Do most stars form as singles or multiples?

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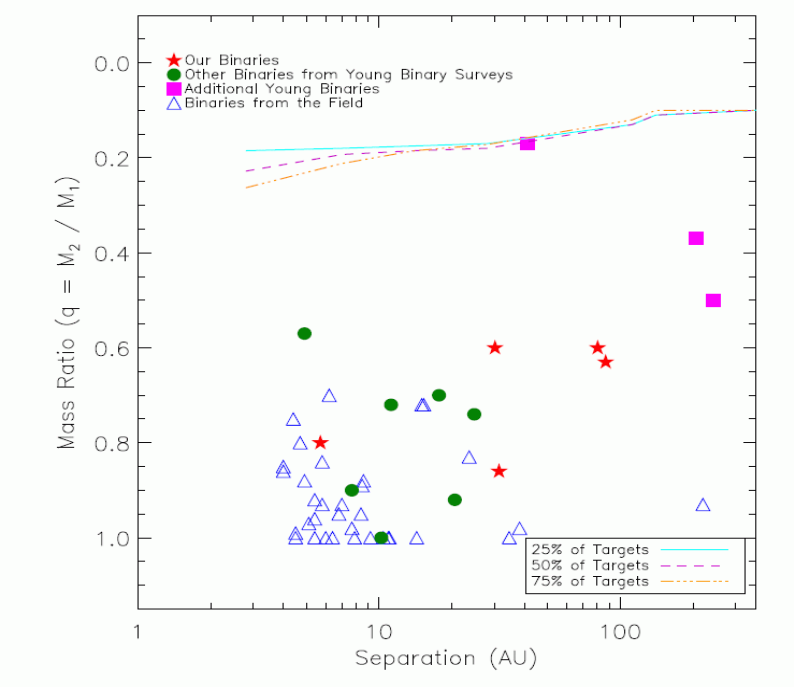
At least 50/50...

