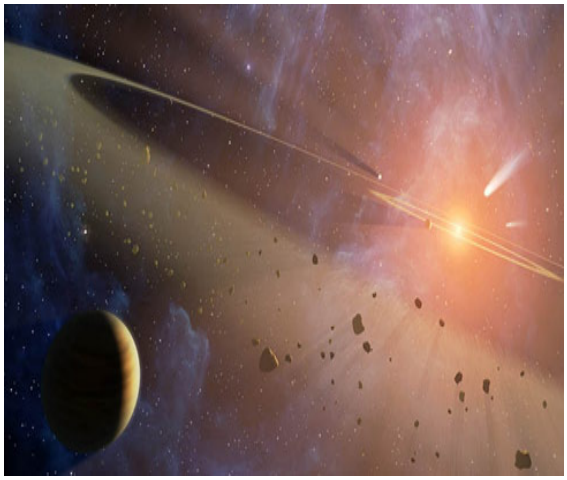
M 285: Origin and Evolution of Solar Systems

Spring 2010 syllabus



M285 is offered jointly by the Departments of Physics and Astronomy and of Earth and Space Sciences in a new, 2-quarter format during Winter and Spring of 2010. The course is intended for graduate students who are interested in the origins of planetary systems and the history of our Solar System. Advanced undergraduates and postdocs are welcome to participate as well.

Instructors: Prof. Brad Hansen, hansen@astro.ucla.edu, PAB 3-913
Prof. Jean-Luc Margot, jlm@ess.ucla.edu, Geology 5642

Course Goals:
1) To provide the background needed to understand and/or participate in research related to the formation and evolution of the solar system and of other planetary systems.
2) To describe the star/planet formation process and subsequent evolution of planetary systems by integrating observations and theory.
3) To foster interdisciplinary knowledge and communication among P&A, ESS students and faculty.

Format: The course will consist of lectures by the instructor and/or guests, as well as discussions of current literature. Additionally, each student will present a review and lead a discussion of a topic of their choice. Some problem sets may be assigned.

Schedule: Lecture TR, 2:00 – 3:20 pm, GEOLOGY 5644.

LECTURE SCHEDULE- SPRING QUARTER

Week	Date	Topic	Who
1	03/30 04/01	From dust to planetesimals: particle-gas dynamics, drag regimes, mid-plane settling, grain growth, radial drift, growth from dust to cm-sized and m-sized particles, formation of 1-10 km planetesimals, Goldreich-Ward process, planetesimal formation in turbulent disks.	BH BH
2	04/06 04/08	From planetesimals to planets: pairwise accretion, Hill radius, gravitational focusing, dynamical friction, orderly growth, runaway growth, oligarchic growth, terrestrial planet formation, gas giant planet formation.	BH BH
3	04/13 04/15	Astronomical context, protoplanetary disk structure. Planetesimal formation, terrestrial planet formation.	JLM JLM
4	04/20 04/22	Exoplanet search techniques, census and statistical properties.	BH BH
5	04/27 04/29	Planetary atmospheres, evolution of gas giants.	BH BH
6	05/04 05/06	Planetary dynamics: two-body problem, perturbation theory. Dynamical evolution of planetary systems: secular perturbations.	JLM JLM
7	05/11 05/13	Dynamical evolution of planetary systems: resonances Nice model debate	JLM JLM
8	05/18 05/20	Dynamical evolution of planetary systems: migration, stability. Planetary interiors, planetary structure, gravity, tides.	JLM JLM
9	05/25 05/27	Planetary thermal evolution, planetary magnetic fields. Student presentations	
10	06/01 06/03	Student presentations Student presentations	

Useful references:

Astrophysics of Planet Formation, Philip Armitage, Cambridge Univ. Press, 2009
Accretion Processes in Star Formation, Lee Hartman, Cambridge Univ. Press, 2008
Physics and Chemistry of the Solar System, 2nd Edition, J. S. Lewis, 2004
Treatise on Geochemistry, Vol. 1 – Meteorites, Comets, and Planets, ed. A. Davis, 2004
Meteorites, a petrologic-chemical synthesis, Robert T. Dodd. 1981
Meteorites, a petrologic, chemical and isotopic synthesis, Robert Hutchinson 2004
Meteorites: Their Record of Early Solar-system History, John Wasson, 1985
Chondrites and the protoplanetary disk, Astronomical Society of the Pacific, 2005
Chondrules and the protoplanetary disk, Cambridge Univ. Press, 1996
Protostars and Planets V, U. of Arizona Press, 2007
Protostars and Planets IV, U. of Arizona Press, 2000
Protostars and Planets III, U. of Arizona Press, 1993
Meteorites and the Early Solar System, U. of Arizona Press, 1988
Meteorites and the Early Solar System II, U. of Arizona Press, 2006
Solar System Evolution: A New Perspective, 2nd Edition, S. Ross Taylor, 2001
Planetary Interiors, Bill Hubbard, 1984