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Observation of the periodicity of cloud rotation in Venus with Pirka telescope

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The Super-rotation, which is a phenomenon that Venusian atmosphere moves westward at a velocity 60 times faster than the solid planet rotation, is a unique atmospheric system of Venus. Its mechanism and even the fundamental properties, such as the variation of the rotation period, are still unknown. When we observe the Venusian atmosphere in ultraviolet range, the dark pattern, which is considered to represent the distribu-tion of UV-absorber above the clouds, can be seen. The time variation of this pattern suggests the wind circulation of the atmosphere and/or the atmospheric wave propagating at an altitude of 70 km or higher, being related to the super-rotation. Del Genio & Rossow (1982, 1990) reported the brightness of the Venus cloud has a variation in periodicity changing from four to five days and this change occurred independently for each latitude band. Our purpose is to monitor this change of the period in brightness based on the long-term observation with Pirka telescope and to investigate its mechanism.

Multi-Spectral Imager (MSI) mounted on the 1.6 m Pirka telescope, owned and operated by the graduate school of science in Hokkaido University, is used to take UV images of Venus. The Pirka telescope is primarily dedicated to the observations of solar planets, and MSI can set the exposure time very short (~ 0.04 s) and change the center wavelength of narrow band transmittance using liquid crystal tunable filters rapidly. Thanks to Pirka telescope and MSI, we can observe in the daytime of the erath and monitor the planetary scale UV-features ($>$ 5,000 km) over 8 hours in 1 day with 1 or 2 month interval. Using MSI data, it is possible to investigate the time variation of cloud brightness in UV covering the full super-rotation time scale (over 4 days) and to compare the variations at different latitudes.

We estimated the brightness of each latitude band and calculated the relative brightness to equatorial region at 365 nm for the data observed in July 2012. Size of each examined area is 10^o x 10^o (longitude x latitude), which is larger than the atmospheric seeing size at the observation site. This method makes it possible to work through the problem of correcting the earth's atmosphere effect so that we can compare the time variations between different latitudes. We found the typical time variation seems to be related to the super-rotation. This results show piecewise continuous distribution of UV features in the direction of longitude and suggest that features propagate in synchronization among 50^oS - 50^oN. For further investigation, we also analyze the VCM/Venus Express data to estimate the absolute change of brightness along some latitude band. We will be able to obtain the absolute brightness distribution for each latitude band from combining the MSI and the VMC data and to compare the results among different observation periods.

Keywords: venus, super-rotation, grand base observation, pirka telescope