

## The development of high-resolution infrared laser spectrometer for future planetary explorations

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We report the current status of our high-spectral resolution laser spectrometer in Mid-infrared (3~20micron). In 2008FY, we succeeded to get the basis of in-situ and heterodyne technique for future planetary observations.

The infrared light provides much valuable scientific information of planetary atmospheres by many molecule vibration / rotation bands.

For the establishment of the spectroscopic techniques with high sensitivity, high frequency resolution, and light weight, our group has tried to develop the infrared heterodyne technique from 1990s.

From 2007, we reformed this technique by the usage of new semiconductor technology, quantum cascade laser (QCL), under the collaboration with Hamamatsu Photonics and Research Institute of Electrical Communication, Tohoku Univ.

This paper present the results of (1) Evaluation of QCL technology, (2) test development of in-situ gas detection system with QCL, (3) the test results of heterodyne system with QCL.

In Feb 2009, we are now applying new laser for CO<sub>2</sub> absorption band and new digital backend receiver for the improvement of S/N. In 2009 FY, we try to adopt our system to the Venus / Mars velocity field measurements.

Related to this development, we have also done two projects.

One is the planetary sub-millimeter observations for lessons and learns, which cover similar scientific targets of the IR Heterodyne, i.e., gas detection / temperature detection / velocity detections with high sensitivity and frequency resolution. We executed the observation of <sup>12</sup>CO, <sup>13</sup>CO, SO<sub>2</sub>, and SO of Mars in Dec. 2007 by ASTE (Atacama Submillimeter Telescope Experiment) under the collaboration with Prof. Mizuno, Dr. Maezawa (Nagoya Univ.) and Dr. Momose (Ibaraki Univ.).

The results is shown in Nakagawa et al. in this society meeting.

The other is the development of the new off-axis telescope for solar system planet and exoplanet studies at the mountain top of Haleacara (Maui islands) with Univ. Hawaii.

It is done by the international consortium.

This observatory will serve the future infrastructure for infrared observations under much better environment than ours in Japan.

The details for this project will be presented by Okano et al. in this meeting.