HABITABILITY OF A HYPOTHETICAL EXOMOON OF THE CIRCUMBINARY PLANET KEPLER 1647 b Z. E. González[1], J. I. Zuluaga[1] and P. A. Mason[2]. [1]Asociación Multidisciplinaria de Estudios en Biología y Astrobiología (AMEBA), Solar, Earth and Planetary Physics Group (SEAP), Instituto de Física – FCEN, Universidad de Antioquia, Calle 70 No 52-21, Medellín, Colombia, zusi.gonzalez@udea.edu.co, jorge.zuluaga@udea.edu.co , [2]New Mexico State University – DACC, Las Cruces, NM, 88003, USA, pmason@nmsu.edu.

Introduction: Kepler 1647 b is the most massive circumbinary. The planet is located at 2.7 AU from the host binary star what makes it the only Jupiter-sized circumbinary planet in the Habitable Zone [4]. The binary system is made of sun-like stars in an orbit with P_{bin} ~11 days and an e ~ 0.16. The age of the system is ~ 4.4 Gyr [1]. We analyze whether the planet has an exomoon that may support surficial life. For that purpose we study the radiation flux into the planet, the magnetic protection provided by the planetary magnetic field to their moons and the tidal heating caused by the planet on any hypothetical exomoon [2, 3, 4].

Methods: We use the BHMcalc tool introduced in Zuluaga et al. (2016) to study the evolution and conditions around the binary. We study the continuous habitable zone (CHZ), the rotational evolution of the stars, the radiation evolution and plasma environment of the system, the size of the planetary magnetosphere and its evolution. The tidal effects and the relationship between magnetosphere size and lunar orbit are computed with the methods of Heller & Zuluaga. We analyze how all the previous parameters affect the hypothetical life forms on an exomoon surface. Finally, we aim at comparing it with the planetary habitable edge (HE) [2, 3].

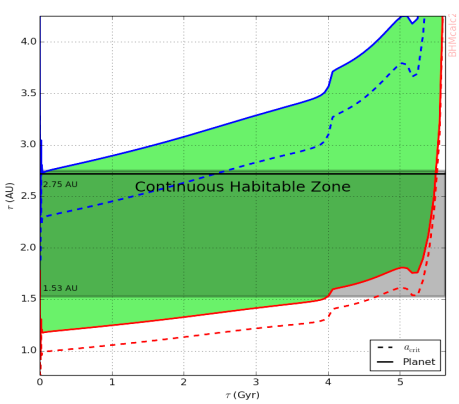

***Figure 1**: The black line indicates the distance of the planet to the stars, the shaded area is the CHZ. The planet could remain at HZ for 5.8 Gyr. The plot is obtained using BHMcalc tool.*

Results: In Figure 1 we show the CHZ for the planet at a average distance of 2.7 AU. We find that the planet will be in the Circumbinary HZ for 5.8 Gyr. This is a considerable time for the development of complex life, at least using life on Earth as an example. In Figure 2 we present the evolution of the planetary magnetosphere radius. At the current age of the system, the magnetosphere of the planet could cover several of its exomoons located up to a distance of 15 Rp, at least if they are distributed as Jupiter's and Saturn's moons. Moreover, there could be times where exomoons could be magnetically shielded up to 20 Rp. In all cases the space between the HE and the magnetosphere radius is enough to accommodate several magnetically shielded exomoons around the planet.

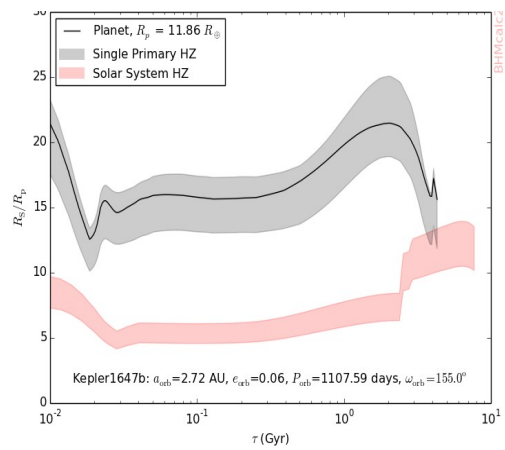

***Figure 2**: The plot shows the evolution of the magnetic shielded by the planet to the exomoon in a distance of planetary radius (Rp). It is obtained using BHMcalc tool.*

Conclusions: Kepler 1647 b is in the CHZ during a considerable time. The exomoon could be completely shielded if her semi-major axis is less of 15 Rp. The X and UV radiation environment is not a threatening factor for habitability at 2.7 AU.

References:

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