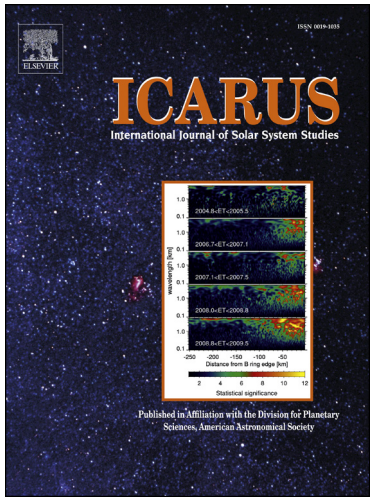

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Pluto's Solar Wind Interaction: Collisional Effects

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Abstract

Exospheric neutral atoms and molecules (primarily N_2, with trace amounts of CH_4 and CO according to our current understanding of Pluto's atmosphere) escape from Pluto and travel into interplanetary space for millions of kilometers. Eventually, the neutrals are ionized by solar EUV photons and/or by collisions with solar wind electrons. The mass-loading associated with this ion pick-up is thought to produce a comet-like interaction of the solar wind with Pluto. Within a few thousand kilometers of Pluto the solar wind interaction should lead to a magnetic field pile-up and draping, as it does around other "non-magnetic" bodies such as Venus and comets. The structure of plasma regions and boundaries will be greatly affected by large gyroradii effects and the extensive exosphere. Energetic plasma should disappear from the flow within radial distances of a few thousand kilometers due to charge exchange collisions. An ionosphere should be present close to Pluto with a composition that is determined both by the primary ion production and ion-neutral chemistry. One question discussed in the paper is whether or not the ionosphere has a Venus-like sharply defined ionopause boundary or a diamagnetic cavity such as that found around comet Halley. Simple physical estimates of plasma processes and structures in the collision-dominated region are made in this paper and predictions are made for the New Horizons mission.

Keywords: Pluto; Pluto Atmosphere; Ionospheres; Solar Wind; Comets, plasma

1.0 Introduction

Exospheric neutral atoms and molecules (primarily N_2, with trace amounts CH_4 and CO according to our current understanding of Pluto's atmosphere) escape from Pluto and travel into interplanetary space for millions of kilometers (cf. *Zhu et al.,* 2014). Eventually, the neutrals are ionized and the resulting mass loading associated with the ion pick-up is thought to produce a comet-like interaction of the solar wind with Pluto as discussed by *Bagenal and McNutt* (1989). Note that heavy ion gyroradii far upstream of Pluto should be about a half million kilometers due to the weak interplanetary magnetic