PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

DEPARTMENT: Physics  EFFECTIVE SESSION:

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

☑ 1. New course with supporting documents
☐ 2. Add existing course offered at another campus
☐ 3. Expiration of a course
☐ 4. Change in course number
☐ 5. Change in course title
☐ 6. Change in course credit/type
☐ 7. Change in course attributes (department head signature only)
☐ 8. Change in instructional hours
☐ 9. Change in course description
☐ 10. Change in course requisites
☐ 11. Change in semesters offered (department head signature only)
☐ 12. Transfer from one department to another

PROPOSED:

Subject Abbreviation: ASTR  Existing:

Course Number: 36200  Course Number:

Long Title: Exoplanetary Environments  Short Title: Exoplanetary Environments

TERMS OFFERED:

Check All That Apply:
☐ Summer  ☑ Fall  ☑ Spring

CAMPUS(ES) INVOLVED:
☐ N. Control  ☐ Cont Ed  ☐ Tech Statewide
☐ Ft. Wayne  ☑ Indianapolis

Subject Abbreviation:  

Course Number:  

Credit Type: 

1. Fixed Credit: Cr. Hrs.  
2. Variable Credit: Range:  
3. Equivalent Credit: Yes  No

COURSE ATTRIBUTES:

Check All That Apply:
☐ Pass/Not Pass Only
☐ Satisfactory/Unsatisfactory Only
☐ Repeatable
☐ Maximum Repeatable Credit:
☐ Credit by Examination
☐ Fees  ☐ Coop  ☐ Lab  ☐ Rate Request

Schedule Type: 

Lecture  Recitation  Presentation  Laboratory  Lab Prep  Studio  Distance  Clinic  Experiential  Research  Ind. Study  Pract/Observ

Cross-Listed Courses

This course intended for physics or engineering majors. Recent observations from astronomical satellites and spacecraft will be used to discuss the solar system and the physical processes responsible for its formation and evolution.

Prerequisites: MA 16400 or MA 16600 and PHYS 22000 or PHYS 15200 with a grade of 2.0 or better. Students with less than a 2.0 may be enrolled with the instructor or department chair's permission.

COURSE OUTCOMES

Students will understand the physics of the gravitational, thermal and radioactive decay processes shaping the diverse collection of bodies within the influence of the Sun.

Students will appreciate how knowledge of exoplanetary systems is developed by analogy with the Solar System.

Column:

Department Head  Date  Column School Dean  Date

Ft. Wayne Department Head  Date  Ft. Wayne School Dean  Date

Indianapolis Department Head  Date  Indianapolis School Dean  Date

North Central Faculty Senate Chair  Date  Vice Chancellor for Academic Affairs  Date

West Lafayette Department Head  Date  West Lafayette College/School Dean  Date  West Lafayette Registrar  Date
ASTR 36200 Tentative Syllabus Fall 2014
Modeling Exoplanetary Environments

Instructor: Stephen Gillam
Office: KT122A
Office Hours: TBD
Class room: TBD
Textbook: None

In this calculus-based course, we will build a model of the environment of earth-like exoplanets by extrapolation from recent observations of the solar system from astronomical satellites and space missions. We will use these to discuss the physical processes responsible for exoplanet formation and evolution. The roles of hydrostatic equilibrium, orbital dynamics, gravitational tidal forces, radioactive decay, and heat flow in shaping exoplanetary surfaces and atmospheres will be discussed. This course will make extensive use of spacecraft images.

You will be required to read selected journal articles and discuss them in class.

Prerequisites

MA16400 (Integrated Calculus and Analytical Geometry II, honors) or
MA 16600 (Analytical Geometry and Calculus II)

and

PHYS 22000 (Mechanics, heat, and sound for non-physics majors) or
PHYS 15200 (Mechanics)

The minimum grade for each is 2.0.
You may be admitted to the course with the instructor’s agreement.

Tentative Schedule of Topics

Finding Extrasolar Earths.
   How many stars like the sun are there in the Milky Way?
   What properties must a Sun-like star have to support Earth-like planets?
   The solar and galactic “Goldilocks” zones.
   Can we detect Earth-like planets?

Formation of Terrestrial planets
   Results from the Messenger mission to Mercury, the Magellan Venus orbiter, GRAIL, and Earth-orbiting satellites will be used to discuss the formation and processes shaping Earth-like, and Venusian planets.
Results from the Spirit and Opportunity rovers on Mars, and from the Mars Reconnaissance Orbiter will be used to model Mars-like planets. We will discuss
  The occurrence of water and life on such a planet,
  Carbon dioxide geysers,
  Cyclic atmospheres, climate and weather.

Asteroid Belts
  Dawn Mission observations of Cere and Vesta will guide discussion of extrasolar asteroids.

Asteroids interactions with terrestrial planets.
  Effects on planet formation and development of life.

Modeling the Environment of a Jupiter-like Planet
  Rings
  Plasma tori
  Aurorae
  Resonances and land tides on inner moons

Modeling a Saturn-like Planet, using results from the Cassini-Huygens Mission
  Rings and shepherding moons
  Atmosphere, climate, and weather
  Titan-like moons with hydrocarbon lakes, dunes and rain
  Gravitational tidal heating of rocky moons (plumes, hotspots and geysers)
  Radioactive heating and surface deformation

Extrasolar Kuiper- Belts
  What would they contain?
  Can we observe these?

Comets
  Can we detect extrasolar comets? We will use the following spacecraft flybys to explore this question.
    Borrelly from Deep Space 1
    Hartley 2 from the EPOXI flyby
    Wild 2 from the Stardust Flyby
    Tempel 1 from the Deep Impact and Stardust NExT Flybys

Homework
This will consist of a semester-long project to build a numerical model of a gas giant planet atmosphere.

Observational Project
This will be a planetary astronomy observational project, using the IPFW Physics Dept. 8-inch remotely operated telescope.
**Grading**  
Class Participation 15%  
Midterm 20%  
Final 20%  
Project 15%  
Homework 30%  

Class participation means discussing the assigned reading. You will take turns leading the discussion.