

Extraterrestrial Life Detection Microscope

*Keigo Enya¹, Yoshitaka Yoshimura², Satoshi Sasaki³, Sohsuke Ohno⁴, Shunta Kimura¹, Hajime Mita⁵, Akihiko Yamagishi⁶, Atsuo Miyakawa⁶, Eiichi Imai⁷, Kensei Kobayashi⁸

1. ISAS, 2. Tamagawa University, 3. Tokyo University of Technology, 4. Chiba Institute of Technology, 5. Fukuoka Institute of Technology, 6. Tokyo University of Pharmacy and Life Science, 7. Nagaoka University of Technology, 8. Yokohama National University

We consider that it is one of the most important issue of space science to detect and analyze extraterrestrial life by planetary exploration of the solar system. Pioneering life detection experiments on Mars were conducted in the 1970s by the Viking mission, but could not conclude the existence of life. Since then, multiple Mars exploration missions have been carried out, but their astrobiological programs have focused primarily on the search for life-related materials and environments. It looks reasonable to focus on microorganisms rather than large organisms as a starting point of extraterrestrial life search in planetary exploration. The reasons are, the fact that the first life forms are thought to originate as microorganisms but not necessarily evolve into large organisms, as well as the density and wide distribution of microorganisms.

Considering these backgrounds, we have proposed a microscope for detecting extraterrestrial microorganisms. In particular, fluorescence microscopy using fluorescence pigments and excitation light is effective. Fluorescence pigments applied to terrestrial microorganisms exhibit fluorescence corresponding to the features of intracellular organic matter, cell membranes (including the identification of life and death activity), and catalytic reactions, which are the basis of life activity for terrestrial life. Microscopic observation of the fluorescence enables us to detect the shape of cells and to understand their biological and chemical characteristics. SYTO24, Propidium iodide (PI), SYPRO Red, etc. are selected as fluorescent dyes for this purpose.

In this presentation, we will show an introduction for fluorescence microscopy for extraterrestrial life exploration and a proto-type of the microscope.

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