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IMPORTANCE OF UV RADIATION OF STARS WITH DIFFERENT SPECTRAL TYPES IN THE FORMATION OF ADENINE ON A POTENTIALLY HABITABLE PLANET WITH A CO_2 ATMOSPHERE

M. Z. Armas[1,2], A. Segura[2], A. Heredia[2], and C. E. González-Espinoza[3]

Prebiotic compounds have been successfully synthesized using UV radiation as a source of energy under different atmospheric compositions, temperature and catalysts (Barks et al. 2010). These works have found that UV radiation may be necessary to trigger the chemical reactions in the prebiotic stage of the Earth about 3.8 Gy. Among the most significant molecular products of these experiments (Szabla et al. 2014) are the purines (adenine and guanine) that are part of the DNA and RNA nucleotides. In the astrobiological context, chemical evolution is promoted by the photochemical reactions to raise the complexity of organic molecules in the interstellar medium, planetary surfaces, meteorites, or cosmic and planetary dust (Fornaro et al. 2013).

M dwarfs, being the most abundant stars (75%), stay long enough (10^{10} Gy) in the main sequence and emitting high amounts of UV radiation due to their chromospheric activity (Hunt-Walker et al. 2012), are important targets for the detection of exoplanets. In this work we extrapolate our studies of prebiotic chemistry simulating the conditions of a potentially habitable planet (PHP) in an environment of UV radiation from different spectral types of stars of the main sequence (G and active M dwarfs). We analyzed a known route of adenine synthesis from diaminomaleonitrile (DAMN) to assess the effect of UV radiation to trigger reactions to produce molecules of prebiotic importance in planets around M dwarfs. We use the ATMOS photochemical model to calculate the amount of UV light that would reach the surface of a PHP with an atmosphere composed of CO_2, N_2 and H_2O around a young Sun-like star and M dwarfs with different levels of chromospheric activity C1-11-Fig. 1. We obtained the UV absorption cross sections and rate constants relevant for the synthesis route using computational chemistry software. On the other hand, we made a code for the chemical reactions of the synthesis route the adenine concentration for different UV fluxes. The UV absorption coefficients calculated are in the same wavelength range where UV photons reach the planetary surface (200 nm - 300 nm), and therefore is possible that adenine molecules may be formed from the selected synthesis route.

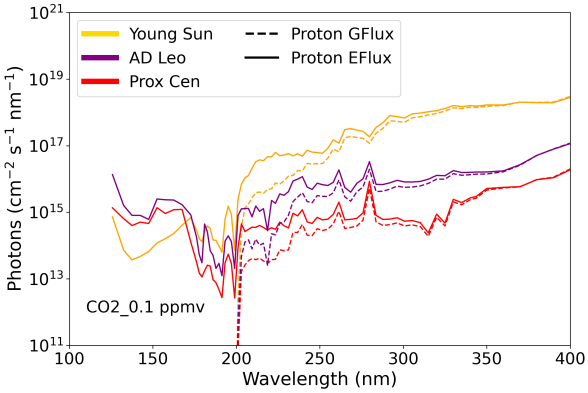

Fig. 1. UV photon flux that arrives to planets located at 1 au equivalent distance (i.e. all planets receive the same integrated energy as Earth), with atmospheres of CO_2 = 0.1 bar and N_2 = 0.9 bar. Top of the atmosphere (TOA) photons in continuous lines and photons at the surface in dashed lines.

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[1]Posgrado en Astrofísica, Universidad Nacional Autónoma de México, Av. Universidad 3000, C.U., Coyoacán, 04510 Ciudad de México. (mzulem@correo.nucleares.unam.mx).
[2]Instituto de Ciencias Nucleares Universidad Nacional Autónoma de México, CDMX.
[3]Department of physical chemistry of the Faculty of science of the University of Geneva, Switzerland.