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MHD Simulations of Disk-Star Interaction

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Many disk-accreting stars have a dynamically important magnetic field which strongly influences matter flow in their vicinity and determines the observational properties of these stars. Examples include young Solar-type stars at the stage of planet formation, neutron stars and white dwarfs in binary systems, and other stars. Recent 3D simulations have shown that accretion to such stars may be in the stable or unstable regime. In the stable regime, matter is lifted above the equatorial plane and accretes to the star in two ordered funnel streams which form two ordered hot spots on the star, and the magnetospheric gap in the equatorial plane has a low matter density. In the unstable regime, matter penetrates through the magnetosphere due to the 3D interchange instability, where the low-m perturbation modes dominate, due to which matter accretes to the star through a few chaotic tongues which form chaotic hot spots on the star. I will discuss the observational appearance of both regimes of accretion, and also the possible importance of the magnetospheric gap for the survival of close-in planets.