time variation of 130.4nm atomic oxygen emission near Io observed by hisaki/EXCEED

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Io, one of the Jupiter moon, is the most volcanically active body in the solar system because of its large tidal force from Jupiter. Main components of Io’s atmosphere are SO2, and its dissociative sulfur and oxygen atoms. The rest components (a few percent) are neutral sodium and potassium. Origins of the atmosphere are thought to be gaseous plume driven by volcanic activity and sublimation of SO2 frost, but it is not clear which is dominant. The object of this study is to understanding the atmospheric generation process through the time variation of 130.4nm atomic oxygen emission near Io.
The brightening event of the extended sodium nebula was reported by the ground imaging observation from December 2014 to May 2015 (Yoneda et al., 2015). To show the behavior of atomic oxygen during the period, we analyzed the time variation of atomic oxygen, one of the main components of volcanic gas, -near Io (1 Jupiter radius) by using data observed by hisaki/EXCEED. We selected observed data when Io was in the dawn side (Io’s phase angle of 45~135) and in the dusk side (225~315), and accumulated photons which came from around Io within a range of 60" on each day to acquire enough S/N. We carefully selected data when the local time of Hisaki was in the range of 20-4h to avoid the contamination from geocorona. As a result, it is found that the brightness of atomic oxygen emission was 11R at the beginning of January, but started to increase in the middle January and showed the maximum of -32R in the middle of February. It decreased by the end of May and returned the normal brightness (10R). We also confirmed that the emission in the dusk side more intense than that in the dawn side by about 1.2 times throughout the period.
The result shows amount of atomic oxygen near Io increases when Io is volcanically active. To discuss the relation between the atmospheric generation process and volcanic activity, we need to derive atomic oxygen column density from emission brightness of atomic oxygen at 130.4nm. While both solar resonant scattering and electron impact excitation could contribute to 130.4nm atomic oxygen emission, we estimate the contribution of electron impact excitation is several hundred times as high as that of solar scattering. The estimation shows electron impact excitation is dominant and it is likely to explain dawn-dusk asymmetry of 130.4nm atomic oxygen emission because thermal electron temperature in the dusk side is higher than that in the dawn side. In this talk, we drive the atomic oxygen column density and discuss how volcanic activities influence characteristic of Io’s atmosphere according to the estimation.

Keywords: Jupiter, Io, hisaki/EXCEED, volcanic activity

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