Rev. Mexicana Astron. Astrof., 12, 444 (1986)

A COMPARISON OF THE POYNTING-ROBERTSON DRAG WITH THE CHARGE DRAG IN THE EARTH'S PLASMA

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SUMMARY

The Poynting-Robertson drag is an effect of solar radiation that causes small particles in orbit around the Sun to spiral closer and eventually plunge in. It's very important in astronomical studies, such as the decay time for particles moving about the planets, the orbit of meteors and the tails of comets (Robertson, 1937; Burns et al.,1979).

A neutral conducting body moving in plasma acquires a negative Debye's potential due to collisions with electrons more often with ions. The charge drag consistes of the momentum exchange of the body with the ions due to collisions and scattering (Afonso et al.,in press).

In this work, we compare the charge drag (F_c) with the Poynting-Robertson drag (F_{PR}) for small spheres(radius of spheres smaller than Debye's length) and we obtain the following approximate expression: $F_c/F_{PR}=8.1\times10^{-10}n^{5/6}T^{2/3}$, where n and T are, respectively, the density of ions and the thermal temperature of electrons.

By using the Earth's plasma parameters derived from in situ satellite measurements and whistler observations (Chiu et al.,1979), we show that, for altitudes less than 25,000km, the effect of charge drag is the most important one to be considered.

REFERENCES

Afonso,G.B., Barlier,F., Berger,C., Mignard,F. and Walch,J.J.,in press,J.G.R.
Burns,J.A., Lamy,P. and Soter,S.,1979,Icarus,40,339.
Chiu,Y.T., Luhmann,J.G., Ching,B.K. and Boucher,D.J.,Jr.,1979,J.G.R.,84,909.
Robertson,H.P.,1937,M.N.R.A.S.,97,423.

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