

ROTATION AND ECLIPSES OF LOW-MASS STARS THE YOUNG OPEN CLUSTER NGC 2362.

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We have undertaken a large scale monitoring survey of nine young (1–200 Myr) open clusters in the solar neighbourhood: the Monitor project (Aigrain et al. 2007, MNRAS, 375, 29, see <http://www.ast.cam.ac.uk/research/monitor/> for more details.). The primary goal of the program is to search for eclipses by very low mass stars, brown dwarfs or planets in the light curves of the low-mass cluster members, so as to constrain formation and early evolution models for these objects. The data are also ideally suited to the study of angular momentum evolution in low mass stars, through the comparison of photometric rotation period distributions in the Monitor clusters and in the literature, as well as of other forms of variability associated with flaring or time-variable accretion.

In this contribution, we report preliminary results of our survey in the rich young cluster NGC 2362 (5_{-2}^{+1} Myr, 1480 pc, Moitinho et al. 2001, ApJL, 563, 73). Because of its age, the detection of eclipses or transits in NGC 2362's would provide a crucial test of evolutionary models. It is also at a particularly interesting stage for angular momentum evolution, where stars are fast becoming decoupled from their circumstellar disks (Haisch 2001, ApJL, 553, 153), enabling us to study the dependence of disk-locking on stellar mass by comparing its rotation period distribution to that of younger and older clusters.

Data were obtained from the 4m CTIO Blanco telescope and MosaicII imager on 18 nights between February 2005 and January 2006. We describe the observations and the subsequent data processing using our automated pipeline (Irwin et al. 2007a, MNRAS, 374, 1449), which enabled us to achieve better than 1% photometry down to $I = 18.5$ (RMS of ~ 3 mmag

at $I = 15$), covering stars with masses $1.2\text{--}0.1 M_{\odot}$.

Initial selection of likely cluster members was based on a deep V , $V - I$ CMD, and we computed contamination estimates using simulations based on the Besançon Galactic model and comparison with the photometric and spectroscopic surveys of others (e.g. Moitinho 2001; Dahm 2005, AJ, 130, 1805 Dahm 2005; Dahm & Hillenbrand 2007, AJ, 133, 2072).

All candidate cluster members were searched for periodic sinusoidal variability following Irwin et al. (2006, MNRAS, 370, 954; 2007, MNRAS, in press), and we present the results of our period analysis for some 1800 stars down to $I = 19$, among which we find ~ 400 rotators. We compare the period-mass distribution of NGC2362 with that of other open clusters at a range of ages and investigate simple models of rotational evolution and disk-locking timescales.

We also search for eclipse-like events in the light curves of candidate cluster members, after filtering to remove rotational modulation. We find ~ 10 candidate eclipsing binary systems, some of which we describe in more detail. Spectroscopic follow-up of these objects is underway to determine component masses and assess cluster membership.

Finally, we expand on a subset of likely cluster members which exhibit significant (several tens of %) but somewhat erratic variability. Possible interpretations include rapidly evolving star-spots or eclipses by evolving or precessing circumstellar material. In the hope of distinguishing between the two hypotheses, we used the SMARTS 1.3 m telescope at CTIO and ANDICAM to obtain near-IR light curves of a subset of these objects, where we see clear eclipse-like events which repeat periodically but change in depth and/or phase over week to month timescales.