

ASTRONOMY 120
Highlights of Astronomy
Fall Quarter 2017

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OFFICE HOURS: MWF 12:30 – 1:30 PM

TA (Instruction): Alex Gurvich
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TA (Project): Cody Dirks
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OFFICE HOURS: W 10:00 AM – Noon

LECTURES: MWF at 2:00 – 2:50 PM in Tech LR3
TEXTBOOK: *The Cosmos: Astronomy in the New Millenium (4th Ed.)*
(Pasachoff & Filippenko)
MID-TERM EXAM: Monday, Oct. 23, 2017 2 PM Tech LR3 (1 hour)
VIDEO PROJECT DUE: Monday, Nov. 20, 2017 2 PM
FINAL EXAM: Monday, Dec. 4, 2017 9 AM Tech LR3 (2 hours)

Grading Policy

The course grade will be based on the final (45%) and mid-term (25%) exams, the Galaxy Zoo research project (20%), and two “pop” quizzes (10%). The pop quizzes will be given without warning twice in lecture during the quarter. There will be no make-up quizzes. Since only the highest quiz grade will be counted, missing one will not hurt your grade. The exams will consist of multiple choice, short answer, and essay questions.

Observing Sessions

There will be evening observing sessions every Wednesday night at 8 PM starting the second week of the quarter utilizing the historic 18.5-inch telescope in the Dearborn Observatory. If the weather cooperates, you will have an opportunity to view the Moon, planets, nebulae, etc. If not, the TA on duty will give you an entertaining tour of Dearborn. Either way, you will be exposed to interesting information not easily discussed in a lecture setting. Attending at least one of these sessions during the quarter is strongly encouraged and will be of help on the final exam. Since we can accommodate only a limited number of students per session, a prior sign-up will be in effect after lecture each Wednesday for that night’s observing. **DON’T WAIT UNTIL THE END OF THE QUARTER.** The instructor will inform you where to meet for the sessions.

Video Lectures on Galaxies (Required)

In order to accommodate in-class activities in support of the Galaxy Zoo project outlined below, the lecture material on galaxies has been recorded in six 10-minute video segments accessible via the course Canvas website. In support of these video lectures, please read Chapters 16.1-16.9, 17.1-17.6, and 18.2-18.3 in your text (P&F). All of these video lectures should be viewed by Oct 30 before you begin your Galaxy Zoo project. You will be responsible for the material in these lectures and the associated reading on both the second pop quiz and the final exam.

Supplemental Video Lectures (Recommended)

If you need help beyond the classroom lectures, galaxy video lectures, and reading assignments in understanding some of the course material, another resource to consider is a video course that the instructor recorded for The Great Courses several years ago. This course, entitled “Experiencing Hubble: Understanding the Greatest Images of the Universe” consists of twelve 30-minute lectures that discuss the basic astronomy and physics behind Hubble’s most noteworthy images. These video lectures are now available for free to all NU students via the following weblink: (<http://northwestern.kanopystreaming.com/video/experiencing-hubble-understanding-greatest-images-universe>). The following Experiencing Hubble (EH) lectures cover material discussed in lecture and in the specific reading assignments noted below:

EH Lecture 1 – The Rationale for a Space Telescope (P&F 2.1-2.2, 3.1-3.6)

EH Lecture 2 – Comet Shoemaker-Levy 9 and Jupiter (P&F 8.3-8.5)

EH Lecture 3 – The Sagittarius Star Cloud (P&F 11.1-11.4, 11.8, 15.1, 15.4)

EH Lecture 4 – The Star Factory inside the Eagle Nebula (P&F 15.3, 15.9, 15.13)

EH Lecture 5 – The Cat’s Eye Nebula – A Stellar Demise (P&F 13.1)

EH Lecture 6 – The Crab Nebula – A Supernova’s Aftermath (P&F 13.2-13.3)

EH Lecture 7 – The Sombrero Galaxy – An Island Universe (P&F 16.1-16.3)

EH Lecture 8 – Hubble’s View of Galaxies Near and Far (P&F 16.7, 18.2-18.3)

EH Lecture 9 – The Antennae Galaxies – A Cosmic Collision (P&F 16.9)

EH Lecture 10 – Abell 2218 – A Massive Gravitational Lens (P&F 16.4-16.5)

EH Lecture 11 – The Hubble Ultra Deep Field (P&F 16.8, 19.1-19.2)

