Radiation effects on impact of accretion streams in Classical T Tauri Stars

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Abstract

Classical T Tauri Stars (CTTSs) are young stars accreting mass from their circumstellar disks. According to the largely accepted magnetospheric accretion scenario, the disk extends up to the truncation radius. In this region, the magnetic field is strong enough to disrupt the inner part of the disk and to channel the material towards the star forming accretion columns. The channeled material impacts into the stellar surface producing shocks that heats up the plasma at a few million degrees.

In the last twenty years, the X-ray and UV observations of these systems have raised several questions. In particular, the UV lines arising from the accretion regions show complex profiles, which cannot be easily interpreted using current accretion models. Also, the observed X-ray luminosity is systematically below the value predicted by theoretical models.

To tackle these problems, we modelled the structure and the dynamics of the plasma in the impact region using radiation hydrodynamics simulations, including, for the first time, the effects of radiative transport in the Non-Local Thermodynamic Equilibrium (NLTE) regime.

The radiation arising from the shocked plasma is partially absorbed by the unshocked accretion column. As a result, due to the absorption of X-rays arising from the shocked plasma at the impact region, the pre-shock downfalling accreted material is gradually heated up to a few 10^5 K.

We discuss the implication of this pre-shock heating for the UV and X-ray emission arising from the impact region.

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