# North-south asymmetry of Saturn's auroral radio emissions: The seasonal variation of their fluxes

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Saturn emits intense radio emissions, Saturn Kilometric Radiation (SKR), from the northern and southern polar region in 3-1200kHz. SKR is generated by field-aligned energetic auroral electrons via Cyclotron Maser Instability (CMI) at local cyclotron frequency. Saturn’s rotation period has been evaluated based on occurrence period of SKR because SKR source is fixed in the planetary magnetic field with highly anisotropic beaming, thus forming a corotating searchlight of radio emission. In the Saturn’s magnetic field directions, the right-handed circularly polarization (RH) emissions are from the northern region and the left-handed (LH) ones from the southern region, respectively. Cassini observations in the southern summer (2004-2009) showed that the period of SKR daily variation is variable [Kurth et al., 2008]. It was slightly longer in the southern (summer) hemisphere [Gurnett et al., 2009], but close to each other near the equinox (September in 2009) [Gurnett et al., 2010]. Related to this trend, we also studied the flux ratio between northern and southern SKR in 2004-2010, and showed that the LH (summer, south) is stronger than the RH (winter, north) in average [Kimura et al., 2013]. Those characteristics could be explained by the north-south asymmetry in the polar ionospheric conductivities, which are related to the seasonal variations of the solar EUV flux illuminating to the polar region. However, the clear scenario has not been yet established. For example, in the observations in the Northern summer after 2010, northern and southern SKR periods merged together and are not clearly separated [Provan et al., 2014; Fischer et al., 2015]. This fact could not be explained by the simple idea based on the polar ionospheric conductivities.

In this study, we extend the study in Kimura et al. (2013) to 2015 covering the northern summer. We note that the simple extension of the analysis period is hard because of the Cassini orbit bias. Since the SKR is stronger in the dawn side, Kimura et al. (2013) adopted the detection criteria that Cassini is at the dawn side (2h - 10h LT). And in order to avoid the visibility effect of SKR caused by its propagation, other selection criteria were also set in the latitude (-5 to +30deg (RH), +5 to -30 (LH)) and the distance from Saturn (10 - 100 Rs). However, because of Cassini’s apokrone after 2010 was gradually shifted from dawn to dusk, it becomes hard to get a large number of observations under the same criteria.

In this study, we kept the same latitude and distance criteria but used the all LT data set. But, at former we could see the different LT between the both SKR, so we couldn’t avoid the LT dependence. In parallel, at latter we selected +-5deg in the latitude and verified the result about the data observed simultaneously for the north and south. In this revised result, the intensity of LH component in 2004-2009 (south, summer) was stronger ~+40 than RH (north, winter). In 2010-2012, the both SKR intensities got close to each other. After 2013, RH (north, summer) was stronger by ~+20 than LH (south, winter). These results support the result in Kimura et al. (2013) that the summer hemisphere is more enhanced. The variation of SKR peak intensity by a running median with a window of +-35 days to avoid visibility effect also showed same trend. However, it is not well explained that the flux ratio was more than 10 in southern summer but only 0.2-0.4 in northern summer. In this presentation, we will also show the correlation of these trends to the SKR rotational period, solar EUV activity, etc. (Cassini Solstice Mission will be finished in Sep.

 

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