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Formation and Structure of Magnetized Protoplanetary Disks

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Abstract. Protoplanetary disks are expected to form through the gravitational collapse of magnetized rotating dense cores. We discuss the structure and emission of models of accretion disks threaded by a poloidal magnetic field and irradiated by the central star, expected to form in this process (Shu *et al.* 2007; Lizano *et al.* 2016). The poloidal magnetic field produces sub-keplerian rotation of the gas which can accelerate planet migration (Adams *et al.* 2009). It can make the disk more stable against gravitational perturbations (Lizano *et al.* 2010). Also, the magnetic compression can reduce the disk scale height with respect to nonmagnetic disks. We find that the mass-to-flux ratio λ is a critical parameter: disks with a weaker magnetization (high values of λ) are denser and hotter and emit more at millimeter wavelengths than disks with a stronger magnetization (low values of λ). Applying these models to the millimeter observations of the disk around the young star HL Tau indicate the large grains are present at the external radii in order to reproduce the observed 7 mm emission that extends up to 100 AU (Tapia & Lizano 2017). In the near future, observations with ALMA and VLA will be able to determine the level of magnetization of protoplanetary disks, which will be important to understand their formation and evolution.

Keywords. accretion, accretion disks, ISM: magnetic fields, planetary systems: protoplanetary disks, stars: formation

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