Analysis of Star-Disk Interaction in Young Stellar Systems

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Abstract

We present the study of star-disk interaction in the classical T Tauri star V354 Mon, a member of the young stellar cluster NGC 2264. As part of an international campaign of observation of NGC 2264 organized from December 2011 to February 2012, high resolution photometric and spectroscopic data of this object were obtained simultaneously with the Chandra, CoRoT and Spitzer satellites, and ground-based telescopes, as CFHT and VLT/FLAMES at ESO. The optical and infrared light curves of V354 Mon show periodic brightness minima that vary in depth and width every rotational cycle. We found evidence that the H/alpha emission line profile changes according to the period of photometric variations, indicating that the same phenomenon causes both modulations. Such correlation was also identified in a previous observational campaign on the same object, where we concluded that material non-uniformly distributed in the inner part of the disk is the main cause of the photometric modulation. This assumption is supported by the fact that the system is seen at high inclination. It is believed that this distortion of the inner part of the disk results from the dynamical interaction between the stellar magnetosphere, inclined with respect to the rotation axis, and the circumstellar disk, as also observed in the classical T Tauri star AA Tau, and predicted by magnetohydrodynamic numerical simulations. A model of occultation by circumstellar material was applied to the photometric data in order to determine the parameters of the obscuring material during both observational campaigns, thus providing an investigation of its stability on a timescale of a few years. We also studied V422 Mon, a classical T Tauri star with photometric variations similar to those of V354 Mon at optical wavelengths, but with a distinct behavior in the infrared. The mechanism that produces such difference is investigated, testing the predictions of magnetospheric accretion models.

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