



## **Stability and instability of Io plasma torus**

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The instability of Io plasma torus is dominated by so called interchange instability. The exchange of radial adjoining flux tubes is determined by both cold and hot plasma distributions in the radial direction. Only when the centrifugal energy released by cold plasma is larger than the work to compress a hot plasma pressure dominant, larger outer flux tube inward, the exchange is possible. Otherwise Io plasma torus is stable. The preferred profile for this instability is an outward decreasing distribution of cold plasma. On the other hand, the favorite distribution for stability is an outward increase profile of hot plasma. The Galileo spacecraft observed that the cold plasma content is twice as that of the Voyager period, while the hot plasma content maintains at the same level. The stability of Io plasma torus was studied numerically via magnetohydrodynamics (MHD) approach. Our calculations indicated that for the Voyager period Io torus is stable, radial transport is impossible; while for the Galileo period Io torus is unstable, convection can take place. Our results are consistent with the observations by both spacecraft.