Observation of [SII] emission in Io plasma torus using an imaging Fabry-Perot interferometer: preliminary results

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Plasma originated from volcanic eruption on Jovian satellite Io forms a donut-shaped region of dense plasma along Io's orbit, which is called Io plasma torus (IPT). Spectral line emissions from singly charged sulfur ions, [SII], at 671.6 nm and 673.1 nm in IPT is intense enough to be observable from the ground. Imaging observation of sulfur ion emission with sufficient spectral resolution will enable us to monitor two-dimensional distributions of ion temperatures, line-of-sight velocities of ions, and emission intensity. In order to attain such purpose, we have developed an imaging Fabry-Perot interferometer (IFPI) for continuous observation of Io plasma torus. The IFPI is coupled to a 60-cm Coude telescope of our Iitate observatory (37.7N, 140.7E). Fabry-Perot etalon of the IFPI is characterized by wavelength resolution of .011nm and finesse of 40 at 671.6 nm. The gap of etalon is scanned in order to obtain two-dimensional distributions of above mentioned physical quantities, and spectral profile is recorded at each pixel of a CCD detector. Before starting actual observation, the best combination of observation parameters; the etalon scanning step, number of scanning points, and exposure time, were determined based on simulation. Calibration of the IFPI was made using Ne spectral lamp, whose wavelength (671.704 nm) is within one free spectral range of the Doppler-shifted sulfur ion line, as a light source for determination of absolute wavelength, and a frequency stabilized He-Ne laser as a light source for determination of etalon finesse. Preliminary observation was made on November 23, 2002 (JST). Although the nature of observation is very preliminary, following results were obtained from analysis of the recorded data for the east ansa of IPT; (1) emission intensity at 6.05RJ was 600R, (2) regarding line-of-sight velocity, slowing down from the corotation velocity at 6.05RJ was 5 km/sec, (3) ion temperatures perpendicular to the field line showed increase from 5.7RJ to 6.05RJ, where the value was approximately 2x10^6K. From these results, it has been shown that the method is encouraging and we are going to continue monitoring observation of IPT.