3-D NUMERICAL SIMULATIONS OF TTAURI MAGNETOSPHERES.

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As shown by the detections of kG fields, TTauri stars are magnetized and it is straightforward to assume that the magnetic fields are crucial in the region connecting the star and the disk. However, the way in which the interaction between the magnetosphere and the accretion disk takes place is very complicated and still not well understood. The idea that disks play a role in the regulation of the stellar angular momentum is supported by observations of rotation periods in these stars: in the absence of disks, the star is expected to spin-up during the contraction phase to the main sequence due to angular momentum conservation. However, the presence of disks is probably restraining this spin-up effect expected during the contraction. Despite theoretical and numerical advances, the detailed mechanism of how the star-disk interaction transports the angular momentum of the disk is still poorly known. The momentum loss can be achieved based on a few assumptions on the mass loss rate and on the magnetic field geometries. For instance, magnetic torques can transfer angular momentum into the disk if we assume that the stellar magnetosphere truncates the circumstellar disk at a characteristic radius, forcing accretion onto the star along field lines.

Due to the complexity of this problem, magnetohydrodynamic (MHD) numerical simulations are in a unique position to examine global properties, time evolution, and dynamical stability of the disks; and thus have become an indispensable tool in these studies. Therefore, in order to investigate the interaction between the magnetosphere and the disk, we use the 3D MHD code BATS-R-US.

The highly parallel BATS-R-US code uses a 3D block-adaptive MHD Cartesian grid and has been extensively used to investigate numerous problems, among others, the physics of solar ambient and well as the interaction of the solar wind with the interstellar medium, all of them with high spatial resolution (e.g., Manchester et al. 2004, Cohen et al. 2007, Opher et al. 2007). BATS-R-US will be extended to study the disk-star magnetic coupling in proto-stellar systems.

In this work, we present some preliminary results of the high resolution numerical simulations that we are performing in order to study the disk-star magnetic coupling.

Acknowledgments

This work is being supported by the Brazilian funding agency CAPES under grants BEX4686/06-3 and 304523/90-9 and by NASA grant LWS03-0130-0149.

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Opher, M., Stone, E. C., Gombosi, T. I. 2007, Science, in press