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# Alfvenic current system in Saturn's magnetosphere and time variation of the magnetic field in the outer Saturn magnetosphere.

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## 1. Introduction

As pointed out in particularly by Cowley et al. [1], the magnetosphere-ionosphere interactions in the case of rapidly rotated planets with additional source of inter-magnetospheric plasma, results that the magnetospheric plasma cannot state in the rigid corotation together with the planet. Slipping of the magnetospheric plasma relative to the outer atmosphere results in the generation of the equatorial plasma magnetodisk with embedded strong thin azimuthal currents. The same process results in the generation of potential drop along the magnetic field lines, as well as the electrons beams acceleration and powerful aurora emitting by the upper atmosphere. The very high field-aligned conductivity requires that magnetic field lines be equipotential (parallel electric field must be zero) and angular velocity must be the same at the ionosphere and in the equatorial plane, but beyond the Alfvenic radius magnetic field can not control of the plasma flow in the magnetosphere, and specific 3D current system will be generated.

## 2. Ionospheric and field-aligned currents.

We describe all toroidal and poloidal currents connected by each to other through the ratio of the Pedersen and Hall ionospheric conductivities as parts of the total current system. We added the azimuthal field B_phi created by the field-aligned currents to the global paraboloid model of the magnetic field in the Kronian magnetospheres [2]. Because the ionospheric part of the total current loop controlled by ionospheric conductivity, and the conductivity is determined by precipitation electron flux, we have a positive feedback. The electron beams results in increasing of Hall conductivity and last effect increase the field-aligned potential drop and the energy exchange between neutral atmosphere

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## References

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