

Young Stellar Object Variability at IRAC Wavelengths: Clues to Star and Planet Formation

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In Morales *et al.* (2009), we have recently investigated the mid-infrared (3.6 to 8.0 micron) variability of young-stellar objects (YSOs) using the IRAC camera on the Spitzer Space Telescope. Specifically, we obtained synoptic photometry of about 70 YSOs in the ~ 1 Myr old IC1396A globule over a 14 day period. More than half of the YSOs were detectably variable, with amplitudes up to about 0.2 magnitudes. About a third of these objects showed quasi-sinusoidal light curves with apparent periods of typically 5 to 12 days. At least two families of models can explain such light curves: (a) a Class II YSO with a photospheric hot spot which locally heats the inner circumstellar disk which is viewed from slightly above the disk plane, and (b) a YSO with a warped disk or with some other non-axisymmetric inner disk density profile, also seen with a view angle slightly above the disk plane. The two models can both yield light curve shapes and amplitudes similar to what we observe in the mid-infrared, but produce very different light curves at shorter wavelengths dominated by the stellar photosphere. Because we only had IRAC photometry for IC1396A, we were not able to discriminate between the two models for this set of data.

We have just begun a much more extensive monitoring program to obtain synoptic observations of >1500 YSOs in Orion and eleven other star formation regions. The new effort - called YSOVAR - is a Spitzer "Warm Mission Exploration Science" program allocated 550 hours of observing time. For each cluster, we will obtain about 100 epochs of IRAC photometry, normally mostly in a 40 day window of time. We will also obtain a large body of optical and near-IR photometry in order to discriminate between the different physical models. Observations of IC1396A and the inner one square degree of the Orion Nebula Cluster will be obtained during Sept.-Dec. 2009. All of the IRAC data from the program will be made publicly available within 90 days of their being pipeline processed. The optical and near-IR photometry will also be made public, as rapidly as we can do so.

Details about YSOVAR, the clusters to be observed, and the schedule of observations can be found at <http://ysovar.ipac.caltech.edu/>.

References

Morales, M., Stauffer, J., Rebull, L. *et al.* 2009, *ApJ* 702, 507