Instructor: Eric Gaidos (gaidos@hawaii.edu 956-7897)
Time and location: MWF 12:30 PM, POST 702
Credits: 3 (lecture)
Prerequisites: ASTR 430 or GG 466 (or equivalent), or permission of instructor

Content: How did the Earth and other planets form? How common are planets around other stars, and what are their properties? Can other planets support life and how would we detect it? These questions are at the forefront and interface of the earth, space and life sciences. Material in this course will be presented through the three observational "windows" through which almost everything has been learned in this field: measurements of early events recorded in Solar System bodies and materials; astronomical observations of the process of star and planet formation; and characterization of planets around other stars. Theory will be introduced at the appropriate times and in the appropriate measure throughout the course.

Student learning objectives: (1) gain a broad understanding of the current state of fundamental knowledge of the formation of the Solar System and planets around other stars; (2) refine skills of critically analysis of the very recent, relevant scientific literature; (3) develop scientific expository writing skills.

Course structure: The course is divided into three parts. The first part (3 weeks) will be an intense introduction to the theory of Solar System formation as understood through its current physical and chemical structure, the record provided by meteorites, and observations of young stellar systems. The second part (9 weeks) will consist of a series of podcasts and lecture notes on cutting-edge topics from several conferences and laboratories that the instructor will be visiting (including interviews with the investigators involved with the research), (live) guest lectures, and work on individual writing projects. In the third part (4 weeks), the focus will be on extrasolar planet detection, characterization, and an emerging theory of the diversity of planetary systems of which our Solar System is but one interesting example.

Student writing project: Each student will select a manuscript on planet formation, evolution, or detection that has appeared in preprint form and has been submitted or accepted for publication in a peer-reviewed journal, but has not yet appeared. The student will write a brief summary of the paper for a broad scientific audience that places it in the context of the problem(s) being addressed, other work that has been done, and future directions. The style, level and scope of the article will be that of a "Perspective" article in *Science*. The student will select a paper by the end of the third week, and, in online consultation with the instructor, identify and read that and other relevant literature. The student writes a rough draft of the article, with extensive online feedback from the instructor, by the end of the twelfth week. A final draft will be due by the end of the course. Student articles will appear in the online *Planetary Science Research Discoveries* when the manuscript in question is accepted for publication (www.psrd.hawaii.edu)

A **draft schedule** follows:

			Instructor	Topic
AUGUST	M	24	EG	Physical and chemical structure of the Solar System
	W	26	EG	Extraterrestrial materials and their classification
	F	28	EG	Chronology and short-lived radionuclides, isotopes
	M	31	EG	Thermal and chemical events in parent bodies
SEPTEMBER	W	2	EG	Interstellar medium and star-forming regions
	F	4	EG	Protostellar disks
	M	7	HOLIDAY	
	W	9	EG	Debris disks
	F	11	EG	Brown dwarfs and the end of the main sequence
	M	14		Guest lecture 1
	W	16		
	F	18	EG	Podcast 1: Report from Barcelona Exoplanets Meeting
	M	21		Guest lecture 2
	W	23		
	F	25	EG	Podcast 2: Report from Bordeaux Observatory
	M	28		Guest lecture 3
	W	30		
OCTOBER	F	2	EG	Podcast 3: Report from Institute d'Astrophysique Paris
	M	5		Guest lecture 4
	W	7		
	F	9	EG	Podcast 4: Report from DPS Meeting in Puerto Rico
	M	12		Guest lecture Jonathan Wiams: Short-Lived Radionuclides
	W	14		
	F	16	EG	Podcast 5: Report from Carnegie Institute of Washington
	M	19		Guest lecture 6
	W	21		
	F	23	EG	Podcast 6: Report from Exoplanets meeting in Porto, Portugal
	M	26		Guest lecture 7
	W	28		
	F	30	EG	Podcast 7: Report from Copenhagen University (tentative)
NOVEMBER	M	2		Guest lecture 8
	W	4		
	F	6	EG	Podcast 8: Report from University of Geneva (tentative)
	M	9		Guest lecture 9
	W	11	HOLIDAY	
	F	13	EG	Podcast 9: Report from the Vatican Observatory, Rome
	M	16	EG	Radial velocity detection and planet statistics
	W	18	EG	Astrometry
	F	20	EG	Transits and transit timing
	M	23	EG	Microlensing
	W	25	EG	Direct detection
	F	27	HOLIDAY	
	M	30	EG	Terrestrial planet formation
DECEMBR	W	2	EG	Giant planet formation
	F	4	EG	Planetary composition and structure
	M	7	EG	Planetary volatiles and atmospheres
	W	9	EG	Astrobiology
	F	11	EG	Wrap-up discussion

Grades: Attendance and participation: 20%
Problem sets: 30%
"Perspectives" article: 50%

Textbook: There is (as yet) no authoritative book on extrasolar planets, and any such book would rapidly become dated. Students might arm themselves with a copy of *Protostars and Planets V* (University of Arizona Press) if they plan to continue in the field.