

The time variation of atomic oxygen emission around Io during a volcanic active event observed by Hisaki/EXCEED

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The atmosphere of a Jovian satellite Io has been thought to be mainly by volcanism and sublimation of frost. Dominant atmospheric gases are sulfur dioxide, and dissociative product such as atomic oxygen and sulfur, which are produced mainly by electron impact dissociation and photolysis. Neutral oxygen escape from exobase to neutral clouds (> 5.8 Io radius) mainly by atmospheric sputtering. However, it was not understood the characteristics of spatial and time variations of atomic oxygen escaping from Io.

The brightening event of the Io's extended sodium nebula was reported by the ground imaging observation in the spring of 2015 [Yoneda *et al.*, 2015]. We therefore examined the time variation of atomic oxygen emission at 130.4 nm around Io obtained with Hisaki/EXCEED from 27 November 2014 to 14 May 2015 and compare the result with the brightening event of the Io's extended sodium nebula. We accumulated observed counts within $46''$ centering at Io for one day to obtain enough signal to noise ratio. We found the atomic oxygen emission increased by 2.5 during the volcanically active period of day of year (DOY) 20-110 of 2015. The time variation of atomic oxygen emission was well correlated with that of sodium emission until the brightness maximum on DOY 50 of 2015. In the meanwhile, the duration of atomic oxygen brightness declining from the maximum to the quiet level (60 days) was longer than that of sodium nebula (40 days).

In addition, we investigated Io phase angle (IPA) dependence of atomic oxygen emission at 130.4 nm averaged for the distance range of 4.5-6.5 Jupiter radius from Jupiter in the dawn and dusk sides, respectively during volcanically quiet period (DOY -35 -1). Then, we found following two important observation fact. First, weak atomic oxygen emission (4-6 Rayleighs (R)) continuously exists on both dawn and dusk sides not depending on the phase angle. This suggests that small amount of atomic oxygen distributes uniformly along the Io's orbit. Second, the emission averaged between IPA 60-90 degrees (14.0 R) was larger than that between IPA 90-120 degrees (10.5 R) on the dawn side, and the emission at IPA 240-270 degrees (15.8 R) was larger than that at IPA 270-300 degrees (12.3 R) on the dusk side. We can explain this difference if the large amount of atomic oxygen spread inward and ahead of Io's orbit and shape like banana expected by the model of atomic oxygen neutral clouds such as *Smyth and Marconi* [2003].