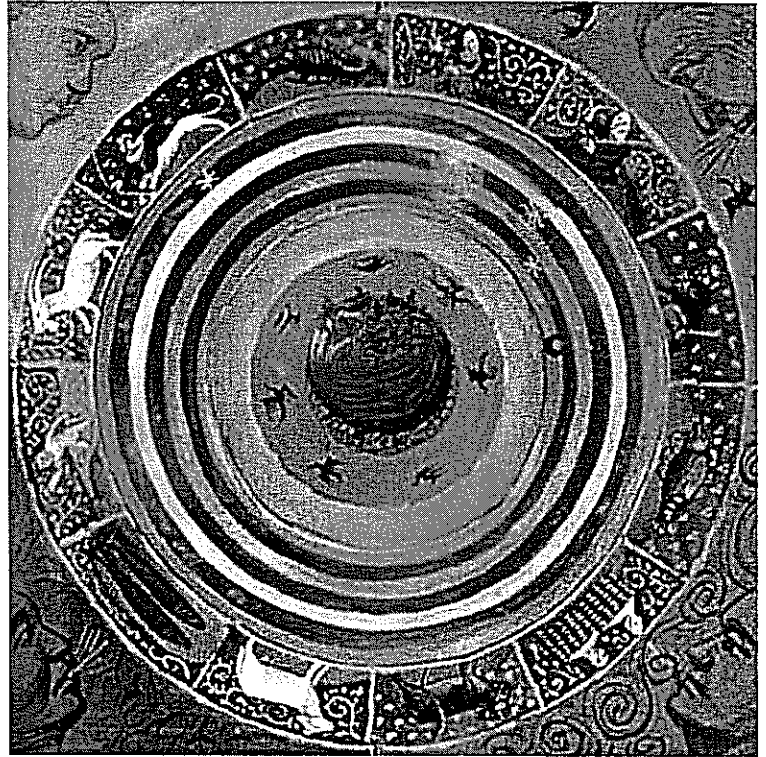
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### **Textbooks:**

Hetherington: *Cosmology: Historical, Literary, Philosophical, Religious, and Scientific Perspectives*

Stenudd: *Cosmos of the Ancients: The Greek Philosophers on Myth and Cosmology*



**Course web page:** <http://astroweb.case.edu/ssm/USNA287/>

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## Course Description

For all of recorded history, and presumably well before that, people have asked the Big Questions: What is the nature of the Universe? How big is it? How old? What is our place in it? For just as long, we've been making up the answers.

Cosmology is the subject that seeks to answer the big questions. As such, it is the nexus where science, philosophy, and religion collide. This course will explore the subject of cosmology, from both an historical and scientific perspective. In the process, we will examine the roles of faith, philosophy, and empirical knowledge. We will survey prevailing attitudes towards the nature of the world model over time, examining the impact of belief systems on the interpretation of physical evidence. Subjects to be covered include the first vital steps of the ancient philosophers, the tension between geocentric and heliocentric world models at the time of Copernicus and

Galileo, and the modern scientific world view.

Students will learn to critically examine evidence and its interpretation, and to appreciate the strengths and shortcomings of various forms of human knowledge. Emphasis will be placed on the importance and limitations of empirical evidence, and the dangers inherent in the interpretation of evidence within a preconceived framework. The student will gain an appreciation for the historical development of world models, culminating with modern cosmology. In the process comes a respect for the diverse paths to knowledge followed by humanity.

Course work will include weekly readings and written reading responses. An essential part of the seminar will be lively discussion of the topic at hand; as such, class participation will constitute a portion of the grade. Students will be responsible for researching and presenting an appropriate subject chosen in consultation with the instructor. The presentation will take the form of a term paper and an oral presentation to the class.

## **Course Structure**

Meetings: Tuesdays & Thursdays 11:30AM-12:45PM in Sears 552.

This is a three credit course consisting of twice weekly meetings. Typical meetings will be dominated by class discussion. The role of the Professor in this seminar is more tour guide than lecturer. The point is to guide and inform an intelligent discussion involving the entire class. Some time will be devoted to traditional instruction in both science and writing, as appropriate.

The discussion each week will be start from the assigned readings. As such, it is essential that each student complete the reading prior to the class in which it is to be discussed. To foster careful thought on the readings, a questions will be posed to spark a discussion thread on Blackboard prior to each class meeting.

The readings serve as the launching point for the discussion, which will focus on the topic at hand but need not be limited to it. Participation in the discussions is fundamental to this seminar. Consequently, attendance and preparedness is essential. We seek to ask the Big Questions, ponder the answers others have offered, and perhaps develop a few answers - or at least questions - of our own.

## **Work and Grades**

Please see <http://astroweb.case.edu/ssm/USNA287/work.html> for a description of the course work and grading policy.

