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MAGNETIC FIELD EVOLUTION IN NEUTRON STARS

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Neutron stars contain the strongest magnetic fields known in the Universe. Using numerical simulations restricted to axially symmetric geometry, we study the long-term evolution of the magnetic field in the interior of an isolated neutron star under the effect of ambipolar diffusion, i.e. the drift of the magnetic field and the charged particles relative to the neutrons. We model the stellar interior as an electrically neutral fluid composed of neutrons, protons and electrons; these species can be converted into each other by weak interactions (beta decays), suffer binary collisions, and be affected by each other's macroscopic electromagnetic fields. We show that, in the restricted case of pure ambipolar diffusion, neglecting weak interactions, the magnetic fields evolves towards a stable MHD equilibria configuration, in the timescales analytically expected.

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HEATING OF PROTOSTELLAR ACCRETION DISKS

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The magneto-rotational instability (MRI) is believed to be the mechanism responsible for a magnetohydrodynamic turbulence that could lead to the accretion observed in protoplanetary disks. The need of a minimum amount of ionization in protostellar accretion disks is necessary for the MRI to take place. There are in the literature several studies that include the damping of Alfvén waves as an additional heating source besides the viscous heating mechanism in a geometrically thin and optically thick disk. The damping of the waves transfers energy to the disk increasing the temperature and consequently its ionization fraction, making possible the presence of the MRI in a large part of the disk. We analyzed the contribution of non-ideal effects such as Ohmic and ambipolar diffusion for the disk heating and compare these heating rates with those obtained by damping of Alfvén waves. In order to study these non-ideal effects, we have estimated the radiation emission of each effect through the energy conservation equation, and associated each emission with a black body radiation, which enabled us to assign a temperature contribution of each effect. Using the *ATHENA* code we were able to simulate the disk at different radial distances, and estimate the electric current density needed to calculate the radiation emission associated with each effect. Once we have those data, we were able to compare the results with other heating sources, like viscosity and Alfvén waves damping, and we concluded that the Ohmic and ambipolar diffusions do not heat the disk in any significant way.

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