HABITABLE MOONS AROUND GAS GIANT EXOPLANETS. Peter Santana[1], Jose Colón[2], and Abel Méndez[3]. [1]Department of Electrical and Computer Engineering, University of Puerto Rico at Mayagüez, (peter.santana@upr.edu). [3]Department of Mechanical Engineering, University of Puerto Rico at Mayagüez, Mayagüez, PR, USA (jose.colon79@upr.edu). [1]Planetary Habitability Laboratory, University of Puerto Rico at Arecibo, Arecibo, PR, USA (abel.mendez@upr.edu).

The detection and characterization of the first potentially habitable moons around gas giant exoplanets is one of the goals of the exoplanetary science community [1]. In the future, observatories based on the ground and space will need to focus their observations in the stellar systems of interest for a more effective search of these moons. The main goal of this project is to identify those stellar systems that are more suitable and prone to host habitable exomoons.

Some of the variables that are essential for habitable moons are a source of energy, a temperate climate, and orbital stability. This study is focused on the orbital stability of moons around gas giant planets in the habitable zone, especially those in elliptical orbits.

We used the orbital integrator Mercury6 [2] to explore the orbital stability of large moons around Jupiter-sized planets in the habitable zone. This orbital integrator runs on a Fortran compiler and has been heavily utilized in the past many others to study the orbital analysis and collisions of planetary bodies within our solar system. In order to feed Mercury6 with our planetary data, an algorithm in Python was created with the capability of generating a series of random exomoons around know gas giants in the habitable zone. The python algorithm was creatively named the Random Moon Generator (RMG).

The output data from Mercury6 is being graphed to represent the semi-major axis as a function of time. A constant sinusoidal pattern should be observed for stable orbits (Figure 1). If the graph only shows the semi-major axis increasing with time, it would imply the moon has left its orbit (it is possible that the moon becomes stable afterwards).

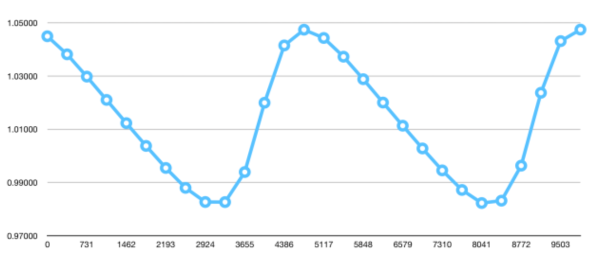

Figure 1. Sample semi-major axis versus time in days for a random generated moon in a stable orbit around a gas giant planet.

A 3D simulator in Java was created in order to have a visual representation of the systems (Figure 2). In this simulation the movement of the planet around the star as well as the movement of the exomoons around the planets are animated.

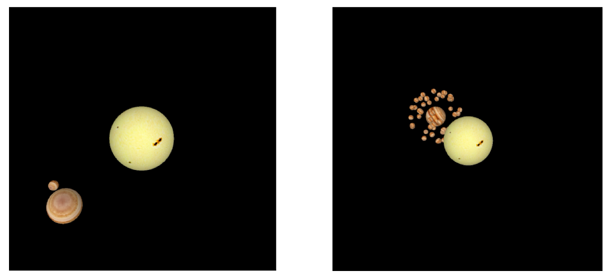

Figure 2. Sample Java 3D simulations of a planet with one or many non-interacting exomoons with random initial orbital parameters.

We are currently setting the initial simulations for known planetary systems with gas giants in the habitable zone. Our poster will present the results of these simulations.

Acknowledgments: Simulations used MERCURY6 (https://github.com/rsmullen/mercury6_binary). Planetary data was provided by the Planetary Habitability Laboratory and the Jet Propulsion Laboratory.

References:

[1] Hinkel, N. R., & Kane, S. R. (2013), *ApJ*, **774**, 27.

[2] Chambers, J. E. (1999), *MNRAS*, **304**, 793.