Mars for Earthlings

# LESSON 21: Kepler

***In-Class Activity 1***

*Seeing like Kepler*

**Purpose**: Understand how Kepler locates planets outside our solar system.

**Searching for Exoplanets**

Observe the orrery demonstration by your instructor

1. You need to detect a planet, thousands of light years away, orbiting its star. What problems inhibit this detection? List at least 3.

2. How might you overcome these issues?

**Determine a Detection Method**

Utilizing the help of a few students around you, develop a detection method for observing and studying exoplanets. Explain your detection method and the instruments you will use below (you may do some outside research or consult your instructor to help guide your ideas).

**Finding Exoplanets in the Habitable Zone.**

1. Navigate to the following link: http://kepler.nasa.gov/multimedia/Interactives/keplerFlashAdvDiscovery/?CFID=9187896&CFTOKEN=28729865 . Follow simulation instructions and record the following:
    a. Choose and record the star system you are observing.

    b. Manually record and make calculations throughout the simulation below:

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c. At the end of the simulation, what kind of planet did you find? The programs offers an "artist's rendition" of the planet surface. What does it look like?

d. Determine if your star system has a planet in the habitable zone. Explain the reasoning for why the planet is or is not in the habitable zone.

2. From your experience in the Kepler simulation, what is the habitable zone and how does it relate to Earth? What criterion makes a zone "habitable"?

3. Explain the "transit method" of detecting planets below.

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***Homework 1***
Detecting Planets_MFE
*Light Grapher*

***Directions***

1. Go to: http://kepler.nasa.gov/education/ModelsandSimulations/lightgrapher/

2. Read over the webpage for context.

3. Briefly describe the principle(s) being used in order to locate planets.

4. Read through the directions and hints.

5. Run the program at least 3 different times. For each iteration, change the parameters by trying different methods of interaction with the camera, objects, sizes of objects, spacing of objects from camera, light source, etc. Report each iteration as follows as in the example below.

   Ex:
   **Iteration #1**
   **Parameters Used:**
   **Outcomes** (describe the graph and cut/paste images you capture)**:**

6. From your different iterations, what did you learn about the objects? Did the size, color, transparency, or opacity matter?

7. Consider the planet Mars (typically red-tones) and a planet like Neptune (lighter blue colors). If you were to pass it in front of the webcam which planet would yield a greater change in light? Explain your reasoning.

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***Homework 2***
Missions Outside our Solar System_MFE
*Planet Hunters*

***Join Planet Hunters***

1. Navigate to: http://www.planethunters.org. Register, and begin planet hunting by following the online tutorial.
2. What method is *PlanetHunters* using to detect planets?

3. What role do you play? Will people use your findings? Why or why not?

***Classifying the star***

4. What types of stars might you encounter? How do you discern the differences with the data provided? Draw examples of each star and the data they provide.

5. Draw below what a planet transit looks like below. From your observations, have most of the stars had a planet transiting? What does this tell you? Would it be possible for a star to have a planet but have an apparent transit?