

Surface conditions of habitable planets of different atmospheric compositions and their effect on the survival of Earth-life forms

Keywords: habitability, climate, life, evolution, biology

Short description:

Life is defined by the Darwinian evolution of self-sustaining, bounded, chemical reactions. Experimental evolution has proven to be one of the most powerful tools to study the mechanisms of evolution on Earth, but we know little about the directions that evolution may take in alien environmental conditions. In the context of the newly created Center for Life in the Universe, evolution experiments will be carried out to observe which phenotypic traits contribute to the success of microbes living in conditions found on alien planets, and their genetic basis. To perform these experiments and choose the environment in which the life form will evolve, realistic surface conditions of a habitable alien planet should be modelled.

This project therefore aims at modeling the climate of rocky planets with different atmospheric compositions (H₂ dominated, CO₂ dominated, O₂ dominated) to 1) find parameters for which the surface conditions are compatible with liquid water, 2) investigate the different surface conditions in terms of pressure and radiation to inform the evolution experiments. In the meantime, the student will help determine the practical set up design of the evolution experiments and assist two PhD students with the experiments themselves. These experiments will allow to check if life survives the simulated surface conditions, if it adapts to these new conditions, and if it adapts, what kind of gases it generates. The student will therefore have the opportunity to discover a new domain of research which will open doors to the astrobiology community.

This project will be happening in the context of the newly created Center for Life in the Universe (CVU: <https://www.unige.ch/sciences/cvu/>) and is shared between the department of Astronomy and the department F.-A. Forel for Environmental and Aquatic Sciences located at Uni Carl Vogt in downtown Geneva. The student will share time between the two departments.

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