SPECTROSCOPIC OBSERVATION OF VELOCITY DISTRIBUTION OF SODIUM ATOMS ORIGINATED FROM JOVIAN SATELLITE IO AND THEIR RELEASE MECHANISM

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It is well known that volcanic gas originated from Jovian satellite Io is the primary source of plasma in the Jovian magnetosphere. Hence, it is important to clarify the plasma supply process from Io for understanding the Jovian magnetosphere. Sodium atoms extending to a few hundreds Jovian radius (RJ) have been observed, and those atoms should have velocities exceeding escape velocity of Jovian gravitational field.

We made spectroscopic observation of spatial distribution of line of sight velocities of sodium atoms around Io. Observation was carried out at Iitate observatory using a combination of 60cm telescope and a spectrograph with resolving power of 12,000 and a field of view of 16RJ, at a time of 32 degree Io phase angle. Observation result clearly showed three kinds of velocity components; (1) high velocity component toward anti-Jupiter direction, (2) high velocity component toward Io rotation direction, and (3) low velocity component extending to the outside of Io orbit.

It is concluded that, from comparison between observed result and simulation which includes various release mechanism, there co-exist following three kinds of sodium atoms release mechanisms;

(1) high velocity component toward anti-Jupiter direction is produced by neutralization of pick up ions,

(2) high velocity component toward Io rotation direction is produced by dissociation and dissociative recombination of molecular ions, and

(3) low velocity component is produced by sputtering of Io's atmosphere by torus plasma.

In addition, it is also found that neutralization takes place at anti Jupiter and trailing side of Io where direction of ion velocity is tilted from corotation direction by 20 degree.