[JJ] Evening Poster | P (Space and Planetary Sciences) | P-CG Complex & General

[P-CG22]New Developments of Planetary Sciences with ALMA

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Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The Atacama Large Millimeter/Submillimeter Array (ALMA) starated its science operation in 2011, and long-baseline observations have become available since 2014. ALMA, with its high sensitivity and resolution, has provided us with qualitatively new information on star and planet formation and small bodies in our Solar System. For example, the discovery of narrow gap structures in the protoplanetary disks around young stars HL Tan and TW Hya enabled us to actually compare the long-standing theoretical models of planet formation with real observations. In our solar system, 60km pixel-scale non-uniform brightness distribution and the rotation of the asteroid Juno are detected. Spatially-resolved thermal mapping of Europa icy surface enables us to search for thermal anomaly in possible plume source regions. As of Cycle 4, Solar observations are available, enabling us, for example, to determine the physical parameters of plasmoid quantitatively. In this session, we overview the latest results of ALMA observations in the field of planetary sciences. We also accept any theoretical and experimental works that are closely related to the observations and discuss the impact on the planetary science community.

[PCG22-P04]Investigation of Venusian upper troposphere using millimeter-wave continuum emission

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Keywords:Venus, atmosphere, ALMA

Venus has dense 90-bar CO_2 atmosphere with a thick cloud layer covering entire the planet at altitudes of ~50 - 70 km. This optically thick cloud layer hampers us to observe any information below the cloud. Only a few specific spectral regions at near infrared (e.g., 2.3 micron) play as the atmospheric “window” at which wavelengths the thermal emission from the hot lower atmosphere (~35 km for 2.3 micron window) leaks to the space. The emission at such near infrared wavelengths is attenuated by cloud particles, and can be used to retrieve cloud opacities.

A new approach to the upper troposphere of Venus is proposed by using millimeter-wave (microwave) observations. At the microwave region, the main opacity source in the Venusian atmosphere is the collision induced absorption (CIA) of CO_2, whereas the cloud opacity becomes almost negligible due to relatively long wavelength of observations compared to the sizes of cloud particles (~order of several microns). The CO_2 CIA reduces its absorption intensity with increasing the wavelength at millimeter-wave domain (and becomes almost transparent at radio frequencies). The radiative transfer calculation of the CO_2 CIA opacity indicates that the thermal emission originated from the altitudes of ~40–60 km can be observed at millimeter-wave of λ = 3 - 4 mm (frequency of ~60 – 100 GHz) — which is the operation wavelength of the currently under development ALMA Band-2 receiver.

This study reviews potential scientific topics that can be investigated with the millimeter-wave continuum emission from Venus atmosphere, and presents feasibility study of the application of ALMA – Band 2 receiver in future Venus observations.

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