The Monitor project – Searching for eclipses in young open clusters

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and the Monitor project team:

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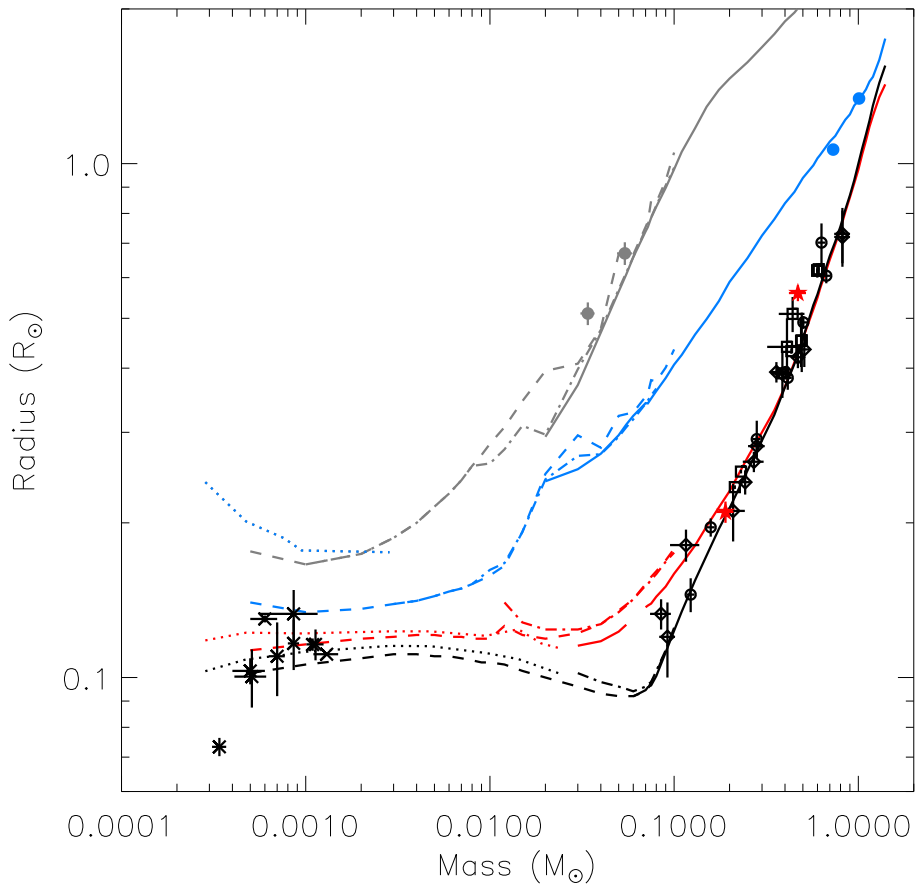
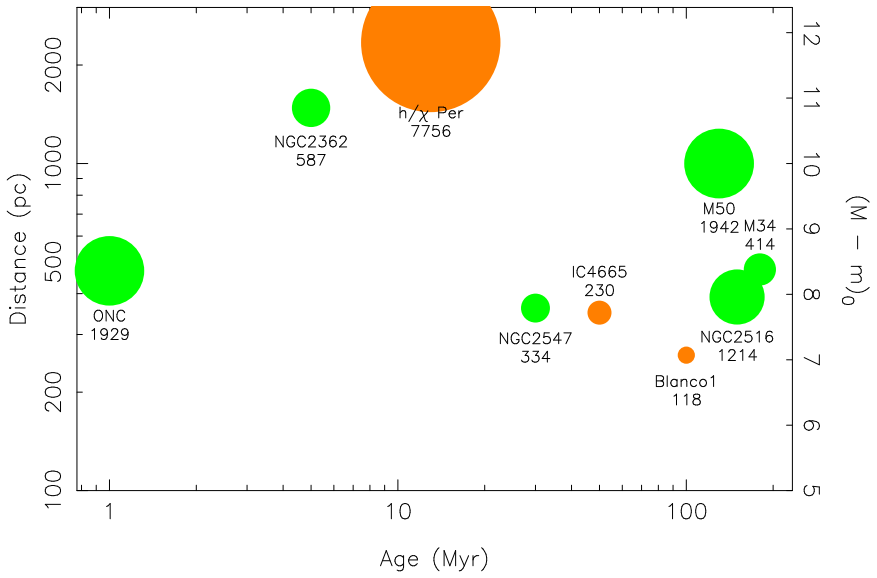
Motivation: mass-radius relation



