

PtyS 596

Impact Cratering Seminar

Spring 2008

Instructor: **H. J. Melosh—Kuiper Space Sciences 429 E**

Tel. 621-2806

Class Schedule: Tuesday and Thursday 2:00 to 3:15 pm, Space Sciences Room 308

Course Description:

This is a one-semester, 3 unit graduate course that offers an in-depth description of the process of Impact Cratering and its application to the terrestrial planets and moons. Principal topics will be: Physics of the impact process, Geologic structure of individual craters, Statistics of cratered landscapes, Impact cratering and solar system evolution (origin of the planets, origin of the moon, early evolution of the Earth and planets), Impacts and Earth history (K/T impact, biologic extinctions), Impacts and the ejection meteorites from major planets. Course work will include a hands-on exercise in impact modeling using numerical methods. Text: Impact Cratering: A Geologic Process (available in PDF format).

Lectures will be principally by the instructor, but occasionally local experts will be tapped for presentations. Regular reading in the text and adjunct materials will be assigned.

Lecture Content:

Jan 17: History of impact crater studies

Jan 22: Prelude to impact: Stress waves in solids

Jan 24: The beginning of impact: Contact and compression stage

Jan 29: Expansion of the shock wave and impact metamorphism

Jan 31: Formation of the excavation flow and opening of the crater

- Feb 5: Ejection and ejecta deposits
Feb 7: Impact spallation: ejection of rocks from asteroids and planets
- Feb 12: Impact vapor plumes and chemical alteration of ejecta
Feb 14: Scaling of crater dimensions
- Feb 19: Crater morphology: Simple craters
Feb 21: Crater morphology: Complex craters
- Feb 26: Crater collapse and modification
Feb 28: Giant impact craters: Rings and basins on silicate and icy bodies
- March 4: Modeling impact craters: Basics of numerical simulation
March 6: Modeling impact craters: Impact crater hydrocodes, equations of state
- March 11: LPSC Houston: class rescheduled: The SALE hydrocode
March 13: LPSC Houston, class rescheduled: Hands-on exercise in numerical modeling
- March 18: Spring Break, no class
March 20: Spring Break, no class
- March 25: Cratered landscapes: Populations
March 27: Cratered landscapes: Evolution of crater populations
- April 1: Regolith formation and evolution
April 3: Impact/atmosphere interactions: Crater clusters, atmospheric erosion
- April 8: Impacts and the growth of planetesimals
April 10: Origin of the Moon by giant impact: Early ideas
- April 15: Origin of the Moon by giant impact: Current thinking
April 17: Late heavy bombardment, Moon and Earth
- April 22: Impacts the destroyer: Biological extinctions
April 24: Impacts the creator: The origin of and spread of life
- April 29: Are asteroid impacts a serious hazard to civilization?
May 1: The Big Three impact craters: Vredefort, Sudbury and Chicxulub
- May 6: Economic benefits from impact cratering

Grading Policy:

Grades are determined by class participation and a short (3-5 page) paper on a relevant topic of interest to the student. Class discussion and interruptions (within reason!) are encouraged.

Grades are assigned on the S, P, C, D, E system.

Attendance Policy:

This is a seminar course, so attendance is optional. But remember that your grade will depend on participation, so please do not skip too many classes.

Text:

The text for this class is Melosh, "Impact Cratering: A Geologic Process". Although this book is out of print and nearly impossible to obtain, I will provide a PDF copy to all class participants.

Significant Dates:

First Class: Thursday, January 17, 2:00 to 3:15 pm
LPSC conference (most of us will be away), March 10-14
Spring Break, March 15-23
Last Class: Tuesday, May 6, 2:00 to 3:15 pm