Temporal evolution of periodicity of Venusian UV brightness observed with Pirka telescope

Masataka Imai[1]; Yukihiro Takahashi[1]; Shigeto Watanabe[1]; Makoto Watanabe[1]
[1] Cosmosciences, Hokkaido Univ.

The dynamical mechanism of Venusian superrotation, which is the phenomenon that the Venus atmosphere moves westward at a velocity 60 times faster than the planetary rotation, is still unknown. But several theses suggest planetary scale waves are associated with the superrotation [e.g. Yamamoto and Tanaka, 1997]. And also these waves are considered to form planetary scale UV features in Venus. Pioneer Venus spacecraft observed that the propagation of planetary scale UV features causes the periodical variation of UV brightness with the period 4-5 days. [Del Genio and Rossow, 1982, 1990].

The purpose of our study is to identify the source of planetary scale waves in Venus. We carried out the ground-based observation of UV brightness. We have already observed Venus routinely from mid-August 2013 to end of June 2014 that cover almost one Venus year. Such kind of long monitoring has not been carried out since the Pioneer Venus observation. Our instrument is Multi-Spectral Imager (MSI) installed at the Pirka telescope. The Pirka is 1.6-m a telescope primary decided to observe solar system planets. Our observation provides information about the periodicity of brightness variations at 365 nm from equatorial to mid-latitudinal regions in both hemispheres, which is associated with the Venus superrotation.

At the beginning of observation in August 2013, we detected about 5-day periodical brightness change from equator to both northern and southern mid-latitudes. We supposed this periodical change indicates the propagation of planetary waves. Our results clearly showed the amplitude of brightness variation in the equatorial region decays to the latitudes of 30^oN and 30^oS. Bright and dark pattern had a symmetric structure about the equator and is considered as a high-contrast Y-feature (UV feature) such as Pioneer Venus Orbiter found. On the other hand, after the mid-September 2013, there was no significant brightness variation in the latitudinal region lower than 30^o latitude while near 60^oN and 60^oS the brightness still showed periodical variation. These periodical variations in both hemispheres were synchronized though the periodicity was more obvious in southern hemisphere. We also analyzed images taken by Venus Monitoring Camera (VMC) on-board Venus Express spacecraft from Aug 1 to Nov 31, 2013. UV features in global scale are captured only in southern hemisphere because Venus Express is in elliptic orbit with apocenter in southern hemisphere. But, we found a good correlation between MSI and VMC. We also found 5-day periodical variation in these data until the beginning of October 2013. Coupling our ground-based telescope and spacecraft observation data, we found that disappearance of periodical wave structure was started in equatorial region at first and after a half-month or later waves were vanished in both hemispheres.