STUDYING PLANETARY HABITABILITY AFTER A NASA ASTROBIOLOGY INSTITUTE MIRS SABBATICAL. Abel Méndez[1], [1]Department of Physics and Chemistry, University of Puerto Rico at Arecibo, Arecibo, Puerto Rico 00614 (abel.mendez@upr.edu).

The study of planetary habitability has become more important not only with climate change [1] but also with the search for habitable environments in the Solar System and extrasolar planets [2,3]. Our biosphere is not even equally distributed in our planet. In general, tropical regions are more abundant in species and diversity than higher latitudes [4]. Global latitudinal gradients are present for all species, from microorganisms [5,6] to macroorganisms [7]. Although there are many works related to planetary habitability, there is no agreement in a quantitative definition to measure habitability. Just recently, a few works are starting to propose quantitative definitions of habitability, mostly in terms of available energy [8,9,10,11]. Habitability is an essential concept that needs a practical and universal definition if we want to measure and compare planetary habitability not only in Earth but also in the Solar System and beyond. Studies about planetary habitability are one of the goals of established in the NASA Astrobiology Institute Roadmap.

On 2007 I participated in a summer sabbatical at NASA Ames Research Center sponsored by the National Astrobiology Institute Minority Institute Research Support (NAI-MIRS). This was my first formal attempt to test some ideas of how to measure habitability with experimental work. Together with Dr. Chris McKay I constructed a small device to measure microbial growth by optical density in closed liquid batch cultures. This device was used to continuously measure microbial growth under the natural daily fluctuations of temperature. I used the results of these experiments to test a habitability model of temperature in dynamic environments. Traditionally, the daily averages temperatures are taken to make similar predictions but this is not always accurate. These experiments demonstrated the practical approach of the habitability models to understand growth dynamics. From here, I generalized the models to global scales and created a framework to study planetary habitability and make predictions about the potential for life of planetary bodies (Fig. 1) [11].

Since 2000 I had been participating in NASA Astrobiology Science conferences, but it was the experience of the NAI-MIRS program the one that opened new collaborative opportunities for me. The NAI-MIRS experience definitely pushed me forward in the astrobiology field. I have been invited in various proposals and papers as co-investigator, and wrote various collaborative proposals as PI to study planetary habitability. My next goal is to organize a ***Planetary Habitability Laboratory*** (PHL), a workgroup or virtual laboratory dedicated to theoretical and experimental work related to planetary habitability. The PHL will be composed of a highly diverse team of international scientist. Various scientists already expressed interest in this idea. The formalization of the PHL can be done with a proposal for team member to the NASA Astrobiology Institute. The PHL will be complemented with a strong educational component, especially considering minority serving institutions.

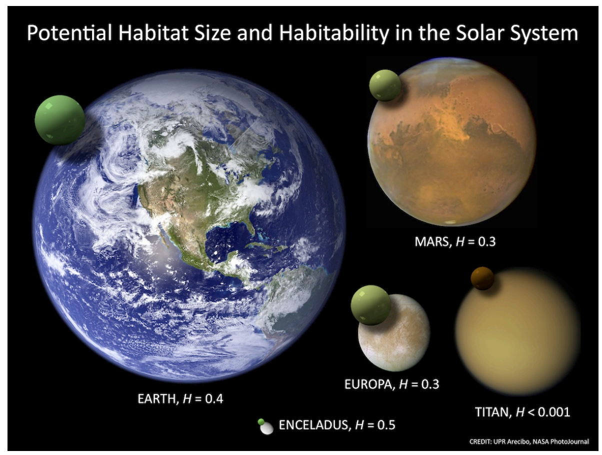

Figure 1: This image shows a comparison of the potential habitable space available on Earth, Mars, Europa, Titan, and Enceladus. The green spheres represent the global volume with the right physical environment for most terrestrial microorganisms. On Earth it includes parts of the atmosphere, oceans, and subsurface while in the other planetary bodies is limited to subsurface environments.

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