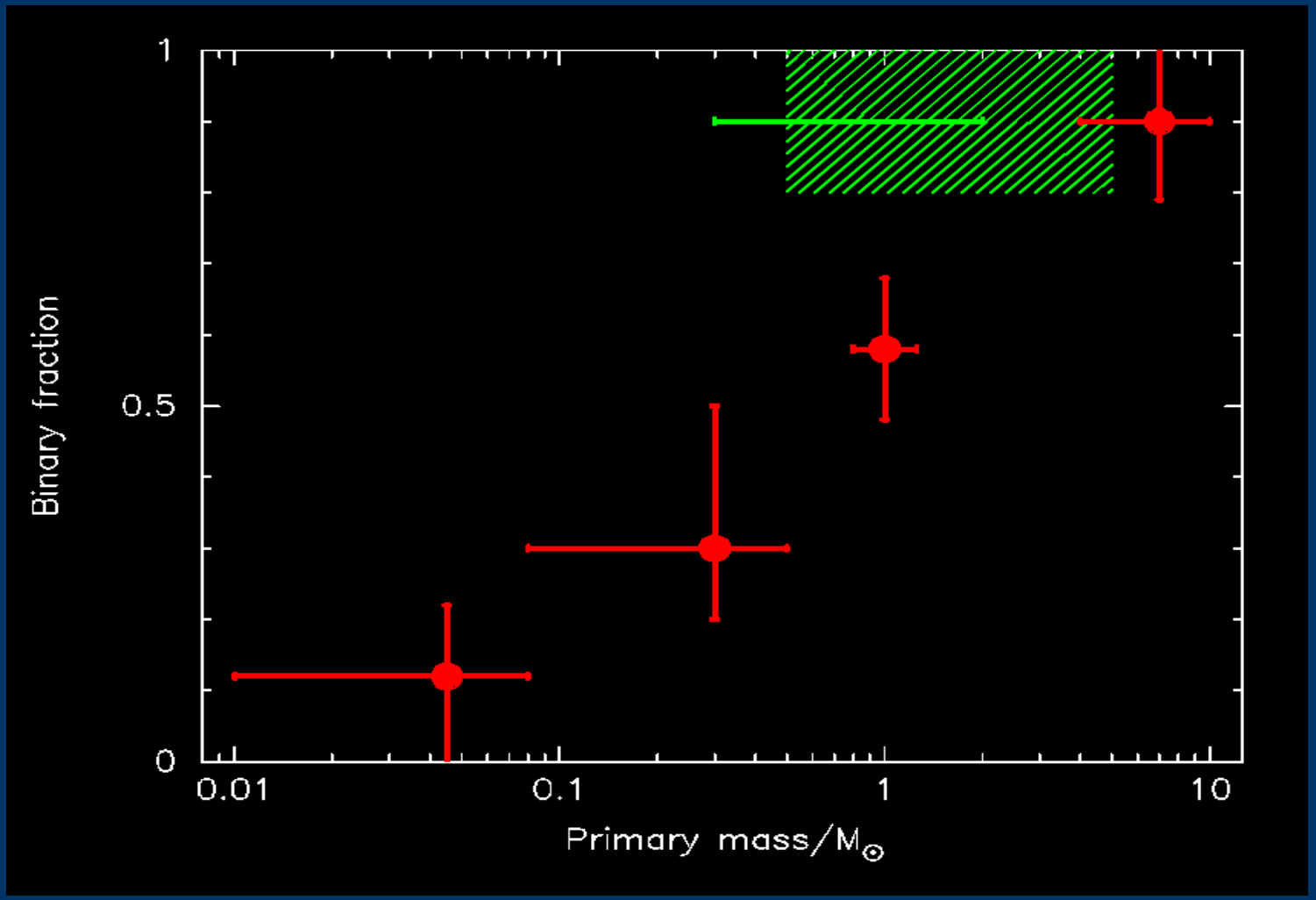
As Lada (2006) pointed-out ~90% of stars are M-dwarfs and the M-dwarf binary fraction is ~30% with M-dwarf secondaries.

