Saturday Enrichment Program: Winter 2015
Alien Worlds

Instructor: Kristen Garofali

Course Description

To date astronomers have discovered well over 1000 confirmed exoplanets-- planets orbiting stars other than our own Sun--and predict that there could be as many as 100 billion "habitable" Earth-sized planets orbiting stars slightly smaller than our Sun in the Milky Way galaxy alone. In order to understand more about these alien worlds we will first explore the planets and moons in our own Solar System before moving on to the methods used to detect and characterize far-away exoplanets. With this knowledge we will be able to identify which alien worlds, from those portrayed in movies to those recently discovered by astronomers, are potentially capable of harboring life.

Essential Questions

How do we detect and characterize exoplanets?
What factors determine if an exoplanet is likely to be habitable?
How is habitability of alien worlds portrayed in popular shows and movies versus how scientists view habitable exoplanets?
How common are habitable exoplanets and what does this mean for our search for intelligent life on other worlds?

Learning Outcomes:

Students will learn how astronomers are capable of detecting far-away exoplanets, and how missions like *Kepler* have been revolutionary for exoplanet studies. In addition, they will learn the kinds of follow-up observations that are necessary to characterize an exoplanet-star system. Ultimately, this will help the student understand what factors determine habitability for an exoplanet. Students will be able to determine if "habitable" worlds in science fiction truly pass an astronomer's criteria for habitability and which of the many recent exoplanet discoveries are more likely to be "Earth twins." In the end, students will understand what the prevalence of nearby worlds means for our search for life (intelligent or otherwise) on other worlds.

Instructional Strategies

Since we cannot yet visit any alien worlds outside of our solar system, detecting and characterizing these worlds requires both critical thinking and creativity. Students will take the concepts introduced in short power-point lectures at the beginning of class and expand upon them through a combination of hands-on and discussion based activities. These activities will challenge students to construct models, perform rough calculations, and interpret results, just as astronomers do.

Student Assessment

This class will be orientated around the in-class activities; no formal homework will be assigned. Instead students will be assessed through their engagement in class work and their ability to contribute to class discussion by asking questions. Feedback will be given on in-class assignments.

Resources and Materials

- Scientific calculator
- Pen or pencil
- Scratch paper

Tentative Course Schedule

Date	Topic(s)	In-Class Activities
January 23	Introduction to the Solar System	Alien Worlds in the Solar System
January 30	Exoplanet Detection Techniques: Radial Velocity & Transit Method	Building a Transit
February 6	Exoplanet Interiors & Atmospheres	Atmospheric Escape
February 20	Exoplanet Host Stars	Looking Through Alien Eyes
February 27	The Habitable Zone	Crash Landing!
March 5	Alien Worlds in Science Fiction	The "Habitable" Worlds of Sci-Fi
March 12	Exoplanet Discoveries: Today and Beyond	Mission Planner: Finding Earth's Twin
March 19	SETI	A Message From Earth