- Lack of objects with M, R in the BD regime
- Restricted range of ages sampled
- So... look for EBs in young clusters and SFRs

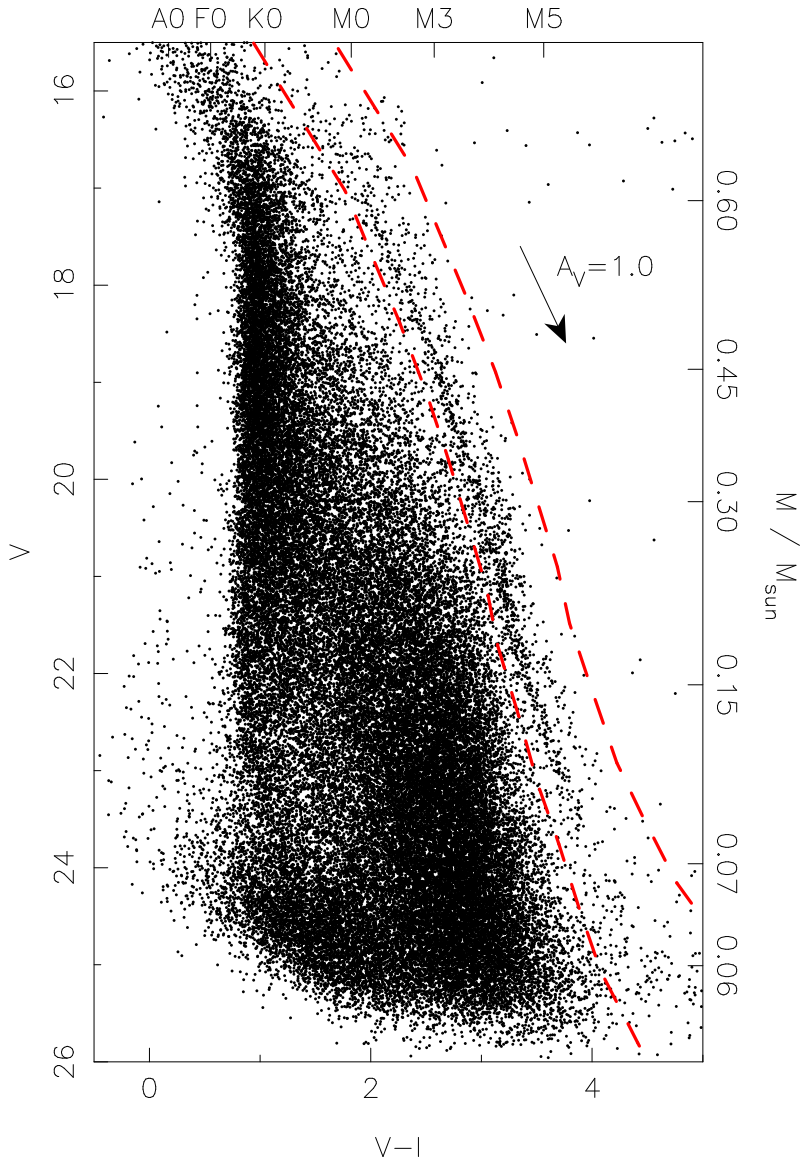
The Monitor project

- Transit survey in young open clusters and SFRs
  - Known age (and metallicity)
  - Bloated primaries
- Concentrating on low- and very low-mass primaries
  - Deeper transits
  - Larger RV amplitudes
- Targets

