
[EE] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS01] Outer Solar System Exploration Today, and Tomorrow

convener: Jun Kimura (Osaka University), Yasumasa Kasaba (Dep. Geophysics Graduate School of Science Tohoku University), Steven Vance (Jet Propulsion Laboratory, Caltech, 共同), Kunio M. Sayanagi (Hampton University)

Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The giant planets provide many keys to understanding planetary processes. They play an important role in shaping our solar system, and the physical and chemical processes they harbor also provide a unique opportunity to study the phenomena relevant for studying

Earth and other planets, including exoplanetary systems. In this session, we discuss a wide range of topics encompassing the giant planets and their moons, including their origins, interiors, atmospheres, compositions, surface features, and electromagnetic fields. To advocate for current and future outer planets exploration (Cassini, Juno, New Horizons, JUICE, and beyond), we also call for discussions on future missions to explore giant planet systems, including how to develop better international cooperation. Discussion in this latter category will include progress in developing a solar sail mission concept for observing the Jupiter system and its trojan asteroids.

[PPS01-P08] Long-term variation of the North–South asymmetry in the intensity of Saturn Kilometric Radiation (SKR) in 2004-2017

*Yuki Nakamura¹, Yasumasa Kasaba¹, Tomoki Kimura², Laurent Lamy³, Baptiste Cecconi³, Georg Fischer⁴, Chihiro Tao⁵, Akira Morioka⁶ (1. Department of Geophysics, Graduate School of Science, Tohoku University, 2. Nishina-Center for Accelerator Based Science, RIKEN, 3. LESIA, Observatoire de Paris, CNRS, PSL Research University LESIA, Observatoire de Paris, CNRS, PSL Research University, 4. Space Research Institute, Austrian Academy of Sciences, Schmiedlstr. 6, A-8042 Graz, Austria, 5. National Institute of Information and Communications Technology, 6. Planetary Plasma and Atmosphere Research Center, Graduate School, Tohoku University)

Keywords: Saturn, Aurora, Saturn Kilometric Radiation

This study investigates the long-term variation of Saturn Kilometric Radiation (SKR) intensity observed by the Radio and Plasma Wave Science (RPWS) instrument on board the Cassini spacecraft from 2004 (southern summer) to 2017 (northern summer). The results clearly showed that the SKR intensity was more enhanced on the summer side than on the winter side. No clear correlation was found between the SKR intensity and the solar EUV flux.

SKR is a proxy of Saturn's auroral activity and magnetospheric dynamics. SKR emissions are right-handed extraordinary (R-X) mode waves excited via the cyclotron maser instability in the polar auroral regions along high-latitude magnetic field lines. Northern SKR (N-SKR) and Southern SKR (S-SKR) can be distinguished from their right-handed and left-handed sense of circular polarization, respectively. Its intensity has a long-term variation with north-south asymmetry. Kimura et al. [2013] studied the long-term variation of SKR intensity in the southern summer season from 2004 to 2010, and showed that the peak spectral density of S-SKR was found to be up to 100 times greater than that of N-SKR in 2004 (mid southern summer), and became comparable around equinox in August 2009. SKR was thus brighter on the summer side than on the winter side. This trend seemed to be also related to the declining solar activity.

We extended this study up to September 2017, taking advantage of radio observations acquired over the whole Cassini mission. We used the SKR spectral densities integrated over 100 – 800 kHz and normalized at the distance of 1 AU. To remove visibility effects resulting from strongly anisotropic emission, we restricted to Cassini near-equatorial observations (latitudes $|\lambda| < 5^\circ$), where both N-SKR and S-SKR can additionally be observed simultaneously.

We first investigated the long-term variation of the N- and S-SKR intensities separately. The integrated N-SKR flux did not largely change from 2004 to 2017, while the S-SKR flux became 100 times smaller at northern summer than at southern summer. Then, we investigated the intensity ratio of S-SKR to N-SKR. This ratio evolved from ~ 10 around mid southern summer (2004), reduced to ~ 1 around equinox (2009), and to ~ 0.1 in mid northern summer (2015). These results illustrate that SKR is brighter in the summer hemisphere, in agreement with Kimura et al. [2013].

Our study also revealed two interesting results. (1) The reversal in the intensity ratio of S-SKR to N-SKR was mainly caused by the long-term reduction of the S-SKR intensity. (2) The long-term variation of the intensity ratio was not clearly synchronized to that of N- and S-SKR rotational periods. We checked the correlation between the SKR intensities and the solar EUV flux, but found no clear correlation. On long-term timescales, while the solar activity increased from 2010 to 2014, the N-SKR intensity was almost constant and the S-SKR intensity decreased by a factor of 10. On short-term timescales, when the EUV flux suddenly increased due to a solar flare, there were no apparent changes in the SKR flux in both hemispheres. We thus conclude that the seasonal (and also short-term) variation of solar EUV illumination of Saturn's ionosphere do not directly affect the SKR intensity.