

A320 DAY 1 HANDOUT

ASTRONOMY 320
University of Arizona

The Philosophy and History of Astronomical Thought

PROF. MICHAEL CHRISS
Fall 2015

PRELIMINARY REMARKS: Who are we? What are we? This question has been the concern of every civilization, and, ultimately of each one of us as we seek our own identity and the meaning of our own life. This quest has led us to a consideration of the cosmos, and our place in it. We have been looking at the heavens since we have become human. We have searched the cosmos ... and we have found ourselves. This course is the story of astronomy. This course is the story of our quest. This course is the story of us!

TEXTS:

<i>(required)</i>	Hoskin: <i>The Cambridge Illustrated History of Astronomy</i> , Cambridge Univ. Press This book is out of print but many copies are available on Amazon and Barnes & Noble. There is a copy reserved for this class in the SO Library, on the 3 rd floor of the Steward Observatory.
<i>(required)</i>	Chriss: <i>Handbook for ASTR 320</i> (find this in the D2L site for this course. Free –of course!)
<i>(required)</i>	STELLARIUM (this is a computer program that you can download for free)
<i>(optional)</i>	North: <i>Cosmos</i> , Univ. Chicago Press, 2008 North's book is a brand new compendium of information, a brick of a book, encyclopedic in scope.

CLASS MEETINGS: Lectures will be given TTh 11:00 - 12:15 in room SO 202 .

OFFICE HOURS: Tuesday and Thursday, before or following class, or by arrangement. Office: N402

ATTENDANCE AND ETIQUETTE: Class attendance is important and mandatory. Academic integrity and behavior is required and expected. (see further attendance and etiquette information in Astr320 Handbook/ Sec.1a and 1d.)

IMPORTANT DATES: 1st Lecture- Aug. 25th Thanksgiving Break- Nov. 26-29 Last Lecture- Dec. 8th Final Exam- Dec.14 (10:30a)

THE ASTRONOMY 320 HANDBOOK

This is the indispensable guide to this course and contains all information relating to understanding this course. You will find the Handbook on the D2L site for this class. The A320 Handbook contains 10 sections:

Sec 1- CLASS INTRODUCTORY MATERIALS	< <i>Syllabus; Lecture Schedule; Lecture Outlines; Homeworks & Readings; Classroom Etiquette</i>
Sec 2- QUOTES re ASTRONOMY	
Sec 3- TIMELINES	
Sec 4- READINGS	< <i>auxiliary readings relating to the lectures</i>
Sec 5- LECTURE SLIDES	< <i>some of the slides used in the lectures</i>
Sec 6- STUDY GUIDES + XTRA CREDITS	< <i>for preparing for the exams + extra credit projects</i>
Sec 7- COLOR CARDS	< <i>make a copy and bring to each lecture</i>
Sec 8- GRADE APPROVAL FORM	< <i>grade improvement form</i>
Sec 9- OBSERVATION REPORTS	< <i>for telescope observation sessions</i>
Sec 10- STELLARIUM	< <i>Stellarium sky program instructions</i>

COURSE OUTLINE AND LECTURES

This course has been divided into 5 themes, each theme covering one general topic and one historical time period. During each of these periods we will discuss the view of the universe of people living in that period, and how they came to believe in that view. Finally, we will discuss the effect that view had on their lives and their times. [see Astr320 Handbook/Sec.1b-Lecture Schedule for full details]

THEME #1: <i>[Weeks 1-2; Lectures 1-4]</i>	SCIENTIFIC TRUTH: What does the sky look like? What is our place in it? How do we know what to believe?
THEME #2: <i>[Weeks 3-5; Lectures 5-9]</i>	THE OLD VIEW: Astronomy and society-Greeks, Romans, Christians, Moslems
THEME #3: <i>[Weeks 6-9; Lectures 10-16]</i>	THE NEW VIEW: The Scientific Revolution from Copernicus to Enlightenment
THEME #4: <i>[Weeks 10-14; Lectures 17-25]</i>	THE MODERN VIEW: Astronomy from Newton to Hubble
THEME #5: <i>[Weeks 15-16; Lectures 26-27]</i>	LINGERING QUESTIONS: Life, Religion, God, Meaning