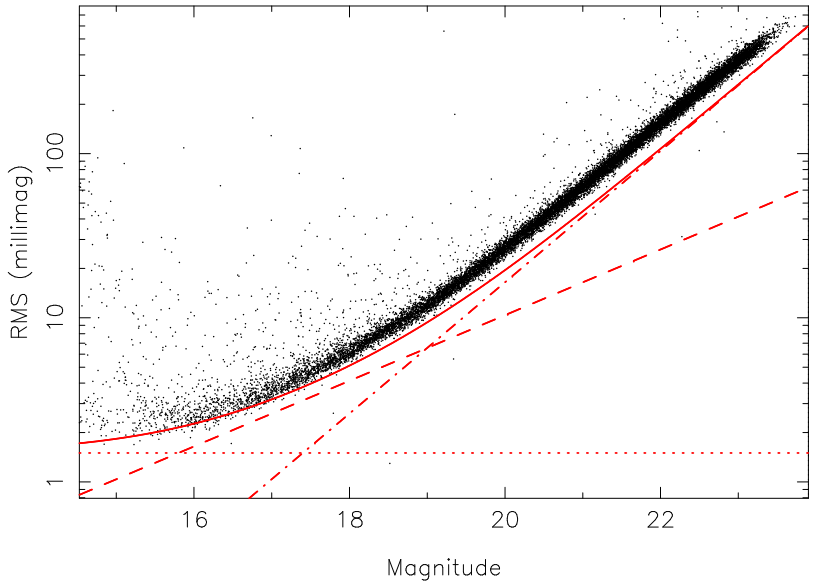


  - Ages up to ~ 200 Myr
  - Need to be relatively rich and compact
  - Small distance modulus to reach low-mass

Photometry

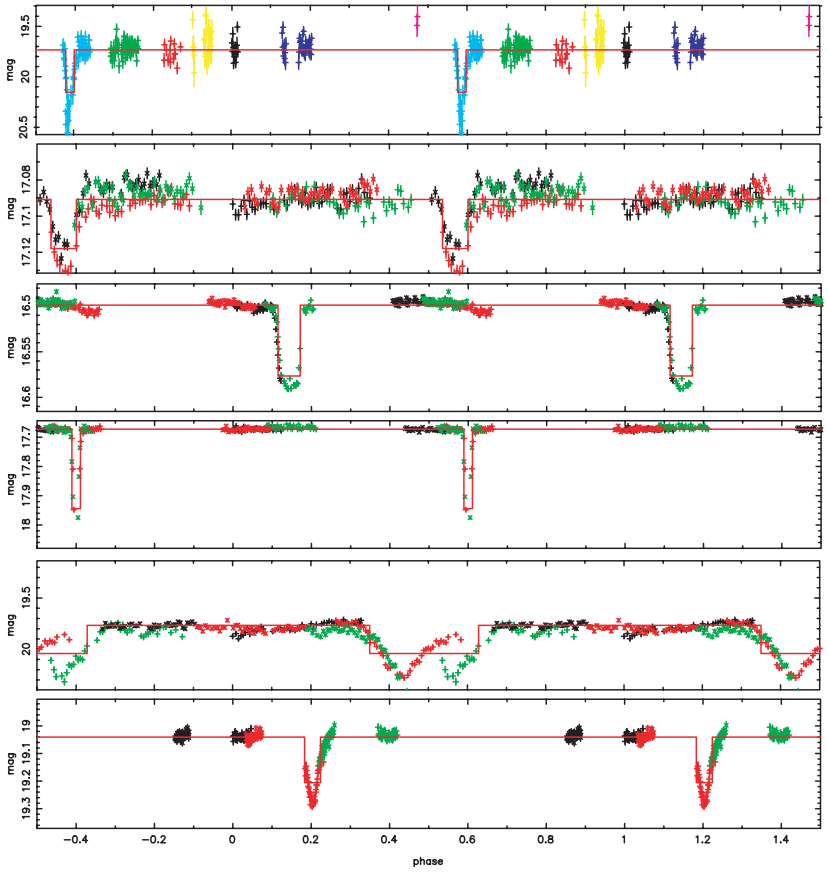


- Candidate cluster members selected in V, $V-I$ CMDs
- High-cadence monitoring (<15 min) aiming for 100 hours per cluster in i-band
- Better than 1% to $i \sim 19$ (CTIO), $i \sim 17$ (INT)

