Multi spectral observation of changes in Uranus' cloud obtained by Pirka telescope

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Uranus was first observed to be free of severe weather changes like Jupiter. However, recent observations (Voyager 2, Hubble Space Telescope, Keck telescope) have revealed that Uranus has a long-time scale phenomenon of several decades and a short-time scale phenomenon of several days or weeks. Hammel and Lockwood (2007) reported a change in brightness on a time scale of about 20 years, which is half the orbital period of Uranus. Irwin et al. (2010) and Peter et al. (2015) showed that some bright clouds fluctuate in a few days. However, there are few observations of short-time scale cloud changes, and the time scale of these cloud phenomena is uncleared. Most observations have been performed once or twice a year, often for several days. This is because it is difficult to have observation time for large telescopes and space telescopes with high spatial resolution. The purpose of this study is to elucidate the time scale of cloud changes. In this study, we used a 1.6 m Pirka telescope and Multi Spectral Imager (MSI)(Watanabe et al., 2012) mounted at Cassegrain focus of Pirka telescope. This is a ground telescope located at Nayoro observatory of Hokkaido University, Japan, and mainly used for planetary observation. MSI enables to take images that cover a 3.3'x3.3' field of view with 0.389" pixel resolution at several visible to near infrared wavelength in a short time. Because this instrument has a liquid crystal tunable filters (LCTFs) that can change the transmission wavelength from 400 nm to 1100 nm, in about 150 ms. We made imaging observations at several wavelengthes from 650 nm to 900 nm for a total of 6 months from September 2019 to February 2020. However, the seeing of Nayoro is about 3 arcsec, which is almost the same size of Uranus. Therefore, in order to confirm the existence of clouds, I use a method of comparing the reflection flux at a methane absorption wavelength ($F_{methane}$) and the reflection flux at a non-absorption wavelength (F_{normal}). If there is a cloud, the incident light will be reflected by the cloud, so the absorption by methane will be weaker than without the cloud, and $F_{methane}$ / F_{normal} will be larger than without the cloud. Using this, it is possible to estimate the change in clouds by comparing the theoretical value of changes in $F_{methane}$ / F_{normal} due to the presence of clouds with actual observations. In this presentation, we will introduce the initial results of the data acquired from September to November 2019.

Keywords: Uranus, multi spectral imaging, planetary atmosphere

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