Origin of delayed rotational periodicity in the inner magnetosphere of Jupiter

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Periodic signature of electromagnetic waves from planets has been used to determine planetary rotation period. In the case of Jupiter, four periodicities have been known so far: System I, II, III, and IV periods. System I and II are related with zonal circulations of the atmosphere and System III shows the intrinsic planet rotation period and determined from periodicity of Jovian auroral radio emission. Only the origin of System IV is unknown but it has been found in periodic variation in plasmas in the inner magnetosphere and is a few % delayed from System III, suggesting that the System IV frame is subcorotating around Jupiter. Here, we resolved the origin of the subcorotation by using spatially resolved extreme ultraviolet (EUV) spectrograph onboard the Hisaki satellite. Hisaki observed emission lines from sulfur and oxygen ions which are products of volcanic gases from the satellite Io and provides plasma parameters such as ion composition and electron temperature from the spectral analysis. We found that the plasma parameters showed periodic variation whose periodicity was delayed from System III and the delay depended on the radial distance from Jupiter. The delay was most significant around the radial distance of Io, which is consistent with mass-loading of plasma from neutral cloud distributed along Io’ s orbit. Hisaki also found change in the delay profile after eruptions of Io’ s volcanos. The delay became small around the Io’ s orbit where enhanced mass-loading was expected during the eruption. The change is not consistent with a previous theoretical prediction and updates of the magnetosphere-ionosphere coupling model may be required to resolve this new issue.

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