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Investigating the dynamics of radio wave propagation in the plasma sheath around the hypersonic space vehicle

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Abstract

The radio blackout occurring in hypersonic spacecraft re-entry is a very fundamental problem, primarily because of the relatively long (several minutes) blackout period. In this research, the role of injected solid dielectric particulate into the plasma sheath formed around the spacecraft in mitigating the radio communication cut-off between the ground-based station and the space vehicle is studied analytically. Considering the propagation dynamics of radio waves in the dusty plasma formed by solid particle injection and using Fresnel's formulae, the effect of dust particle number density and its dimension is investigated in the frequency range of 1-20GHz. In addition, the effect of the incident angle of the wave with the hypersonic shuttle nose surface has also been studied.

Keywords: hypersonic vehicle, plasma sheath, dusty plasma, injection of dielectric materials, transmission and reflection coefficients

For full article, refer to the Persian section