Pre-main sequence binaries and the origin of field stars

The correlation between Hans and the binary frequency

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Taurus-Auriga

Leinert et al. 1993

T Tauri Stars
(48±7)% binaries

Main Sequence Stars
(25.3±3.9)% binaries

Fraction of orbits [%]

log(period) [days]

0 1 2 3 4 5 6 7 8 9 10

0 5 10 15

projected separation [arcsec]

0.13 0.5 1.3 5 13
Extrapolated to all periods, (nearly) all T Tauri stars in Taurus are multiple systems.
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No difference between classical and weak-lined T Tauri stars

Star formation = multiple formation
Where do most of the low-mass field stars originate?

Not in Taurus-Auriga!

Where did all the single main-sequence field stars form??
Initial multiplicity fraction = 100%

Binaries are destroyed by dynamical encounters in dense clusters

Can we find remnants of the initial binary frequency in the ONC?
Where do most of the low-mass field stars originate?

Not in Taurus-Auriga
and not in the ONC
(too many close binaries)
Do all Star-Forming Regions produce lots of close Binaries?
Observing with Hans

ROSAT-selected T Tauri stars in Chamaeleon
Chamaeleon

Ghez et al. 1997, Köhler 2001

Fraction of Orbits [%]

log(Period) [Days]

TTS discovered by ROSAT (20±5)% binaries
PMS: (24±8)% binaries (Koehler 2001)

Main-sequence stars (27±4)% binaries

TTS known before ROSAT (65±19)% bin. (Ghez et al. 1997)

Ghez et al. 1997, Köhler 2001
Two different populations
Classical T Tauri Stars associated with dark clouds Cha I & II at ~150 pc

Many (most?) ROSAT-selected stars are part of the moving group $\epsilon$ Cha

Distance ~100 pc

Age 3 - 5 Myr

See also Briceno & Tokovinin 2017
Takeaway points

- Binary distributions in Taurus-Auriga and the Orion Nebula Cluster do not match main-sequence stars.
- Density plays a role, but there must be more.
- $\epsilon$ Cha agrees with the field.
- What is the difference between Taurus and $\epsilon$ Cha?
- What is/was going on in $\epsilon$ Cha?