Close binaries in young systems

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How sensitive is star formation to environment?

Diagnostics:

– Mass function (stars/BDs?)

– Multiplicity (fraction of multiples? Configurations?)
Determining multiplicity

• Adaptive optics surveys down to ~60 mas
• Optical interferometry: ~1 mas
• Radial velocity surveys: period~years (depending on patience)

• Completeness? @ 150 pc, 60 mas ~ 27 yr @ 50 pc, 60 mas ~ 5 yr!
Close companion programme

Radial velocity survey of 141 stars in young (< 100 Myr), nearby (< 100 pc) groups:

η Cha  ~8 Myr  97 pc
TWA  ~8 Myr  20-100 pc
BPMG  10-20 Myr  10-40 pc
TucHor  20-30 Myr  40-60 pc
AB Dor  50-100 Myr  20-50 pc
Close companion programme

Target selection:

- All known members of SpT later than F5 (< 2 $M_\text{Sun}$)
- Visible from Las Campanas ($\delta < +30^\circ$).
- Brighter than $R=14$ (earlier than M5)
Close companion programme

- Telescope: Clay/Magellan 6.5m at Las Campanas, Chile
- Instrument: MIKE, High resolution echelle spectrograph (R~55000)
- 30 bright nights distributed over 2 years
- ~2200 spectra obtained
Multiple star formation
Toronto, Canada 2007-05-17

η Cha
rms = 55 m/s

TWA
rms = 90 m/s

BPMG
rms = 60 m/s

AB Dor
rms = 24 m/s
Example:

TWA 22

Epoch 1

Epoch 2
BD candidate (P~4 yr)  Planet candidate (5 M_J)
Combined result

$$\text{MSF} = (42 \pm 5) \%$$

$$\text{CSF} = (52 \pm 4) \%$$
Multiple star formation

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Companion fractions

eta Cha TWA BPMG TucHor AB Dor
Other results

- Lithium dating (Mentuch et al., in prep)
- Rotation-accretion connection (Jayawardhana et al. 2006)
- Rotation-activity connection (Scholz et al. 2007)
- Dynamics (N/A)
Conclusion

• Multiplicity is environment dependent.

Immediate future

• Analysis in progress; more juicy statistics to come.