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Sub-Alfvenic magnetosphere of a Hot Jupiter

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Abstract

In this work we investigate properties of Hot Jupiter class exoplanet magnetospheres in cases where the relative velocity of a planet and the stellar plasma flow around it is sub-Alfvenic (i.e. the vector sum of the plasma flow velocity and the exoplanet orbital velocity is less than the local Alfven velocity). Under these conditions a special current structure known as Alfven wings develops in the magnetosphere.

1. Introduction

Alfven wings connect an exoplanet's ionosphere and magnetosphere with the chromosphere of the host star. In this case the exoplanetary magnetosphere structure depends entirely on the structure of the Alfven wings.

Most known exoplanets are located in orbits closer than 0.6 AU, which leads to intense heating, ionization, and chemical changes in the upper atmosphere induced by stellar radiation. This leads to expansion of ionized atmospheric material, which can then form an equatorial plasma disk in the exoplanetary magnetosphere.

2. Summary and Conclusions

In our work we consider possible physical conditions in a typical Hot Jupiter orbit and examine the structure of a magnetosphere with Alfven wings, both with and without a plasma disk.