Geophysical Research Abstracts
Vol. 19, EGU2017-18092, 2017
EGU General Assembly 2017

Haze and cloud distribution in Uranus' atmosphere based on high-contrast spatially resolved polarization measurements

Nadiia Kostogryz (1), Svetlana Berdyugina (1), Daniel Gisler (1,2), and Thomas Berkefeld (1)

(1) Kiepenheuer-Institut für Sonnenphysik, Germany (kostogryz@leibniz-kis.de), (2) Istituto Ricerche Solari Locarno(IRSOL), Locarno, Switzerland

In planetary atmospheres, main sources of opacity are molecular absorption and scattering on molecules, hazes and aerosols. Hence, light reflected from a planetary atmosphere can be linearly polarized. Polarization study of inner solar system planets and exoplanets is a powerful method to characterize their atmospheres, because of a wide range of observable phase angles. For outer solar system planets, observable phase angles are very limited. For instance, Uranus can only be observed up to 3.2 degrees away from conjunctions, and its disk-integrated polarization is close to zero due to the back-scattering geometry. However, resolving the disk of Uranus and measuring the center-to-limb polarization can help constraining the vertical atmospheric structure and the nature of scattering aerosols and particles.

In October 2016, we carried out polarization measurements of Uranus in narrow-band filters centered at methane bands and the adjacent continuum using the GREGOR Planet Polarimeter (GPP). The GPP is a high-precision polarimeter and is mounted at the 1.5-m GREGOR solar telescope, which is suitable for observing at night. In order to reach a high spatial resolution, the instrument uses an adaptive-optics system of the telescope.

To interpret our measurements, we solve the polarized radiative transfer problem taking into account different scattering and absorption opacities. We calculate the center-to-limb variation of polarization of Uranus' disk in the continuum spectrum and in methane bands. By varying the vertical distribution of haze and cloud layers, we derive the vertical structure of the best-fit Uranus atmosphere.