This course seeks to inform your knowledge of cosmological issues, exercise your faculty for creative and philosophical thought, refine your powers of critical thinking, and develop your ability to communicate your thoughts in both written and spoken formats. One desires both questions and answers; how to recognize a compelling argument, and how to debunk a false one. The course work is structured to inform and exercise these abilities through reading, writing, and oral communication. The ability to express oneself clearly both in writing and orally is as important as thinking clearly in the first place.

## Late Policy

**DON'T BE.** We realize students have many demands on their time. Plan your time wisely. Do not procrastinate. Assignments are due at the time specified in the manner specified. If a paper is due in class, a hard copy is due at the beginning of class. Indeed, *two* hard copies are required: one for each instructor. *Late papers will suffer one full grade deduction per day.*

## Missed Classes

The first rule of missing class is: **DON'T.**

This is a discussion driven seminar. Class participation is essential. As with so many things in life, showing up is a prerequisite for participation.

The University recognizes only a few excuses for missing classes, including religious holidays, University-approved travel, and illness. Except in the case of emergencies, you will know beforehand if you will miss a scheduled class. Please inform me ahead of time and provide appropriate documentation.

If a class is missed because the university is closed for some dire reason (e.g., a blizzard), we will simply pick up where we left off at the next regular class time.

## Standards

The subject of this course has challenged the greatest intellects throughout history. We expect you to aspire to the highest standards of academic rigor and intellectual honesty. Plagiarism and other violations of academic integrity will not be tolerated.

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# USNA 287A Class Meetings

Date	Topic	Reading	Work Due
Aug. 26	Introduction The Scientific Method	Harrison: pp17-19; p. 157 & 523	-
Aug. 28	Gods & Creation myths Human and Geological timeline	Handout: <i>Egypt &amp; Babylon</i> Hetherington: Chapters 1, 2, 3 Harrison: Chapters 1, 25	-
Sep. 2	Theistic and Anthropic Principles	Hetherington: Chapters 1, 2, 3 Harrison: Chapters 1, 25	<u>Short paper due:</u> <u>Theistic and Anthropic</u> <u>Principles</u>
Sep. 4	<i>Planetarium Visit</i>	-	-
Sep. 9	The Ancient Philosophers	Stenudd: All  see also Hetherington: Chapters 4, 6; see also p. 69 & 177 Harrison: Chapter 2, 8 (beginnings: pp28-34, 147-152) Quick links: <u>Epicurus</u> , <u>Stoicism</u> from the <u>IEP</u>	-
Sep. 11	The Ancient Philosophers Aristotelean, Epicurean, & Stoic World Models	-	-
Sep. 16	Revolutions Ptolemy to Copernicus	Hetherington: Chapters 7, 8 Harrison: Chapter 2 <u>Explore Ptolemy, Copernicus,</u> <u>Brahe, Galileo, Kepler</u> Read Galileo: <u>Starry Messenger</u>	-

	<i>Making a Claim</i>	<u>Abbreviated Dialogue</u>   <u>Full Dialogue</u>	
Sep. 18	Kepler & Galileo <i>Supporting a Claim</i>	Hetherington: Chapters 12, 13 Historical sketches: <u>Kepler</u>   <u>Galileo</u>	-
Sep. 23	<i>Peer Review</i>	-	Distribute drafts to peers by 9pm Sep. 22
Sep. 25	The Clockwork Universe Newton, Descartes	Harrison: Chapters 3 & 4, esp. Bentley-Newton correspondence, pp60-61 Hetherington: Chapter 14	<u>Modest paper due: Geocentric &amp; Heliocentric Cosmologies</u>
Sep. 30	The Great Debate	Hetherington p. 321-327, Chapter 18	-
Oct. 2	An Expanding Reality Einstein & Hubble	Hetherington: Chapter 19 Harrison: Chapters 7, 8 & 14 especially pp. 147-154 and 275-285 See also this <u>AIP website</u>	-
Oct. 7	<i>Library resources</i>	-	-
Oct. 9	Model Universes	Harrison: Chapters 15, 16, 18 especially pp. 307-309 and 359-367	-
Oct. 14	The Hot Big Bang	Hetherington: Chapter 20 Harrison: Chapters 19, 20	-
Oct. 16	Inflation	Hetherington: Chapter 22 Harrison: Chapters 21, 22 <u>What is the Inflation Theory?</u> (very brief) <u>The Inflationary Universe</u> by Guth & Steinhardt (in <i>Scientific American</i> 1984) <u>The Inflation Debate</u> by Steinhardt (in <i>Scientific American</i> 2011, in which Steinhardt has second thoughts)	-