So for every 100 M-dwarf systems, 30 are primaries, 70 are single, and there are 30 secondaries => **of every 130 M-dwarfs, 60 are in multiple systems**.

This does not include BD secondaries (e.g. Konopacky et al. 2007).

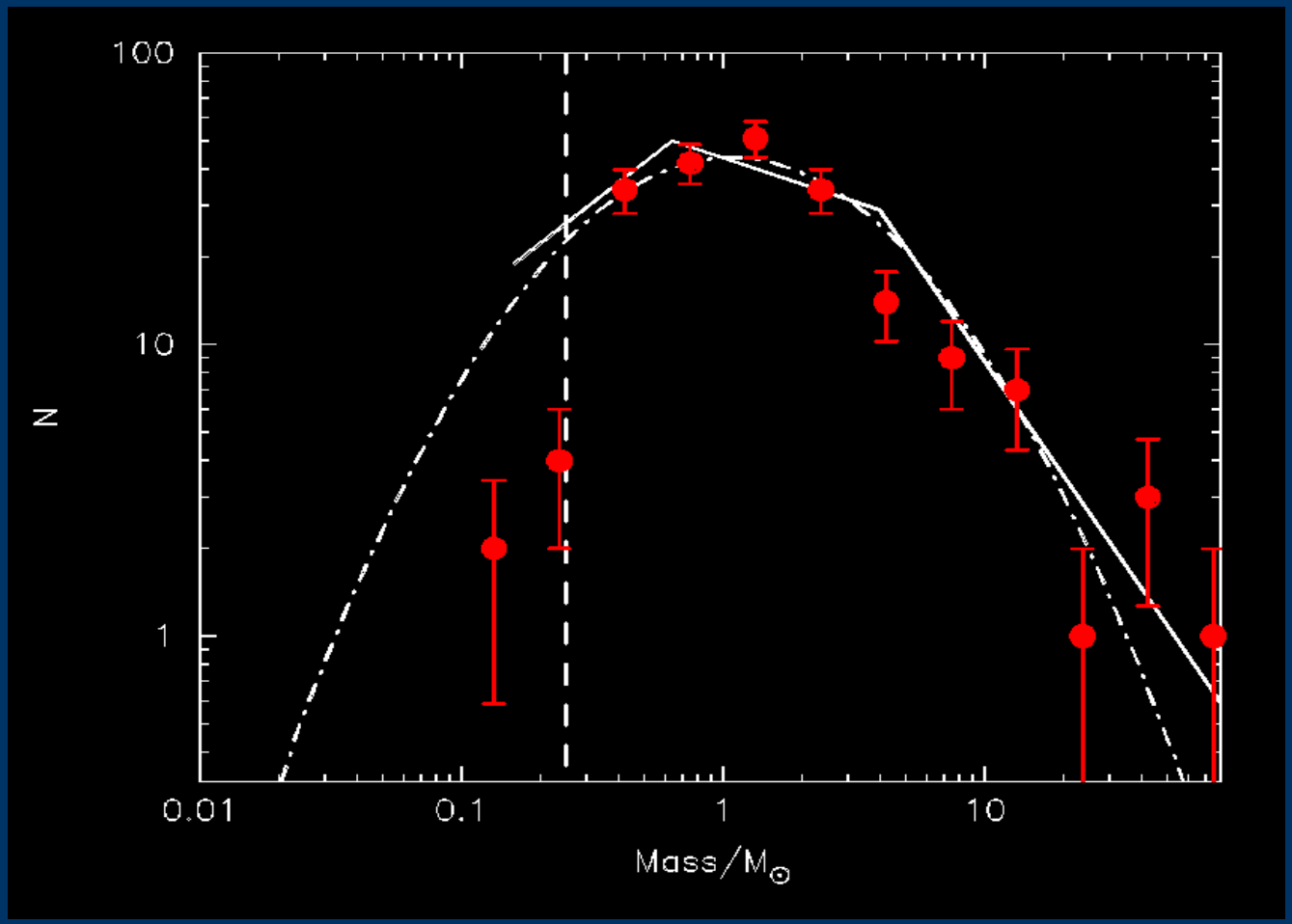


Evolution of the initial population



Binary fraction ~unity for >1M_{sun} PMS stars (Patience et al. 2002), >0.3M_{sun} stars in Taurus (Leinert et al. 1993), see also Goodwin & Kroupa (2005), Duchene et al. (2007) & Goodwin et al. (2007).

