Local electron heating in the Io plasma torus associated with Io observed by HISAKI

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Io-correlated brightness change in Io plasma torus (IPT) has been discovered by Voyager and show an evidence of local electron heating around Io. However, the amount of observation data is still limited to investigate its detail properties. In addition, the clear Io-correlated change has not been detected by EUVE and Cassini observations. Cause of the Io-correlated effect is still open issue. The HISAKI satellite was launched on Sep. 14, 2013 and started observation of IPT and Jovian aurora for more than two months since the end of Dec. 2013. Observation of IPT with HISAKI showed clear Io-correlated brightness change since the Voyager observation. The amplitude of the periodic variation associated with Io's orbital period was larger in the short wavelength than in long wavelength. The wavelength dependence suggests significant electron heating and/or hot electron production. The Io phase dependence shows that bright region is located just downstream of Io. These are evidence of local electron heating around/downstream of Io and consistent with the Voyager result. The brightness also depends on system-III longitude and has local maximum around 120 and 300 degrees. Based on an empirical model of IPT, electron density at Io also shows maxima around the same longitudes. This suggests that the electron heating process is related with plasma density at Io. Candidate mechanisms which are responsible for the electron heating are (1) energy transfer via Coulomb interaction from electron beam produced by Io-Jupiter's ionosphere coupling to thermal electron in IPT and (2) ion cyclotron waves excited by picked-up ion downstream of Io and electron heating via wave-particle interaction.