		Class Handout. See also <a href="#">Ned Wright's cosmology tutorial</a> , especially <a href="#">Flatness &amp; Horizon &amp; Inflation</a>	
Oct. 21	<i>Peer Review</i>	-	Distribute drafts to peers by 9pm Oct. 20
Oct. 23	<i>Writing &amp; Research Workshop</i>	-	<a href="#">Modest paper due: Cosmic Inflation</a>
Oct. 28	FALL BREAK	No class	-
Oct. 30	The Dark Side	Dark Matter: <a href="#">A brief primer</a>   <a href="#">A modest primer</a>   <a href="#">Physics Teacher article</a> Hetherington: Chapter 23	-
Nov. 4	The Dark Side Strikes Again	Other Perspectives: <a href="#">The Missing Universe</a> (Astronomy Magazine April 2014) <a href="#">Does dark matter exist?</a>   <a href="#">Dark matter is dead</a> <a href="#">The Case Against Cosmology</a>   <a href="#">Sociology of Modern Cosmology</a> <a href="#">Humans and Cosmology: Epicycles, Tenacious Beliefs and Test Particles in Motion</a>	Nov. 3 - 7: Individual meetings with Prof. McGaugh to discuss topic for final paper
Nov. 6	Multiverses	Hetherington: Chapter 28 Class Handout (Tegmark)	-
Nov. 11	Life in the Universe	Harrison: Chapter 26 <a href="#">Drake's Equation</a>	-
Nov. 13	<i>Presentation Instruction</i>	-	Annotated Bibliography
Nov. 18	Student Presentations	your talk	-
Nov. 20	Student Presentations	your talk	-

Nov. 25	Student Presentations	your talk	-
Nov. 27	THANKSGIVING	No class	-
Dec. 2	<i>Peer Review</i>	-	Distribute drafts to peers by 9pm Dec. 1
Dec. 4	No class	Individual meetings with Dr. Higgins	<u>Final paper</u> due via e- mail by midnight Friday Dec. 5 (last day of classes)

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## Course Work

### Group Discussions

Considerable class time will be devoted to discussion. We will pose specific questions to debate, and discuss some issues in small groups prior to wider class discussion.

**Short & Modest papers**† (1 - 3 pages\*) on specified topics.

**Final paper**† 10 pages\*, on a topic of your choice.

### Oral Presentations

In addition to daily participation, you will be give a formal presentation of your final research paper. These will be scheduled towards the end of the term.

## Grading and due dates

**10% Participation** in Class Discussions \*\* (daily)

**05% Short paper** (1 page)

The Theistic & Anthropic Principles

Due Sep. 2.

**15% Modest paper** (3 pages)

Geocentric & Heliocentric Cosmologies

Peer review Sep. 23. Complete draft due to peers 9/22.

Due Sep. 25.

**15% Modest paper** (3 pages)

Cosmic Inflation

Peer review Oct. 21. Complete draft due to peers 10/20.

Due Oct. 23.

**40% Final paper**\*\*\* (10 pages)

Select a topic by Nov. 7

Annotated bibliography due Nov. 13 (5%).

Peer review Dec. 2. Complete draft due to peers 12/1.

Due Dec. 5 (the last day of classes).

**15% Oral Presentations**

Nov. 18, 20, 25. Ten minute\*\*\*\* presentations based on your Final paper.

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\*One page is defined to be 250 words. Papers should be formatted in Times New Roman 12 pt. font, double-spaced, with 1" margins all-around. Papers should come within 10% of the specified



length: a ten page paper may be 11 pages of text at most. Twelve pages is right out. The limit refers to text only; it excludes the bibliography and any figures. Each paper should employ MLA reference and in-text citation practices. This applies to all pieces of writing.

\*\*Examples of class participation include, but are not limited to, engaging in class discussion with substantive ideas, questions, and insights, and contributions to group projects and discussions.

For the terribly shy: don't worry, this is not onerous. With 17 people in the class, the challenge is to get a word in edge-wise. For the loquacious: good - please express yourself. But also be respectful of your fellow students and don't overly monopolize the conversation.

\*\*\*The topic of the final paper is your choice, in consultation with Prof. McGaugh. Dig into something that interests you. Each chapter of Hetherington's book could be the launching point for your paper. Here are a some further [ideas for paper topics](#). You are not limited to these - the possibilities are endless. You could choose to explore the cosmology of a particular Ancient Philosopher, investigate the conflict between Galileo and the Catholic Church, or learn about modern ideas about multiverses.

*You must discuss your interests directly with Professor McGaugh and obtain approval for your chosen topic.*

There is no limitation on sources. You should use as many as you need. The textbook has many good references and is a good place to start. By the same token, in no case will the book suffice as the sole source. Indeed, you must *not* rely exclusively on a single source: at a minimum, your bibliography must include five sources.

\*\*\*\*Ten pages may seem like a long paper, but ten minutes is a very short time in which to discuss your topic. Keep focussed! A schedule will be posted when topics are chosen: we will have our own mini-conference, organized by subject (to the extent possible).