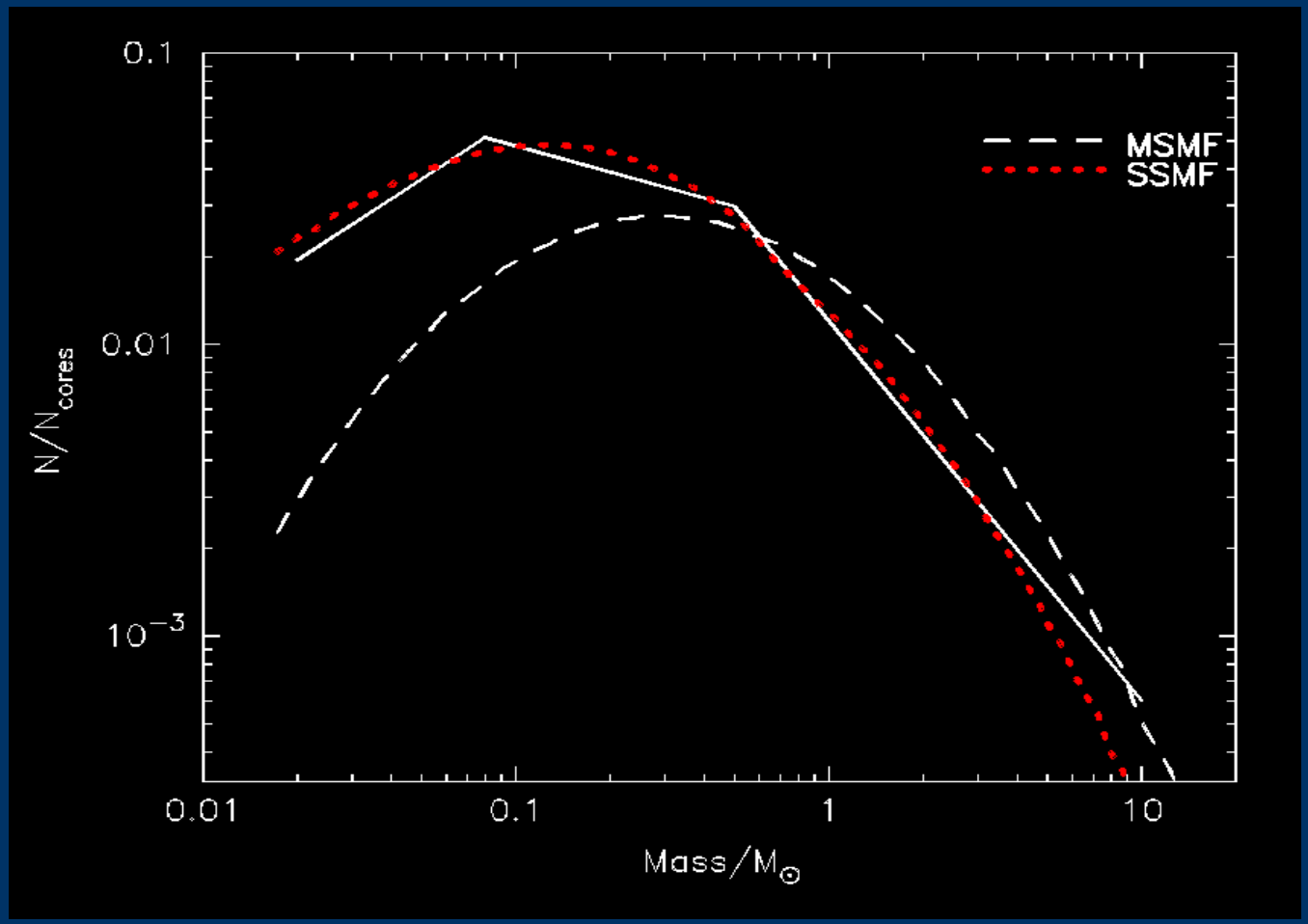
Where do binaries and the IMF come from?



The form of the IMF is presumably related to the **core mass function** (CMF). M-dwarfs form from low-mass cores – do most/all of these cores form binary systems?

(Nutter & Ward-Thompson 2007)

Fully multiple star formation



Low-mass stars <u>all</u> form as binaries, >0.75M_{sun} stars form 3:1 binaries:triples all with a flat mass ratio distribution.

Keeps the log-normal form of the CMF (SFE 27%), and brown dwarfs form as the companions to M-dwarfs (see Goodwin & Whitworth 2007)

Low-mass single star formation

If a significant fraction of stars (ie. M-dwarfs) form singly then the initial binary population must change with core mass.