DOING WELL IN THIS CLASS:

- 1. COME TO CLASS ... EVERYTIME.**
- 2. TAKE GOOD LECTURE NOTES IN CLASS ... ON EVERYTHING! <WRITE IT ALL DOWN FULLY, COMPLETELY, ACCURATELY**
- 3. COMPLETE THE STUDY GUIDES FOR EACH LECTURE ... AFTER EACH LECTURE.**
- 4. COMPLETE THE PREP GUIDE FOR EACH EXAM ... (WELL) BEFORE EACH EXAM.**
- 5. READ IN THE READINGS (SEC.4) THAT GO WITH THE LECTURES ... AFTER EACH LECTURE.**

A SHORT HOMEWORK - DUE THURSDAY AUG 27: A BRIEF BIO OF YOU

I have told you about me in a Brief Bio which you will find on my faculty web site and on the D2L site for this class.

Now, please tell me about you in a Brief Bio about yourself:

name; major; year; previous courses in astronomy, science, history, philosophy; why you chose this course.

*ADDITIONAL WORK REQUIREMENT FOR "A" GRADE

- (1) answer additional essay questions on the final exam (2) write 9 essays from Prep Guides (Sec.6b) -due on date of final exam.

There will be additional essay questions on the final exam for "A" students to answer.

Hand in 9 essay questions of your choice from Exam #1-3 Prep Guides, with a minimum of 2 essays from each Exam Prep Guide. These 9 essays must be at least one full page per essay, and must be fully and accurately answered.

COURSE OUTLINE AND TENTATIVE LECTURES (SEC. 1b)

The tentative lecture schedule for the semester, along with readings for each lecture.

[see Section 1b in this Handbook for details.]

LECTURE OUTLINES SEC. 1c)

Every lecture given in class is outlined in detail.

[see Section 1c in this Handbook for details.]

HOMEWORKS and READINGS SCHEDULE (SEC. 1d)

Homework questions and Text/Handbook readings.

[see Section 1d in this Handbook for details.]

STUDY GUIDE and PREP GUIDE QUESTIONS

(Astronomy 320 Handbook, Sec. 6a, 6b + 6c, 6d)

1. EXAM STUDY GUIDES The study questions from which the exam prep guides are made up. [see Handbook/Sec. 6a for full details]
2. EXAM PREP GUIDES A preview of the questions from which the exams are made up. [see Handbook/Sec. 6b for full details]
3. OTHER HOMEWORK PROBLEMS Additional study problems as assigned. [see Handbook/Sec. 6c for full details]
4. EXTRA CREDIT ASSIGNMENTS Extra credit activities to improve your semester exam grades [see Handbook/Sec. 6d for full details]

Exam Study Guide questions are found in the Handbook, Sec.6a; Exam Prep Guide questions are found in Handbook, Sec.6b. These questions are designed to aid in your learning of the material of this course and to help you to prepare for the exams.

HOMEWORK SCHEDULE: Study Guide Questions to prepare and be discussed at our next lecture session [see Handbook, Sec.6a]

- (1) At The End Of Each Week: do that part of the Study Guide questions which relate to the class lecture material of that week.
- (2) Prior To Each Exam: you should review the Prep Guide questions for that exam.
- (3) In Addition: read Handbook/Sec.4-Readings which go with each lecture, as marked.

DOING WELL IN THIS CLASS:

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2. **TAKE GOOD LECTURE NOTES IN CLASS ... ON EVERYTHING! <WRITE IT ALL DOWN FULLY, COMPLETELY, ACCURATELY**
3. **COMPLETE THE STUDY GUIDES FOR EACH LECTURE ... AFTER EACH LECTURE.**
4. **COMPLETE THE PREP GUIDE FOR EACH EXAM ... (well) BEFORE EACH EXAM.**
5. **READ IN THE READINGS (SEC.4) THAT GO WITH THE LECTURES ... AFTER EACH LECTURE.**

●●PREHISTORY: THE ROOTS OF ASTRONOMY (prior to 500 BC)

Theme: The Cosmic Quest- the search to find our meaning in the universe begins with the search to find our place in the universe.

