3D YSO accretion shock simulations: a study of the magnetic, chromospheric and stochastic flow effects and their observational relevance

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Abstract

The structure and dynamics of young stellar object (YSO) accretion shocks depend strongly on the local magnetic field strength and configuration, as well as on the radiative transfer effects responsible for the energy losses. We present the first 3D YSO shock simulations of the interior of the stream, assuming a uniform background magnetic field, a clumpy infalling gas, and an acoustic energy flux flowing at the base of the chromosphere. We study the dynamical evolution and the post-shock structure as a function of the plasma-beta (thermal pressure over magnetic pressure). We find that a strong magnetic field (_˜hundreds of Gauss) leads to the formation of fibrils in the shocked gas due to the plasma confinement within flux tubes. The corresponding emission is smooth and fully distinguishable from the case of a weak magnetic field (_˜tenths of Gauss) where the hot slab demonstrates chaotic motion and oscillates periodically. We post-process our results with the code IRIS and discuss the observational relevance of the simulations to observed YSOs. The work is supported by French ANR, under grant 08-BLAN-0263-07.

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