[EE] Evening Poster | B (Biogeosciences) | B-AO Astrobiology & the Origin of Life

[B-AO01]Astrobiology

convener:Hikaru Yabuta(Hiroshima University, Department of Earth and Planetary Systems Science), Seiji Sugita(Department of Earth and Planetary Science, Graduate School of Science Sciece, The University of Tokyo), Misato Fukagawa(名古屋大学, 共同), Fujishima Kosuke(Tokyo Institute of Technology, Earth-Life Science Institute)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Twenty years have passed since when the field of Astrobiology, which aims to unveil the origins, evolution, and habitability of life by integrating multidisciplinary fields, was established. Origins of Life are currently being re-conceptualized via expansion of prebiotic chemistry to systems chemistry and chemical space. Besides their relationship to life's building blocks, it is expected to demonstrate the significant roles of organic molecules in the history of planetary formation. The linkages among the variations in chemical compositions of deep-sea hydrothermal environments, geological settings, and ecological systems were systematically investigated. Cassini, which accomplished in the long-term explorations of the planets bearing liquid, had "Grand Finale" this year. Discoveries of extrasolar planets have been dramatically increased to date.

Originally, Astrobiology does not need a specific science category. We therefore aim to make this session so that Earth and Planetary scientists from all the categories join for discussing 'where we came from and where we are going' and for making novel integrated researches.

For the next stage of Astrobiology, presentations on the instrument development in space explorations, comparative studies of solar system and exoplanets, etc, will be very much welcome.

[BAO01-P11]Possible photosynthesis around M dwarfs using the database of excited states

*Yu Komatsu[1] (1.Astrobiology Center / National Astronomical Observatory of Japan)

Keywords:photosynthesis, biosignature, quantum chemistry

Assuming the life outside the Earth, the way to obtain its essential energy is crucial. In near future observations, extrasolar planets around M dwarfs will be good targets. In such an environment, it is interesting to consider the possible photosynthesis, but it has a lot of uncertainties.

Photosynthesis has changed the earth environment in the history. To extend its global effect to photosynthetic organisms outside our Solar system, identifying photosynthetic biosignatures from planetary spectra such as oxygen or surface vegetation (the vegetation red edge), is a promising tool. Even though clarifying the surface environment of exoplanets is challenging, the remote sensing detects the vegetation on the Earth.

In this study, we investigate possible photosynthesis applicable to the M dwarf environment using the quantum chemistry to accumulate the basis for future detection. As we only know the photosynthesis on the Earth, we observe intensively natural (and artificial) photosynthesis and explore the possibility in redder photoenvironment. By quantum chemistry calculations, the database is being constructed on excited states of natural photosynthetic pigments like chlorophylls and carotenoids. Since the electronic structures determine the light absorption properties, starting with natural photosynthetic pigments in a variety of conditions, artificial pigments are calculated with minor difference like the central metal, side chain or solvent as a result from another possible evolution around M dwarfs. After constructing the database, key components to absorb the longer wavelength radiation are analyzed by the dimension reduction such as primary component analysis, one of the techniques in the machine learning. The results

will be discussed in the poster.