Observing plan for continuous monitoring of planetary atmosphere using IR heterodyne instrument 2014

Hiromu Nakagawa[1], Yasumasa Kasaba[1], Shohei Aoki[1], Isao Murata[1], Shoichi Okano[1] , Guido Sonnabend[2]

[1]Department of Geophysics, Graduate School of Science,
Tohoku University, Aoba-ku, Sendai 980-8578, Japan.
[2]I. Physikalisches Institut, Universität zu Köln,
Züplicher Str. 77, 50937, Köln, Germany.
rom@pat.gp.tohoku.ac.jp

We propose a new development in infrared heterodyne instrument, called Mid-Infrared Laser Heterodyne Instrument (MILAHI) for our dedicated telescope at the top of Mt. Haleakala, Hawaii. It is for the applications to astronomy and planetary atmospheric science in 7-13 μm wavelength at a spectral resolution of up to 10^{7-8}, a bandwidth of 1GHz, and a very high sensitivity. Frequency tuneability over a wide range provided by the use of a room-temperature type quantum cascade laser (QCL) as local oscillators (LO) allows a variety of molecules in the mid-infrared to be observed. A compact digital FFT spectrometer (DFT) is applied for infrared heterodyne spectroscopy, replaced conventional acoustro optic spectrometer (AOS) and the large filter bank. DFT provides high resolution, high efficiency, large dynamic range, low weight, small size, and the absence of optical or mechanical components. Sensitivity could achieve the excellent required condition to be 3000 K in system noise temperature at 10 μm. MILAHI will provide key physical/meteorological parameters, such as atmospheric temperature profiles, the abundance profiles of the atmospheric compositions and their isotopes, and wind velocity. MILAHI will also provide the time-variations and evolutions by continuous monitoring with our dedicated telescope to increase our understanding of planetary atmospheric dynamics, photochemistly, and meteorology.