ASTR 220
Collisions in Space
Fall 2006
Syllabus

Introduction

ASTR 220, Collisions in Space, is a 3-credit CORE physical sciences course. It is aimed at non-astronomy majors, and is suitable for non-scientists, though some mathematics, at the level of algebra and scientific notation, will be included. As it is a 3-unit course, students should expect to spend about 9 hours per week on lectures, readings, homework, etc.

The course will cover a broad range of different types of collisions that occur at all scales in the universe, including impacts, gravitational disruption, interactions and explosions.

We will start by studying collisions in the solar system. There is ample evidence that collisions have played a major role in the formation and evolution of the planets and other bodies that orbit the Sun, and we will explore the implications of these impacts. Topics that will be considered include the process of crater formation, the prevalence of collisions throughout the solar system, and how impacts and craters can be used as a tool for scientific study. We will also consider the cases of the Tunguska event, the impact of a comet into Jupiter, and the joint NASA/University of Maryland Deep Impact experiment, which crashed an impactor into comet Tempel 1. The centerpiece of the course will be an investigation into the theory that an impact ended the cretaceous period and caused the extinction of the dinosaurs. This theory will also be highlighted as an example of the scientific method in action.

Scaling up to larger collisions, we will study the lives and deaths of stars, and investigate the supernovae that can transform them into white dwarfs, neutron stars or black holes. We will explore the often bizarre behavior of binary star systems and will investigate the potential implications that arise from stellar collisions.

Continuing to expand the scale of our investigation, we will study galaxies and their evolution. Galactic collisions act to alter the structures of entire galaxies, as well as triggering star formation, activating powerful active galactic nuclei and forming supermassive black holes. Galactic collisions also reveal the presence of the dark matter that comprises most of the matter in the universe.

Class Information

Lectures are presented Tuesdays and Thursdays from 2:00pm to 3:15pm in CSS 2400

Instructor	TA
Dr. Tony Farnham	KwangHo Park
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Textbooks

Required:

The Essential Cosmic Perspective, 3rd Edition by Bennett, Donahue, Schneider and Voit
This is a general astronomy textbook that will provide the background for the collision scenarios that we will be studying. Be careful not to confuse it with the longer book *The Cosmic Perspective* by the same authors.

Night Comes to the Cretaceous by James Lawrence Powell
This is a description of the development of the Alvarez theory, which suggests that an asteroid impact caused the extinction of the dinosaurs.

Recommended:

T. Rex and the Crater of Doom by Walter Alvarez
This is a very readable book that describes the Alvarez theory (by one of the scientists that proposed it). It works well as a companion book to the NCC, though it glosses over much of the controversy and contentious aspects that arose during the process.

The Planetary System by Owen and Morrison
This is another general astronomy textbook that focuses on the solar system

Try to stay up to date on the readings. This provides you with a better understanding of the lectures and improves your ability to do well on the homework.

Web Site

A web site has been set up to provide up-to-date information about the course. The address is

http://www.astro.umd.edu/courses/ASTR220fl06/

General information will be posted at this site, including any announcements, updates and informational items. A course schedule and list of the reading assignments will also be posted, and will reflect the current status, taking into account any slippages or adjustments that are made during the semester. Other items that will be posted include handouts, homework assignments, homework solutions (after the due date), etc.

The powerpoint slides used for the lectures will also be available on the website, though the instructor reserves the right to delay posting them for a few days (until after a homework assignment is due, for example). ***Note that the slides do not contain all of the information covered in the lecture, so students are urged to attend class to obtain all of the relevant information.***

Movies clips and animations will also be shown in class, but will not be posted on the website.

Homework

There will be 6 homework assignments for the course. Anything presented in the lectures, readings, handouts or discussions are fair game for homework problems. Only the 5 highest homework scores will be counted toward your grade, with each assignment having the same weight in the final grade.

Homeworks are due at the beginning of the lecture on the day they are due. None will be accepted after the first 15 minutes of class, and none will be accepted via email. (If you fail to turn in one homework assignment, that assignment will count as the score that is dropped.)

The homework solutions will be posted on the web site immediately after class. Depending on the assignment, select solutions may be discussed in class.

Homework must be done in ink and should be clearly legible (typed if necessary). Illegible work is likely to be assumed to be incorrect. Credit will only be given for answers that answer the questions asked. Partial credit will be given for answers that were incomplete but on the right track.

Each homework assignment is worth 5% of your grade, for a total of 25% of the course grade.

In-Class Activities

There will be three in-class activities.

On September 26, we will conduct an in-class impact experiment. Following the experiment, you will complete a write-up and answer questions using the results that were obtained. The write-up and questions will be due at the start of the following class**. This class will be held in the Astronomy lab, Room CSS 1109.**

On October 10, movie excerpts relating to collisions and impacts will be shown in class, followed by a short discussion. You will complete a worksheet relating to the clips, and turn it in at the beginning of the following lecture

On October 31 we will watch a video discussing the controversy over the dinosaur extinctions. You will discuss the video (and NCC) with a partner and complete a worksheet based on the discussion. The worksheet will be due at the start of the following lecture.

Each of the in-class activities is worth 5% of your grade, totaling 15% of the course grade.

Exams

There will be one midterm exam on October 19. It will be based on all material covered up to that date. The final exam will be held on December 18, 2003 (10:30-12:30 pm). It will be cumulative through the entire course (though it will likely emphasize the second half). Both exams will be held in CSS 2400. As with the homework, anything from the lectures, readings, handouts or discussions is a possible source for exam questions.