- L 1 "CLOSED WORLD TO INFINITE UNIVERSE"
course introduction and overview
- L 2 "WHAT IS TRUTH?" – the philosophical
foundations of the scientific view

THE SKY ABOVE AND THE EARTH BELOW

Theme: The starry vault of night becomes the inspiration of ancient culture's religions.

- L 3 "THE BOWL OF NIGHT" - motions in the sky
- L 4 "SKYWATCHERS OF THE ANCIENT WORLD" - archeoastronomy: Egypt to
Medicine Wheel

**●●CHAOS TO COSMOS: GREEKS, ROMANS, CHRISTIANS, MOSLEMS:
THE FOUNTAINHEAD (500 BC to 1000 AD)**

Theme: The philosophers of classical Greece find a geometrical logic and design to the structure of the heavens, and man's place in it.

- L 5 "THE MUSIC OF THE SPHERES" - early Greek astronomy: Ionia to Pythagoreans
- L 6 "THE LOGIC OF THE HEAVENS" - the Socratic philosophers

THE COSMIC GEOMETRY

Theme: Later Greek philosophers perfect the geocentric model of the universe, and Greek art and architecture embodies this grand cosmic design.

- L 7 "WHEELS ON WHEELS" - the Hellenistic astronomers
- L 8 "IDEALS AND PERFECTION" - the Greek ideal of a cosmic art and architecture

MICROCOSM AND MACROCOSM

Theme: The Greek cosmic model forms the basis for Roman Empire society model, and is adapted by the Christians as God's divine plan.

- L 9 "EMPEROR, GOD, AND COSMOS" – Romans, Christians, Moslems & cosmology

| Exam | **EXAM #1:** Lectures 1-9

**●●THE REBIRTH OF THINKING: THE RENAISSANCE ; NEW HORIZONS
FOR MAN (1200 to 1500 AD)**

Theme: The paradigm shifts. The Renaissance brings new horizons and new view-points for man, on earth and in heaven. The old world ends; a new world begins.

- L 10 "NEW VIEWS OF HEAVEN AND EARTH" - the visions of Luther and Columbus
- L 11 "THE NEW PERSPECTIVE" - Renaissance Art and Humanism

**●●THE SCIENTIFIC REVOLUTION: THE SHATTERING OF THE
CRYSTAL SPHERES (1500 to 1700 AD)****THE BIRTH OF A NEW WORLD VIEW**

Theme: A new model of the universe takes shape as Copernicus removes the earth from the center and Kepler discovers the mathematics of planetary motion.

- L 12 "THE EARTH MOVES!" - Copernicus and a new model of the universe
- L 13 "A MATHEMATICAL UNIVERSE" - Brahe, Kepler; the mathematics of the cosmos

THE CLASH OF SCIENCE AND RELIGION

Theme: Galileo observes the heavens with a telescope and finds new evidence for the Copernican Theory. He tried by the Inquisition for heresy. The science scene shifts to England, where Newton unites the physics of heaven and earth.

- L 14 "THE CRIME OF GALILEO" - Galileo, the Pope, and the battle for men's minds.
- L 15 "THE MARRIAGE OF HEAVEN AND EARTH" - Newton and the physics
of the universe
- L 16 "THE CLOCKWORK UNIVERSE" – fate, free will, and the clockwork universe

**●●THE POST-NEWTONIAN AGE: THE GROWTH OF THE SCIENTIFIC
WORLD VIEW (1700 to 1900 AD)**

Theme: The scientific method takes form and transforms the world view. The Enlightenment.