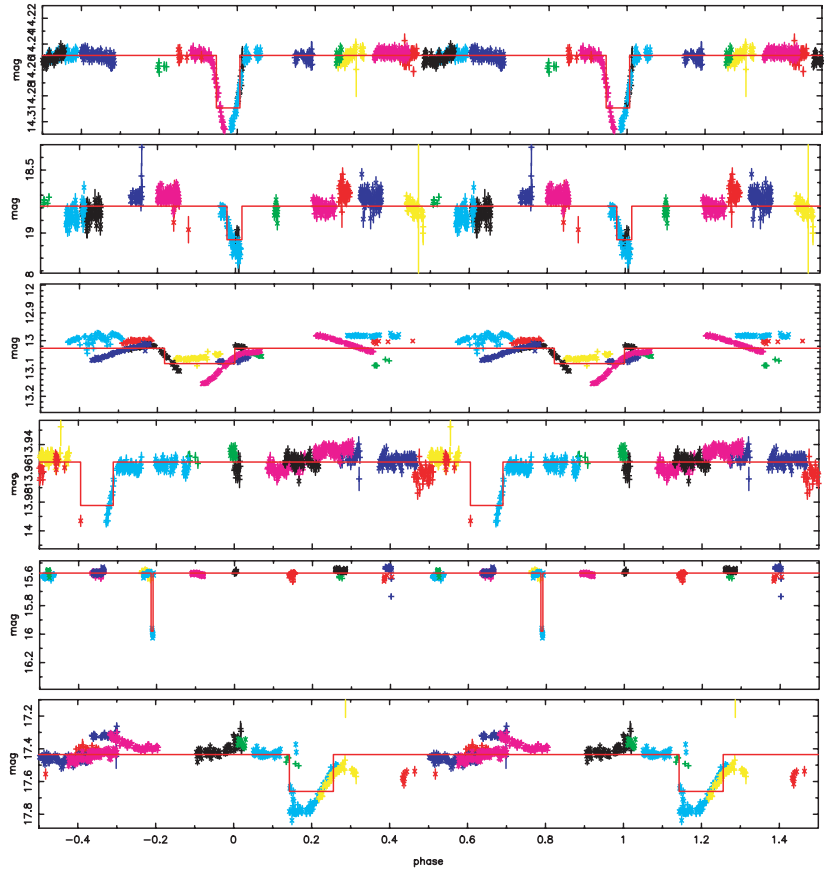


Candidates

- 25 high-quality candidates, in 4 clusters ($\sim 1 - 200$ Myr)



