Observation of Neptune's storms with Pirka telescope

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A storm more than 4,000 km in diameter occurrs occasionally in Neptune. In previous study, Voyager 2 observed Neptune on May 24, 1989 and discovered a storm of 13,000 km in diameter called Great Dark Spot(GDS). GDS was located in southern hemisphere like Great Red Spot of Jupiter. But GDS became extinct when Hubble Space Telescope observed it in 1994. It is unknown whether it is a sudden thing or storms such as GDS always occur in Neptune. In addition, a huge storm of 9,000 km was observed on July 2 and June 26, 2017 by Keck observatory. It's considered that storms of Neptune occurs at mid latitude in the north and south that an ascending air occurs. However, this huge storm occured near the equator. A rotation axis of Neptune is 29.6 degrees, and the storm possibly occurred near the equator because of seasonal change.
Neptune is observed by large telescopes such as Keck observatory and the Hubble Space Telescope, but it is difficult to always use those telescopes for Neptune observation. Therefore Neptune is not observed for long term on a short time scale. I developed the technique to estimate the drift rate and intensity of storms by observing a whole spectrum of Neptune in this study. When seeing is bad, it's possible to observe and aquire the observation data of Neptune for a long term on a short time scale. The purpose is to deepen the understanding of the atmosphere convection structure of Neptune by chasing the detailed change of storms.
In this study, I observed Neptune by using 1.6 m Pirka telescope that Hokkaido University owned. The observation time is from August 7, 2017 to January 17, 2018 and from October 22, 2018 to November 26 2018. The wavelength is 650-1050 nm in 2017, and 890, 855 nm in 2018. In this study, I used methane absorption 890 nm. Storms look brighter at 890 nm because the altitude of storms is higher than that of other areas. In addition, the appearance size of storms from the observation point changes by the rotation of Neptune, so an 890 nm flux changes by the rotation. I took the ratio of an 890 nm flux and an 855 nm flux to correct the effect of the earth atmosphere and calculated the theoretical value of the 890 nm flux by the rotation, compared a relative intensity of the 890nm flux in observation with the theoretical value and estimated the drift rate and intensity of the storms.
I assumed storm's area and calculated the 890 nm reflectance of the storms and estimated the drift rete of storms is 24.9°/day in 2017, and 47.5°/day in 2018, 890 nm reflectance is 0.217 in 2018, and 0.105 in 2018. Edward Monlter et al. (2019) study shows that 2017 storm is located at 2°N and the zonal drift speed is 237.4±0.2 m/s or 47.78±0.04 °/day. This drift rate is consistent with the drift rate estimated in my study.

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