

**P93****The search for extrasolar Earth-like planets: spectral signature of atmospheric evolution**Yumiko Oasa (Kobe University, 1-1, Rokkodai, Nada, Kobe), Nobuhiro Kikuchi (NiCT)

Significant advances have occurred in the field of extrasolar planet research during the past decade. The definitive goal of the search for extrasolar planets is the direct detection of radiation from extrasolar Earth-like planets orbiting Sun-like stars and characterization of their atmospheres for evidence of habitability and life. Future space missions such as Darwin and Terrestrial Planet Finder will ultimately offer the opportunity to obtain spectra of extrasolar planets situated within the habitable zones of stars and thus search for signs of life. In the mid-infrared, planets are relatively brighter than other wavelengths, so mid-infrared spectroscopy is the best-suited method to detect atmospheric biosignatures such as ozone, carbon dioxide, and methane. These molecular species are abundant in the Earth's atmosphere, and could be attributable to primitive life in extrasolar terrestrial planets. Of significant importance will be the development of a database for interpreting those spectra for evidence both of habitable conditions and of life.

In order to explore the possibility of diagnosing the existence of life from mid-infrared spectra, we have calculated synthesized global infrared spectra for hypothetical terrestrial planets. So far, the detection of spectral features of extrasolar terrestrial planets has been discussed mainly for clear atmospheres, not for cloudy atmospheres, although whether any of the terrestrial planets are suitable for life depends on climate as well as volatile abundance. Because approximately 60 % of the Earth is covered with clouds, it is a reasonable assumption that extrasolar terrestrial planets may be partially covered with clouds. Accordingly, we performed calculations of high-resolution mid-infrared spectra of Earth-like planets taking into account the global distribution of clouds, viewing angles, seasonal variation in solar insolation and surface temperatures, and consequently, the infrared radiation emitted to space. In simulating observed spectra of terrestrial planets with cloudy atmospheres, we adopted cloud distributions derived from a general circulation model for the present Earth. In addition, the ancient Earth exhibited significantly different atmospheric signatures, which were modified or strongly influenced by life. The Earth is our only example of a planet whose atmospheric composition is the consequence of the supply of gas from the presence of life. It is therefore the only place to investigate atmospheric biomarkers. We thus examine the spectral characteristics with a global atmosphere for the anoxic atmosphere of the early Earth, the ancient Earth just after the formation of the ozone layer, and the present Earth. In this contribution, we will compare the derived spectral features of terrestrial planets and discuss how cloud radiation has an influence on the detectability of atmospheric constituents of extrasolar terrestrial planets.