Calculators may be used on the exams. **No cell phones, PDAs, computers, or other devices are allowed, nor are hats or sunglasses.**

The midterm exam is worth 25%, and the final exam is worth 35% of your final grade. The final exams will be kept by the instructor for one year after the test date.

Course Grade

Course grades will be computed by weighting the different components as follows:

Component	Percentage
Homework	25
In-Class Activities	15
Midterm Exam	25
Final Exam	35

Letter grades will be assigned for the following percentages:

Percentage	Letter Grade
90% and above	A
80-89%	B
68-79%	C
55-67%	D
below 55%	F

The +/– system will not be applied to the letter grades in this course.

In the event that the homework and exams are more difficult than anticipated, a curve may be applied to adjust the letter grade percentages. This will only act to improve your grade from the straight percentages listed.

No extra credit will be given in this class. If you feel you are not doing as well as you could be on the assignments, make use of office hours to discuss them before they are due. Don't wait until you are so far behind you can't catch up.

Absences

University regulations for excused absences and academic honesty strictly apply in this class. (You can review them in the Schedule of Classes) In case of scheduled absences for University-approved athletic events or religious observances, contact me ASAP to make appropriate arrangements. For other absences, contact me (beforehand if possible, if not, then as soon as possible afterward) to arrange for missed assignments. Be prepared to document the reason for your absence and how it falls under the excused absence policy. Simply taking a long weekend or extended vacation is not acceptable as an excused absence, and in these instances, you may not be allowed to make up the missed assignments.

Academic Integrity

The University of Maryland has a nationally recognized code of Academic Integrity, administered by the Student Honor Council (See http://www.shc.umd.edu/ for details). These standards will be upheld in this class, and there will be zero tolerance for academic dishonesty. All cases will be referred to the Honor Council.

In a course such as this, the most common type of dishonesty is plagiarism. Although discussion and group work is encouraged on the assignments, each student is expected to contribute his or her fair share of work. Furthermore, when writing up the assignments, you must do so independently and in your own words. **Do not copy from classmates or from published sources (including information on web sites).** In certain situations, quoting a phrase from published work is acceptable, but it should be relevant information, and it should be explicitly cited as a quote from another source.

For minor plagiarism offenses, a two-strike policy will be adopted. The first offense will result in a zero for the entire assignment. A second offense will be referred to the Student Honor Council.

For cases in which two papers have the same answers, it is not possible to determine who copied from whom, so both students will be considered to be responsible, and both will receive a strike and the relevant punishment. In other words, don't let someone else copy from your work, because you may be punished for it as well.

The instructor reserves the right to refer even minor cases of plagiarism to the Student Honor Council.

Schedule

The following table provides the baseline schedule for the course. It includes the lecture schedule and topics, the dates for homework assignments, discussions, and the midterm and final exam. It also contains the reading assignments (NCC refers to *Night Comes to the Cretaceous*, ECP refers to *The Essential Cosmic Perspective*). You should at least skim the readings before the lecture. You will need to have read them for the homework assignments.

ASTR 220 Syllabus
Fall 2006

#	Date		Lecture Topic	Reading	Due
1	Aug	31	Introduction		
2	Sep	05	Background and Terminology	ECP Ch. 4	
3		07	Scientific Method, Survey of collisions		
4		12	Syllabus info, Formation of the Solar System	ECP Ch. 6 *Syllabus*	
--		13	***Last Day to drop class without a "W"***		
5		14	Formation of the Solar System (Cont.)	ECP Ch. 9	
6		19	Moon formation theories	NCC Ch. 1-2	HW 1
7		21	Cratering physics	NCC Ch. 3	
8		26	**In-class activity**: Cratering experiment	NCC Ch. 4	**(CSS 1109 or 1220)**
9		28	Impacts as tools for study	NCC Ch. 5	Activity Worksheet
10	Oct	03	Collisions in the solar system	ECP Ch. 7	
11		05	Deep Impact at Comet Tempel 1	NCC Ch. 6	HW 2
12		10	**In-class activity**: Hollywood's impacts	NCC Ch. 7	
13		12	Observed impacts: Tunguska and SL9	NCC Ch. 8	Activity Worksheet
14		17	Geology background	NCC Ch. 9	
15		19	**Midterm**		
16		24	Alvarez theory – K-T crater	NCC Ch. 10	
17		26	Alvarez theory – K-T and other mass extinctions	NCC Ch. 11	HW 3
18		31	**In-class activity** – Video and discussion	NCC Ch. 12-13	
19	Nov	02	Impact risk today		Activity Worksheet
20		07	Principles of light	ECP Ch. 5	
--		08	***Last Day to drop class***		
21		09	Stellar structure and activity	ECP Ch. 10	HW 4
22		14	Stellar evolution: Low mass stars	ECP Ch. 11-12	
23		16	Stellar evolution: High mass stars	ECP Ch. 13	
24		21	Stellar collisions and interactions		
--		23	*Thanksgiving Break*		
25		28	Galactic structure	ECP Ch. 14	HW 5
26		30	Distance scales, Hubble Law and the Big Bang	ECP Ch. 15	
27	Dec	05	Galactic collisions and AGN		
28		07	Dark matter	ECP Ch. 16	HW 6
29		12	The fate of the universe	ECP Ch. 17	
--	Dec	18	**Final Exam** 10:30am-12:30pm, CSS 2400		