Robogals Science Challenge

Minor Challenge Set #2
STEM Field: Physics
Level: Intermediate / Senior
Challenge Name: Explore Exoplanets
Project Cost: 0-20 USD
Materials Required:

- Laptop / tablet with access to internet

Duration:

- The challenge takes approximately 1-2 hours to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules.

Introduction:

Exoplanets are planets that orbit around other stars. Astronomers study exoplanets as some have similar properties to Earth, and it is possible that some exoplanets may also host life.

So far, scientists and engineers at NASA have confirmed over 5000 discoveries of exoplanets to date! You can check out more information on the exoplanets, for example, how they are found and characterised, and the scientists involved in the mission here: https://exoplanets.nasa.gov/discovery/exoplanet-catalog/

In this challenge, you will be trained to use the very same techniques that scientists use every day in the hunt for exoplanets. You will use these tools to find compatible homes for a few different aliens.

You will learn about:

- **Transit method** to identify stars that seem to have planets orbiting them. This allows you to calculate the planet's volume.
- **Radial velocity method** to estimate the planet's mass and density. This allows you to determine if the planet has a rocky surface.
- **Identify the atmospheric composition** of the planet, which contains clues on the planet's temperature. If a planet is just the right temperature, it could contain liquid water - an important ingredient for life.
- Place **Habi-tags** on the planet and make a decision of where to send the aliens.

Instructions:

1) On your Chrome or Firefox browser, click on the link below to access Exoplanet Lab - https://www.pbs.org/wgbh/nova/labs/lab/exoplanet/. Then, click on the 

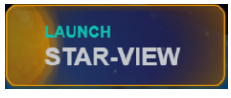
button to start playing.

   Note: You can register for an account to save your progress. Otherwise, you can click on 

button to access.

2) Click on the 

to watch the introductory video.

3) When you have finished watching the videos, you will be taken to another screen. Click on the 

to start your training.

4) As you work through the training videos, there are some multiple-choice questions to test your knowledge. An example is shown in the figure below.

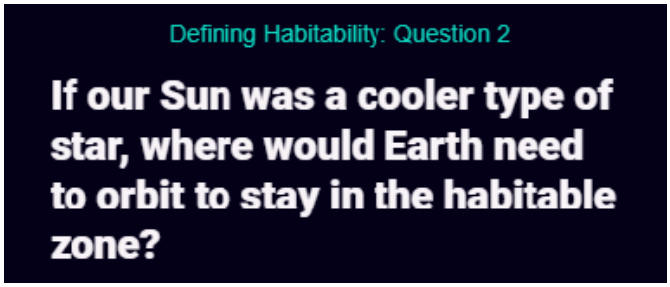


Figure 1 - Question from the training module in Exoplanets Labs

5) If you are stuck, click on the  button at the bottom right of your screen for some hints.

6) Complete the first mission by finding a compatible home for Plantae - sentient photosynthetic creatures. When you have completed the mission, take a screenshot of the screen, similar to the figure below.

Figure 2 - Mission Accomplished screenshot for mission 1

7) Congratulations! You have successfully unlocked all the tools available. Complete mission 2 where you will find a compatible home for Daysiders and Nightsiders. Don't forget to take a screenshot of your accomplishment!

Figure 3 - Mission Accomplished screenshot for mission 2

8) Finally, Earth's cats are seeking another Earth-like planet. Complete mission 3 and take a screenshot of your accomplishment.

Extension

If you enjoy this activity, work through three more Bonus Missions, featuring Cala Mari, Flatuencie, and Li Chen. Cala Mari is looking for a water world, Flatuencie is looking for a gaseous planet, and Li Chen needs a planet with very little oxygen in its atmosphere.

Reflection Questions:

- Are there any improvements you would make to this challenge? Was this challenge easier / harder than you expected?

- From mission 3 or from your own research, what three characteristics would make an exoplanet Earth-like?
- Can you list 3-5 variables that determine if a planet is habitable?
- What characteristics did you look for to determine whether an exoplanet might be suitable for a particular alien species?

Submission Guidelines:

- Submit screenshots of your completed missions. Include a short summary that addresses the reflection questions.

> Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your parent or guardian first.

- The submission form is on the Minor Challenges page: https://sciencechallenge.org.au/index.php/minor-challenges/ Fill out the details and make sure you upload your submission.

Learn More! Resources:

- Learn more about the tools and techniques that scientists use in their search for signs of life on distant planets in this video - https://www.pbslearningmedia.org/resource/nvnw-sci-spectra/using-light-signatures-in-the-search-for-alien-life-nova-wonders-are-we-alone/

- This video features astrophysicist Jason Kaliria who observes stars and searches for habitable planets - https://www.pbs.org/wgbh/nova/video/profile-jason-kalirai/

Bibliography:

- *The exoplanet lab* (no date) *PBS*. Public Broadcasting Service. Available at: https://www.pbs.org/wgbh/nova/labs/about-exoplanet-lab/ (Accessed: April 10, 2023).
- *What is an exoplanet?* (2022) *NASA*. NASA. Available at: https://spaceplace.nasa.gov/all-about-exoplanets/en/ (Accessed: April 10, 2023).