Estimation of the lifetime of the super-rotation’s periodicity by mapping the time variation of the Venusian UV brightness

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When we observe the Venusian atmosphere in UV range (especially 365 nm), the planetary scale dark pattern can be seen. The motion of this pattern is suggested to be the wind circulation of the atmosphere and/or the atmospheric wave propagating at an altitude of 70 km or higher, which would be related to the super-rotation. From the ground-based telescopic observations with the UV photometry, it is possible to observe the motion of this pattern at the Venus atmosphere. Del Genio & Rossow (1982, 1990) reported that the brightness of the Venus cloud has a periodic variation changing from four to five days and that this variation occurred independently for each latitude band. Further, it is not fully understood whether this periodic variation always exists or not, which is the ’lifetime’ of the variation. In order to clarify the periodic variation of the UV brightness at each latitudinal band of the Venus atmosphere and to identify the lifetime of the variation, long-term monitoring data of the Venus UV brightness images are essential.

Venus Monitoring Camera (VMC) onboard the Venus Express spacecraft can provide very precious information about the Venus UV brightness variation, but observation of VMC is mainly limited in the southern hemisphere. In order to realize the long-term Venus monitoring in both hemisphere, we have carried out the ground-based simultaneous observations with Multi-Spectral Imager (MSI) onboard the Pirka telescope. The Pirka 1.6 m telescope, owned and operated by the graduate school of science in Hokkaido University, is primarily dedicated to the observations of solar planets. Using this system, we can carry out daytime observation and monitor the planetary scale UV-features (˜5,000 km) over 8 hours in 1 day. This observation was intermittently carried out with 1 or 2 month interval.

Using MSI image data sets, we have estimated the UV brightness variation map as a function of latitude and time. From the VMC data analysis, we could deduce the absolute brightness change in southern hemisphere, and we found that the Venusian UV brightness variation can be categorized into two types; one is a phase showing strong periodicity, and the other is a phase when the strong periodicity can not be confirmed. Second, we suggest the new possibility to reconstruct the brightness variation in both hemispheres by our new technique using both MSI and VMC data. This technique has two steps. First step was that we made maps of the relative brightness change from the MSI images, which normalized by the brightness in 50OS latitudinal band. Second step, we got the absolute brightness change in 50OS latitudinal band from the VMC data then made new map by combining these results. The correlation between this new map and the VMC map in other southern latitude bands was estimated to be high. In July 2012, we obtained the Venus UV brightness data in five consecutive days and the results of our new technique from these data showed that the two peaks and one trough of the UV brightness was consistent in southern hemisphere between the MSI and the VMC. In the near future, we will observe and estimate the lifetime of the super-rotation’s periodicity for both hemispheres by developing our technique.