RevMexAA (Serie de Conferencias), **44**, 27–27 (2014)

XIV Latin American Regional IAU Meeting (Florianópolis/SC, Brazil, 25-30 November 2013)
Editors: A. Mateus, J. Gregorio-Hetem & R. Cid Fernandes

OBSERVATIONAL ANALYSIS OF YOUNG STARS IN NGC 2264

S. H. P. Alencar[1], J. Bouvier[2], J. Stauffer[3], and the CSI2264 Team

We present initial results of a multiwavelength observational campaign of the young open cluster NGC 2264. We have identified several classes of objects with optical light curves that are dominated by cold spots, extinction by circumstellar material or variable accretion events. We show that we can characterize the different physical processes taking place at the stellar surface and its circumstellar environment.

NGC 2264 is a young ($\sim$ 3 Myr) open cluster at about 760 pc from the Sun that has been extensively studied and has about 2000 known members (Dahm 2008). In 2008 the cluster was observed for 23 days continuously with the CoRoT satellite, yielding light curves of young stellar objects with unprecedent accuracy. This initial campaign provided clues on the relation between accretion and X-ray variability (Flaccomio et al. 2010), the inner disk structure of accreting systems (Alencar et al. 2010), rotation in the pre-main sequence (Affer et al. 2013) and pulsation of young stars (Zwintz et al. 2013). Many young eclipsing binary systems were also discovered and some have been followed-up in the last years (Gillen et al. 2013). In the end of 2011 a new multiwavelength observational campaign of NGC 2264 was organized, which included 40 days of continous and simultaneous optical photometry from CoRoT and MOST satellites, 30 days of infrared photometry from Spitzer and 3.5 days of X-ray observations from Chandra satellites (Cody et a. 2012). We also obtained a number of spectroscopic and photometric observations from the ground at the same epoch.

We have classified the CoRoT light curves according to their morphology as spot-like, AA Tau-like, bursts and irregulars. The spot-like light curves are periodic and due to spots at the stellar surface. The AA Tau-like ones are periodic and present a well defined maximum interrupted by minima that vary in width and depth at each rotation cycle. They are interpreted as due to obscuration by circumstellar material located at the inner disk, as observed in the classical T Tauri star AA Tau (Bouvier et al. 2007). The warp is thought to be created by the interaction of the stellar magnetic field, inclined with respect to the rotation axis, with the circumstellar disk. The burst light curves are flat-bottomed and show short-lived irregular emissions associated with episodic accretion bursts. The CoRoT light curves were classified according to their morphology, but they reflect the evolution of the accretion process: spot, AA Tau and burst systems present very low, intermediate and strong UV excess respectively.

The periods measured in the AA Tau-like light curves correspond to the keplerian period of the region where the occulting material is located. In both campaigns, although the AA Tau-like period distribution is not equal to the spot-like one, they bear strong resemblance with each other, indicating that the obscuring material cannot be too far away from the co-rotation radius, like in AA Tau itself.

About 20% of the CTTSs observed with CoRoT in NGC 2264 were classified as AA Tau in both campaigns, showing that inner disk warps are common features in young star-disk systems. About a third of the AA Tau-like systems observed in 2008 became irregulars in 2011 and almost an equal amount of irregulars in 2008 became AA Tau-like in 2011. In order to be considered AA Tau-like, the light curve had to be periodic, so this result suggests that classical T Tauri stars can move from stable (with an ordered accretion funnel) to unstable (with several accretion streams) accretion regimes (see Kurosawa & Romanova 2013) in a timescale of a few years.

SHPA had support from Fapemig and CNPq.

REFERENCES

Affer, L., et al. 2013, MNRAS, 430, 1433
Alencar, S. H. P, et al. 2010, A&A, 519, A88
Bouvier, J., et al. 2007, A&A, 463, 1017
Cody, A. M., et al. 2013, AN, 334, 63
Dahm, S. E. 2008, Handbook of Star Forming Regions, Volume I, 966
Flaccomio, E. et al. 2010, A&A, 516, L8
Gillen, E. et al. 2013, A&A, accepted
Kurosawa, R. & Romanova, M. M. 2013, MNRAS, 431, 2673
Zwintz, K. et al. 2013, A&A, 550, A121

[1]Dep. de Física – ICEx – UFMG, Av. Antônio Carlos, 6627, 31270-901, Belo Horizonte, MG, Brazil (silvia@fisica.ufmg.br).
[2]UJF-Grenoble 1 / CNRS-INSU, Institut de Planétologie et d'Astrophysique de Grenoble (IPAG) UMR 5274, Grenoble, F-38041, France (Jerome.Bouvier@obs.ujf-grenoble.fr).
[3]Spitzer Science Center, California Institute of Technology, Pasadena, CA 91125, USA (stauffer@ipac.caltech.edu).