### †Papers

The papers can be included in your SAGES portfolio, which "documents your progress as a writer over your first three SAGES seminars and provides the University with programmatic feedback that will be used to enhance future seminars" (SAGES Writing Portfolio Assignment, [www.case.edu/sages/portfolio.html](http://www.case.edu/sages/portfolio.html)).

# Writing Policy

**PEER REVIEW:** Peer review enhances your critical thinking, reading, and editing abilities and provides feedback on your essay before it is graded. For each peer review session, you will pre-circulate your draft to your assigned group, review the work using a peer review sheet (provided), then utilize class time to conference about your feedback. This way, you will have a hard copy of your peers' responses; these responses should be in the context of the writer's intentions (as stated on his/her author sheet) and in terms of the assignment (posed as questions on the peer review sheet).

Ultimately, the decision for what to change and what to keep in your draft is yours. Peer review is an extension of your understanding of the assignment and the readings. Being able to provide constructive criticism and feedback to your peers indicates that you are engaged both with his/her work and the assignment in general. Constructive peer review is not 'This is great' or 'I don't understand,' but, rather, explains why something is great or difficult to understand **in relation to the writer's argument.**

To receive credit for peer review, you must pre-circulate your paper and attend the peer review session with commented drafts of your peers' works.

**CONFERENCES:** We plan to require at least 1 conference this semester. Please feel free to schedule other conferences or drop by during office hours. At these conferences we will entertain specific questions you have about your drafts; in other words, don't come to the conference and ask, 'Is my paper OK?' but rather ask, 'Is my thesis arguable?' or 'Does the evidence in ¶2 support my stated reason?' *Missing a conference is the equivalent of one class absence.*

**LATE PAPERS:** All writings are due as specified. Anything turned in after this time is considered late. Late unit papers may have their grades lowered by one point for every day late; the penalty sticks to the paper even if it is revised. If you have an emergency or will be missing an extended period of class, please contact us as soon as possible to make arrangements for other due dates.

Additionally, leaving assignments in our mailboxes, submitting them via email, or sliding them under our office doors without making arrangements to do so is unacceptable. Papers will be considered late until properly turned-in.

**MISSING PAPERS:** All writing assignments must be submitted and presented to pass the course.

In SAGES, writing instruction is integrated into the seminar experience.

The class will be characterized by intense, yet open-ended intellectual inquiry, guided by reading, lectures, and discussion, and will include practice in written and oral communication individually and in small groups. The result of a writing intensive course is, hopefully, mastery of a variety of

methods of writing. You will be introduced to the elements of effective written communication and learn to organize and express your ideas in a clear and convincing manner; to argue logically, evaluate ideas, understand issues and support a position with credible evidence. You will be expected to read and think critically and asked to analyze different pieces of writing. In a larger scope, this course is meant to introduce you to the methods of inquiry, contexts, and writing involved in the academic community.

In these contexts, the primary goal of the Writing Instructor is to help you to become a better communicator by teaching you to write more effectively. The secondary aims are to make you more aware of your own writing process as a means of helping you write better and to encourage your awareness of the processes of communication (rhetoric).

**Academic Honesty:** Plagiarism, whether from printed, unprinted, or digital sources, is a serious violation of ethical conduct, and will be dealt with severely. Plagiarism is not only misrepresentation, it can also be a form of theft. The following is the Case Western Reserve University policy on **academic integrity**: 'Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information and/or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting the work of another person, or work previously used without informing the instructor, or tampering with the academic work of other students.' It also includes buying or 'borrowing' papers from any source, electronic or otherwise, and attempting to pass them off as your own. Any form of plagiarism is unacceptable and will result in an immediate failing grade for the assignment (and, quite possibly, for the course). *We recommend you review the University Bulletin: <http://bulletin.case.edu/>.*

**Writing Support:** The Writing Resource Center (WRC) is staffed by lecturers and graduate students in the English Department. There are several locations around campus for face-to-face tutoring and on weekends online tutoring is available. To make an appointment, please go to [www.caseonline.com](http://www.caseonline.com). More information about the WRC can be found at: <http://www.case.edu/artsci/engl/writing/writingcenter.html>. Please note that the WRC does offer editing or proofreading services. Tutors will work with you to develop your strengths as writers.

There is also the SAGES Peer Writing Crew offering peer tutoring. Face-to-face appointments can be made at [tutortrac@case.edu](mailto:tutortrac@case.edu).

ESL Support: SAGES ESL Program [writing@case.edu](mailto:writing@case.edu) (Hee-Seung Kang [hxk322@case.edu](mailto:hxk322@case.edu), Gusztav Demeter [gusztav.demeter@case.edu](mailto:gusztav.demeter@case.edu))