8th Asia-Pacific Conference on Plasma Physics, 3-8 Nov, 2024 at Malacca

Role of energetic electrons and ions on space objects potential in space plasma scenarios

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Abstract:

Space plasma particles and space weather conditions greatly affect the space objects at Geosynchronous Earth orbit (GEO). It is well known that objects in space get charged by the photoelectric effect, the collection of free electrons and ions from the plasma, and by secondary and backscattered electron emission due to the impact of energetic particles. Space plasma particles and space weather conditions strongly affect the charging threshold and potential. Due to the presence of highly energetic (superthermal) electrons at GEO altitudes, a generalized two temperature power law q-nonextensive particle distribution is employed to evaluate the modified current-balance equation in order to determine the critical and anti-critical temperature, both analytically and numerically. The mechanism underlying different charging behaviors at or near the threshold are also indicated at various plasma parametric domains. Furthermore, the general conditions of potential jump are also obtained which predict the sudden or smooth potential transition. In order to investigate the accurately electrical charging phenomenon on the object's surface, a detailed emission model has been used by incorporating the energetic electron and ions differentiating secondary electrons, elastically backscattered electrons and their yields.

References

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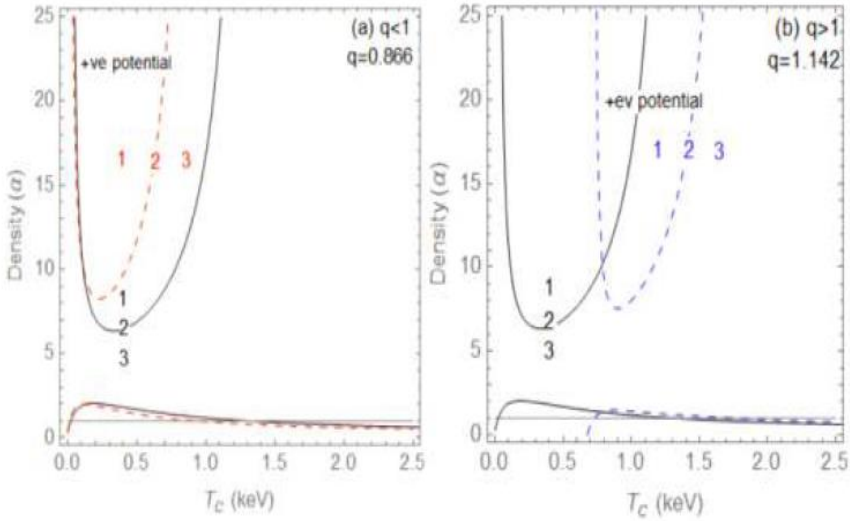

The threshold condition and average secondary and backscattered yield for CuBe that correspond to the surface material. The dashed line represent the q-nonextensive threshold condition and solid line represent Maxwellian threshold for plasma parametric domain $T_A < T_c < T^* < T_h$.