Galaxy Zoo Research Project

This project involves galaxy data from the Sloan Digital Sky Survey (<http://www.sdss.org>) and galaxy classifications from the Galaxy Zoo citizen science effort (<https://www.galaxyzoo.org>). In groups of four students (to be randomly assigned on Oct 28), you will utilize a large database drawn from these resources to investigate a galaxy research question and hypothesis posed by your group. The instructor has recorded a video (accessible via the course Canvas website) that explains the various galaxy parameters in the database from which your group will select and analyze those necessary to address your research question. In support of this effort, you will draw upon the galaxy video lectures and several in-class activities that introduce the online tools to understand and analyze the galaxy database. The final product of each group’s effort will be a 4-minute video discussing their galaxy research question, data analysis, and conclusions. In addition to the project milestones and surveys summarized below (including due dates), full details about the project (and relevant weblinks) can be found on the course Canvas website:

A) Milestones (RPMs)

Along the way toward completing your Galaxy Zoo research project are the following six milestones. It is essential that you complete these milestones by their due dates below. Your project grade will be determined based on the material submitted for RPM #5 and RPM #6.

RPM #1 (Due Oct 27) As individuals, watch the “Pinball Process of Science”

RPM #2 (Due Nov 3) As a group, submit your completed “Guided Research Activity”

RPM #3 (Due Nov 6) As a group, submit your research question and hypothesis

RPM #4 (Due Nov 13) As a group, submit your key data analysis plots

RPM #5 (Due Nov 20) As a group, submit your 4-minute video project

RPM #6 (Due Dec 1) As individuals, submit peer reviews of two other video projects

B) Surveys

In order to improve this pilot program (sponsored by the National Science Foundation), it would be very helpful if you could individually complete each of the following pre-surveys, post-surveys, and activity surveys (after you complete the activities) by their due dates.

Survey #1 (Due Sep 20) Nature of Science pre-survey

Survey #2 (Due Sep 20) Trajectory pre-survey

Survey #3 (Due Oct 16) Ease of use of in-class activities

Survey #4 (Due Nov 6) Ease of use of Guided Research Activity

Survey #5 (Due Nov 13) Data analysis guidance and tools

Survey #6 (Due Nov 20) Video project rubric and tools

Survey #7 (Due Nov 20) Nature of Science post-survey

Survey #8 (Due Nov 20) Trajectory post-survey

Course Outline

Sep 20	Introduction	Read P&F 1.1-1.7
Sep 22	Where is your Home in the Universe?	In-class activity
Sep 25	Light	Read P&F 2.1-2.2
Sep 27	Atoms and Spectroscopy	Read P&F 2.3-2.5
Sep 29	Telescopes	Read P&F 3.1-3.6
Oct 2	Measuring Galaxy Velocities	In-class activity
Oct 4	The Sky	Read P&F 4.5-4.7
Oct 6	The Moon	Read P&F 4.1-4.3
Oct 9	Planetary Motion	Read P&F 5.1-5.7
Oct 11	The Outer Solar System	Read P&F 8.1-8.2
Oct 13	Comets and Asteroids	Read P&F 8.3-8.5
Oct 16	Galaxy Zoo	In-class activity
Oct 18	The Sun	Read P&F 10.1-10.2
Oct 20	Stellar Properties	Read P&F 11.1-11.3
Oct 23	Mid-Term Exam (2 PM in Tech LR3)	
Oct 25	Star Clusters and the HR Diagram	Read P&F 11.4, 11.8
Oct 27	The Death of the Sun	Read P&F 13.1
Oct 30	Novae and Supernovae	Read P&F 13.2
Nov 1	Neutron Stars	Read P&F 13.3
Nov 3	Black Holes	Read P&F 14.1-14.7
Nov 6	The Interstellar Medium	Read P&F 15.3, 15.7-15.12
Nov 8	The Milky Way Galaxy	Read P&F 15.1-15.2, 15.4-15.6
Nov 10	The Fate of the Universe	Read P&F 18.1, 18.4-18.6
Nov 13	The Evidence for the Big Bang	Read P&F 19.1
Nov 15	The Cosmic Microwave Background	Read P&F 19.2-19.4
Nov 17	The Search for Other Earths	Read P&F 9.2-9.4
Nov 20	The Search for Extraterrestrial Intelligence	Read P&F 20.1-20.8
Dec 1	Review Session (2 PM in Tech LR3)	
Dec 4	Final Exam (9 AM in Tech LR3)	