High-resolution spectroscopy of Venus' dayside at 3-4 micron with IRTF/iSHELL

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Venus is completely shrouded by massive sulfuric acid clouds in altitudes of 50-70 km. Their distribution in space and its temporal change are the key to understand several fundamental subjects in the atmosphere of Venus, such as the energy balance i.e., thermal structure, atmospheric waves' propagation which closely links to the mechanism of the super-rotating atmospheric circulation, and the sulfur-related atmospheric chemistry.

One of observational approaches to the clouds is to retrieve cloud top altitude, by measuring CO_2 absorptions in sunlight reflected from Venus. Since CO_2 is thought to be uniformly mixed in the atmosphere, lower reflectivity observed in CO_2 absorption results from a longer path length to clouds, meaning lower cloud top altitude. Altimetry of Venus' cloud top has been conducted using data provided by Pioneer Venus Orbiter, Venera 15, Venus Express, and Akatsuki. The cloud top has an equatorially symmetric structure and the upper cloud boundary is vertically diffuse in the low and middle latitudes and gets sharper at higher latitudes. No considerable local time and long-term variations have been detected before.

In order to improve climatological knowledge on the clouds, we carried out a high-resolution spectroscopy of Venus' dayside at wavelengths of 3.20-3.48 micron and 3.57-4.18 micron with IRTF/iSHELL on August 5-7, 2018 (UT). Taking the full advantages of its high spectral resolution of R ~75,000, IRTF/iSHELL provides its capability of detecting changes of the CO_2 absorption depths due to the cloud-top altitude variation. This spectrally resolved observations will provide another independent measure of the cloud top altitude to be compared with the results obtained by the narrow-band filter imaging of Akatsuki/IR2. In this presentation, we will show several processed spectra and what can be retrieved from them with radiative transfer calculation.