M34, M50, NGC 2362



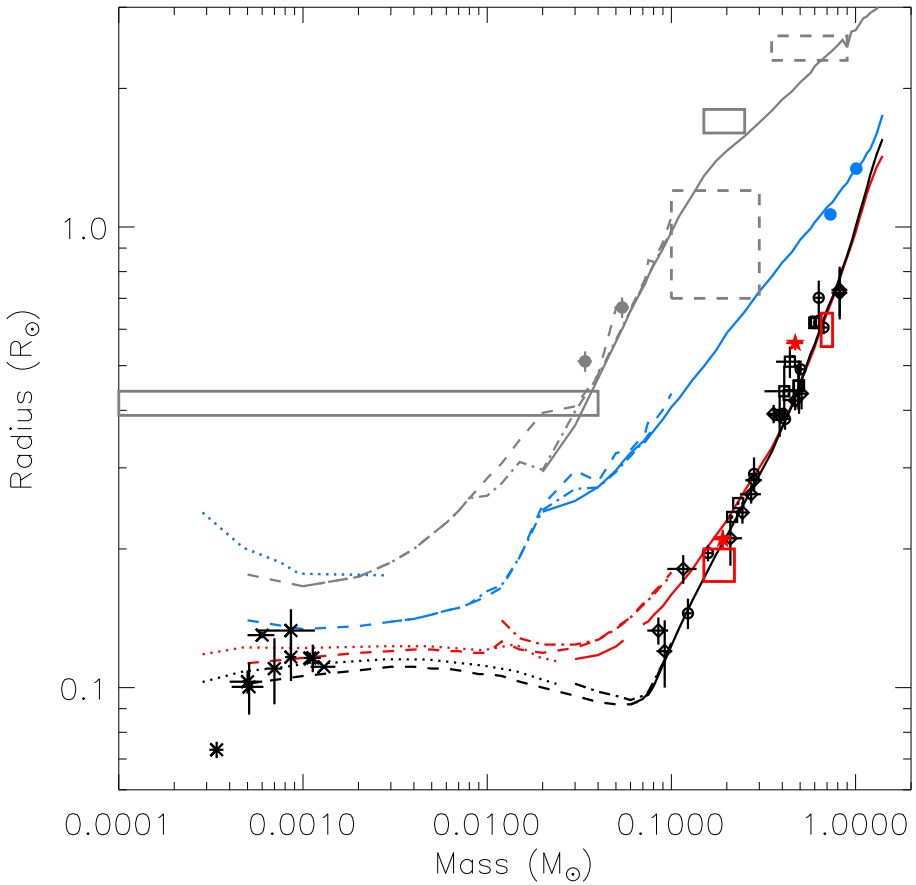
ONC

Preliminary results

- Two good candidates in ONC with some RV data
- Both proper motion ONC members (Hillenbrand 1997)
- Eclipses reconfirmed with NMSU 1m data early 2006
- One shows some RV variations at $\sim \pm 30\ \mathrm{km\ s^{-1}}$
  - Primary $\sim$ M2 spectral type, models $\Rightarrow \sim 0.4\ \mathrm{M_\odot}$
  - Secondary best guess $\sim 0.2\ \mathrm{M_\odot}$ using models
  - Only primary RV curve measured so far, difficult to split lines
  - Discovered independently by Stassun et al., to be published by them
- The other shows no RV variations yet (to $\sim$ a few $\mathrm{km\ s^{-1}}$)
  - Primary $\sim$ M4 spectral type, models $\Rightarrow \sim 0.2\ \mathrm{M_\odot}$
  - Could still be a planet candidate: models indicate planets are bloated at $\sim$ a few Myr, still consistent with eclipse depth $\Delta i = 0.06$
  - Also seen by Stassun et al.

What can we say already?

- ONC-1-290
  - $0.15 \leq M_1/\mathrm{M}_\odot \leq 0.25$
  - $1.6 \leq R_1/\mathrm{R}_\odot \leq 1.8$
  - $M_2 \leq 0.04\ \mathrm{M}_\odot$
  - $0.39 \leq R_2/\mathrm{R}_\odot \leq 0.44$
- ONC-1-295
  - $0.35 \leq M_1/\mathrm{M}_\odot \leq 0.5$
  - $2.3 \leq R_1/\mathrm{R}_\odot \leq 2.6$
  - $M_2 \geq 0.1\ \mathrm{M}_\odot$
  - $R_2 \geq 0.7\ \mathrm{R}_\odot$
- M50-2-3089
  - $M_1 \sim 0.7\ \mathrm{M}_\odot$
  - $R_1 \sim 0.6\ \mathrm{R}_\odot$
  - $M_2 \sim 0.2\ \mathrm{M}_\odot$
  - $R_2 \sim 0.18\ \mathrm{R}_\odot$



Future work

- Highlights:
  - Photometry: NGC 2547 (30 Myr), h and χ Per (13 Myr)
  - Gemini South + Phoenix for high-dispersion RVs in ONC
- Secondary science:
  - Rotation period studies in all clusters (see my poster #298)
  - Flares in ONC (and possibly others)
  - X-ray – optical connection in ONC with COUP
- Thanks due to:
  - Maria Rosa Zapatero Osorio – LAEFF/INTA
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  - Jon Holtzman and Thierry Morel – NMSU 1m and Mercator

`http://www.ast.cam.ac.uk/~suz/monitor/monitor.php`