Characteristics of Jovian polar atmosphere derived from multispectral and polarimetric observations

*Shuntaro Yokota[1], Mitsuteru Sato[1], Yukihiro Takahashi[1], Seiko Takagi[1], Tatsuharu Ono[1], Yuuki Sato[1], Haruki Sugiyama[1]

1. Department of Cosmosciences, Graduate School of Science, Hokkaido University

Polarimetric observation is an effective method for determining the particle properties of the planet's surface and atmosphere. From this reason, many polarimetric observations of Jovian atmosphere have been performed so far. Although previous studies show the difference in the polarization degree depending on the Jovian latitude [McLean et al., 2017, Schmid et al., 2011], there are few observations tracking the regional differences of the polarization degree in a short term period, such as a few hours or a few days. Thus, the data volume is insufficient enough to discuss the temporal variations of particle characteristics. The purpose of this study is to observe the motion of the polar upper layer in the Jovian atmosphere and the temporal variations of the particle characteristics from the polarimetric and multispectral imaging using the 1.6 m Pirka telescope operated by Hokkaido University and to clarify the convection mechanism of the Jovian atmosphere by comparing the multispectral imaging data to polarimetric imaging data.

In this presentation, we introduce the results derived from the spectral imaging observations and the polarimetric imaging observations using the Multi Spectral Imager (MSI) (pixel scale = 0.39 "/ pix) with the band-pass filters of 650 nm, 727 nm, and 889 nm, which is mounted on the Pirka telescope. We conducted the MSI observations from May to August 2019. The images at the methane absorption wavelength of 727 nm and 889 nm show bright clouds and haze layers in Jovian atmosphere due to the higher ratio of scattered light. Liquid Crystal Variable Filter (LCTF) installed in the MSI can be used for the polarimetric observations with the linear polarizer. We obtained the polarimetric data of May 22, 2019 (observed longitudinal range was 120 –270 deg) and June 24, 2019 (0 –180 deg). The latitudinal variations of the stokes parameter are comparable with the results reported by the previous studies. In order to monitor the temporal variations of the cloud/haze structure and their polarimetric characteristics, it is necessary to simultaneously obtain the multispectral and polarimetric data with the time resolution of 1 day. In the 2019 season, we obtained the continuous multispectral imaging data. But, we failed to obtain the continuous polarimetric data due to the climate conditions. From this reason, we could not enough compare the cloud/haze structure in the Jovian polar atmosphere confirmed by the multispectral imaging data with the polarization degree derived from the polarimetric observations. At the presentation, we will show the initial results derived from the image analysis and will show the future observation plan more in detail.

Keywords: Jupiter, Polarimetry, Ground-based telescope

