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Self-driven auroral acceleration process at Jupiter captured by continuous monitoring of Hisaki satellite with HST

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Two possible drivers have been proposed for planetary auroral acceleration processes: magnetosphere-solar wind interaction referred to as an 'external driver' and shear flow of magnetospheric plasma around a planet referred to as an 'internal driver'. Recent observations of Jupiter's aurora indicated significant responses of auroral intensity and morphology to the solar wind. These results are suggestive of the 'external driver' for Jupiter. On the other hand, there have not been reported dynamics of the 'internal driver' for Jupiter yet which should be essential because of Jupiter's fast rotation and internal plasma source Io. Here we firstly report dynamics of the 'internal driver' based on long-term continuous observation of extreme ultraviolet (EUV) aurora by Hisaki satellite. The long-term variations in EUV aurora are compared with solar wind extrapolated from Earth's orbit by numerical simulation. We found dramatical brightening and decay of EUV aurora during the solar wind quiet period. The brightening occurs once every a few days followed by sudden decay with a timescale less than a half of rotation (˜5 hours), which is significantly faster than the solar wind daily variations. Highly-resolved auroral imaging by Hubble Space Telescope captured expansion of diffuse aurora down to latitudes of Io's footprint aurora during the brightening. These observations are indicative of hot plasma deeply injected into the inner magnetosphere around Io's orbit independently from the solar wind, followed by rapid energy dissipation through auroral emissions and possibly other radiation and/or chemical processes.

Keywords: Hisaki satellite, Hubble Space Telescope, Jupiter, aurora