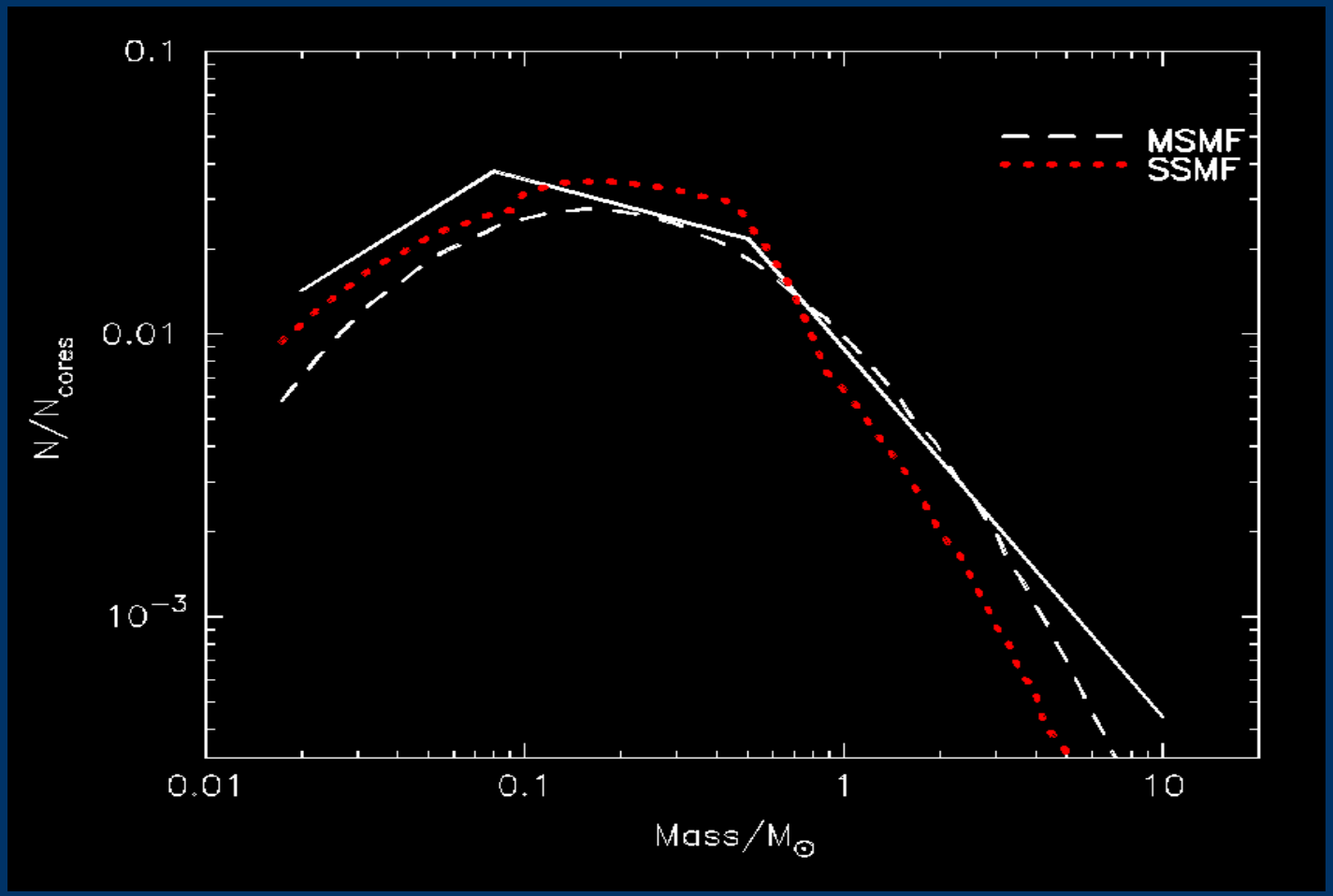
For BD-mass cores the binary fraction is taken to be 15%.

To fit the M-dwarf field binary fraction 60% of low-mass cores form single stars, and 40% form binaries (to include BDs).

To fit the T Tauri binary fraction intermediate- and high-mass cores must form ~100% binaries.

The binary fraction is then smoothly extrapolated between BDs, M-dwarfs and G-dwarfs...

Low-mass single star formation



Log-normal form changes and the SFE is very low (15%) as BDs usually have to form (singly) in very low-mass cores.

Conclusions

- If all cores fragment into 2 (sometimes 3) objects then an IMF-like log-normal CMF straightforwardly reproduces the observed IMF, and BDs form as companions to M-dwarfs.

- If low-mass cores mainly form single stars then the IMF-like form of the CMF is altered (as high-mass stars must mostly form as multiples).

- In the mainly single model **no** M-dwarf binaries can disrupt, despite us knowing that many T Tauri binaries must (100% -> 60%). Is this plausible?

THE MAJORITY OF STARS FORM AS MULTIPLES