- L 17 "SCIENTISTS, ARTISTS, REVOLUTIONS" - science societies, art, politics

| Exam | **EXAM #2:** Lectures 10-16

| libr. | RARE BOOKS COLLECTION (meet at Special Collections Library)
- GREAT BOOKS of the SCIENTIFIC REVOLUTION -

**●●THE 18th and 19th CENTURY: A VISION OF AN INFINITE UNIVERSE
(1700 to 1900 AD)****EXPANDING HORIZONS AND THE PLACE OF MAN**

Theme: 18th and 19th century astronomers sweep the skies and discover new worlds around the sun and others suns that form our galaxy: the Milky Way.

- L 18 "THE MEASURE OF THE EARTH" - the voyages of discovery; the longitude prob.
- L 19 "THE FAMILY OF THE SUN" - the discovery of the solar system: Vulcan to Mars
- L 20 "THE FAMILY OF THE SUN" - the discovery of the solar system: Uranus to Pluto
- L 21 "THE COSMIC PINWHEEL" - the discovery of our galaxy, from Herschel to Shapley
- L 22 "THE COSMIC PINWHEEL" - the discovery of our galaxy, from to Shapley to Baade

**●●THE 20th CENTURY: BRAVE NEW MAN IN A BRAVE NEW
UNIVERSE (1900 to 2000 AD)****WORLDS WITHOUT END**

Theme: In the 20th century the astronomers discover an endless universe of galaxies, explore the life of the stars and question whether we are alone.

- L 23 "HUBBLE'S UNIVERSE" – The great telescopes, Hubble and the discovery of the
galaxies
- L 24 "THE GREAT DEBATE & THE SEARCH FOR THE YEAR 0" – superclusters and H₀
- L 25 "A JOURNEY TO OZ" - stellar evolution and the search for life in the universe

**●●THE 21st CENTURY: QUO VADIS MANKIND? BEGINNINGS AND
ENDINGS (1900 to present)****MODERN MAN AND THE SEARCH FOR MEANING**

Theme: As the 20th century ends, astronomy, philosophy and theology appear to be asking the same kinds of questions.

- L 26 "EINSTEIN AND RELATIVITY" - 4 dimensions and the shape of space
- L 27 "MAN, GODS, MEANING" – lost in the stars: flat earth to noosphere

Exam #3: Lectures 17-27 + previous (given during the Final Exam period)

Astr 320 HOMEWORK and READING SCHEDULE
Fall 2015

	LEC No.	HOMEWORK QUESTIONS due this LECTURE (M.Choice - Sec 6a)	OTHER QUESTIONS	READINGS IN HANDBOOK- (Sec.4)	READINGS IN TEXT - (Hoskin) <i>Cambridge Illustrated History of Astronomy</i>	
THEME #1: SCIENTIFIC TRUTH	1			1.1 - 1.8		
	2	1-1, Brief Bio		2.1 - 2.4		
	3			3.1 - 3.2	pp. 2-21	
	4	3-3	Sec.6c-1/Sec.10 Stellarium Q's	4	22-29	
THEME #2: THE OLD VIEW- Greeks to Moslems	5	4-12		5.1 - 5.2	29-36	
	6	5-16				
	7	6-18			37-47	
	8	7-21		8		
	9	8-27, 9-32		9.1 - 9.2	50-67	
THEME #3: THE NEW VIEW- Scientific Revolution	10	10-2		10.1 - 10.3	68-90	
	11	10-5		11		
	12	11-6			90-97	
	13	12-8; 12-16		13	98-121	
	14	13-24		14.1 - 14.2	122-143	
	15	14-29			144-175	
	16	15-35		16.1 - 16.3		
THEME #4: THE MODERN VIEW Newton to 20 th C.	17	17-2		17		
	18	17-4		18.1 - 18.2	175-183	
	19	18-5			184-197	
	20	19-8				
	21	19-9		21	198-244	
	22	21-11				
	23	21-16			244-343	
	24	23-18				
	25	23-19		25.1 - 25.8	271-329	
THEME #5: LINGERING QUESTIONS	26	25-22		26.1 - 26.4	344-365	
	27	27-36		27.1 - 27.6		