

Hotter Together: The Impact of Asymmetric Radiation on Disc Chemistry and Dynamics in Stellar Binaries

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Computational models of protoplanetary discs have often simplified dynamic processes by assuming a symmetric radiation and temperature field generated by the central star, even when modeling binary systems. This assumption, already inadequate for single-star discs, becomes even less appropriate when modeling multiple stellar systems. In this study, we present novel results obtained using the hybrid code PHANTOM-MCFOST, which combines hydrodynamical SPH simulations and Monte Carlo radiative transfer computations in 3D to study the impact of asymmetric and evolving radiation fields on S-type protoplanetary discs in binary systems. We consider two main configurations for stellar luminosities: an equal-mass binary system (composed of two identical solar-like stars) and an unequal-mass binary, where one star experiences an FU Orionis-like outburst. For each configuration, we explore both coplanar and inclined binary-disc orientations. Our results reveal highly asymmetrical temperature profiles in radial, vertical, and azimuthal directions due to heating from the secondary, which modifies the disc aspect ratio. This mechanism has important implications for disc dynamics and dust composition, as the location of the snowlines within the disc changes with the binary phase.

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