Comprehensive Course Syllabus

Planetary Science
Syllabus – Fall 2018

Course Description:

In brief: To introduce the student to basic concepts in planetary science and the methods that are used to determine what we know about the dynamic processes of planetary formation and evolution.

We will start with some introductory material, going over our model of how the Universe began and how this has led to the Universe that we see today. During this section we will also cover several major advances in physics, and discuss how they help astronomers today.

This will lay the foundation for understanding how our Solar System and the Earth was formed. We will study how we believe our planet has changed and evolved in the billions of years since its formation. One important part of this is the understanding of how different parts of our planet interact with each other dynamically. We will cover the topic of global climate change as one example of these complex interactions that we will study.

The last section of the course will then take what we have learned about the Earth, and apply it to other planets and moons in our Solar System, and to see what we can learn about the Earth by the study of the other planets.

INSTRUCTOR(S):

- Name: Dr. Eric Hawker
- Office: B 117 - When I am not in class I am usually either in my office or in B133. I usually get to IMSA by 7:30 and leave around 5:00.
- Telephone number: 630-907-5049
- Email address: ehawker@imsa.edu

Meeting Days, Time and Room: A -D days from 11:00 – 11:55, room B101

Texts / Materials:

Death by Black Hole and Other Cosmic Quandaries by Neil deGrasse Tyson
Geology the Key Ideas by David Rothery

Essential Content:

- Physics Topics
    - Light
    - Spectra
    - Blackbody radiation
    - Doppler effect
    - Nuclear physics/fusion

- Big Bang
    - Timeline
    - Nucleosynthesis
    - CMB

- Stellar Evolution
    - Stellar fusion
    - Supernovae

- Solar System Formation
    - Virial Theorem
    - Differentiation

- Early Planets/Lunar Formation
    - Differentiation
    - Impact Theory

- Planetary Evolution and Dynamics
    - Temperature/atmosphere/gravity dynamics
    - Core and magnetosphere
    - Tectonics and volcanism
    - Tidal forces
    - Global warming

- The Current Solar System
    - Terrestrial and Jovian planets
    - Moons, rings, comets, and asteroids
    - Unanswered questions

- Life
    - Miller – Urey
    - Life in our Solar System
    - Life outside our Solar System

- The Future

Disciplinary Learning Standards Addressed in Course:

A. Students studying science at IMSA engage in the process of scientific inquiry by:

A.1 applying the skills of observation (describe, compare, and contrast characteristics; identify parameters, precisely observe phenomena).
A.2 designing and planning investigations and constructing questions which further understanding, forge connections, and deepen meaning.
A.3 carrying out investigations that develop skills, concepts, and processes that support and enable complex thought.
A.4 using appropriate technologies to collect, analyze and present information.
A.5 accurately recording findings.
A.6 analyzing data to find ambiguities inherent within any set of textual, social, physical, or theoretical circumstances.
A.7 employing scientific reasoning to evaluate the soundness and relevance of information.
A.8 constructing and supporting judgments based on evidence.
A.9 sharing results by communicating orally, in writing, and through display with power, economy, and elegance.

D. Students studying science at IMSA demonstrate understanding of our Universe, Solar System and Planet by:

D.1 exploring the Big Bang and how it relates to our model of the Universe.
D.2 examining the properties of stars.
D.3 exploring the properties and dynamics of the solar system and its formation.
D.4 examining the dynamics interactions within a planet.
D.5 exploring and evaluating the evidence of, and mechanisms for, global climate change.

G. Students studying science at IMSA will understand the relationship between science and technology and modern society by:

G.1 recognizing the mutual interaction between humans and natural systems.
G.2 examining current issues in science and technology.

SSLs and Outcomes:

IA. Students expected to demonstrate automaticity in skills, concepts, and processes that enable complex thought by

- demonstrating competence on tests. **FA**
- applying content knowledge to alternative scenarios and/or new problems. **FA**

IB. Students expected to construct questions which further understanding, forge connections and deepen meaning by

- analyzing data to draw conclusions. **FA**
- discussing concepts and problem with peers. **NA**
- modeling systems supported by data/observations. **FA**

ID. Students expected to evaluate the soundness and relevance of information and reasoning by

- drawing conclusions from data. **FA**
- evaluating the reasonableness of answers. **FA**
- evaluating models created from data/observations. **FA**

IIA. Students identify unexamined personal assumptions and misconceptions that impede and skew inquiry

- by completing pre-assessments to solicit misconceptions. **NA**
- by reconciling data/observations and preconceptions. **FA**
- through assessment questions targeted at misconceptions. **FA**

IIIA. Students use appropriate technologies as extensions of the mind through

- daily use of tablets for completing work and referencing resources. **NA**
- use of laboratory equipment for data analysis. **NA**

IIIB. Students recognize, pursue, and explain substantive connections within and among areas of knowledge by

- connecting previous concepts in science to current concepts in essays and on projects. **FA**

IIIC. Students recreate beautiful conceptions that give coherence to structures of thought by

- exploring the development of models (mathematical and conceptual). **FA**
- connecting concepts in science to real world scenarios. **FA**

IVA. Students construct and support judgments based on evidence by

- drawing appropriate conclusions supported by data/analysis. **FA**

IVB. Students write and speak with power, economy, and elegance by

- communicating effectively in project reports. **IA**
- explaining problems and asking questions during group discussions. **NA**
- showing work to clearly communicate problem solutions. **IA**

IVC. Students identify and characterize composing elements of systems

- through effectively designing experiments to collect data appropriate to question. **FA**

- by breaking down a complicated problem in order to solve it. **IA**

VB. In order for students to make reasoned decisions which reflect ethical standards, and act in accordance with those decisions, students by

- accurately reporting data even if it seems problematic. **IA**
- submitting essays and project work representing individual student work. **IA**

Instructional Design and Approach:
Because this is a very visual science, there will be quite a few powerpoint presentations. Also there will be several out of class reading and research assignments followed by class discussions and written questions for students to better understand the important concepts of the readings. In essays, group work, and discussions students will be asked to reflect on and question their understanding of different topics. There will be one or more projects to give the students a deeper understanding into unanswered questions in the field of planetary science, and to let students experience how planetary scientists do research in the real world.

Student Expectations:

1. Students are expected to follow the attendance and tardy policies of the Academy.
2. Get help! If a student does not understand a problem or concept I expect the student to either come to me or another physics teacher for help.
3. They are expected to come to class prepared with their assignments done and ready to ask questions and discuss topics with classmates.
4. Outside of class, students are expected to meet with their groups to work on the project, read from the text, study for exams, and work on other assignments.
5. Refer to the student handbook for more details.

Missed Exams: If you miss an exam (or know ahead of time that you will miss it) please contact me as soon as possible. I generally require, if possible, the test to be made up before the next class after a test.

Assessment Practices, Procedures, and Processes:
There will be four exams during the semester, project assignments, and homework and in class activity assignments, and a final exam. Your final grade will be based on the following.

45% from unit exams
10% from the Final exam
30% from the project(s)
15% from homework questions and other assignments

Tentative Exam Schedule:

Exam 1	**September 14th**
Exam 2	**October 15th**
Exam 3	**November 16th**
Exam 4	**December 10th**

There will also be telescope viewings during the semester. Unfortunately, since the website that I use only predicts cloud cover 2 days in advance, students will only get one

to two days head notice before a viewing. These viewings are for extra credit, and are not mandatory.