

Close binaries in the Orion Nebula Cluster

*On the universality of stellar multiplicity
and the origin of field stars*

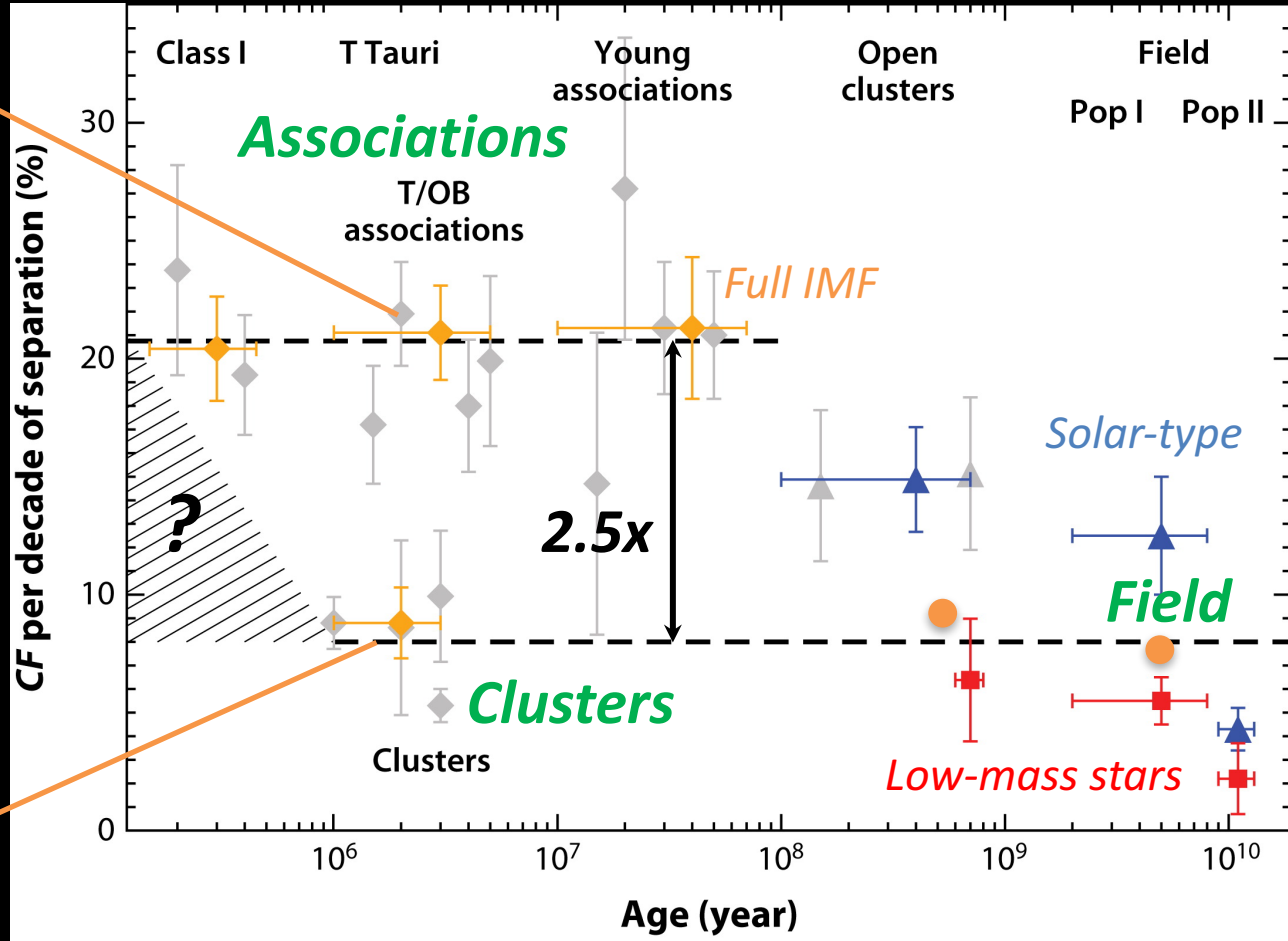
Gaspard Duchêne (UCB, IPAG)


Sylvestre Lacour, Estelle Moraux, Jérôme Bouvier, Simon Goodwin

Multiple star formation: a dichotomy?



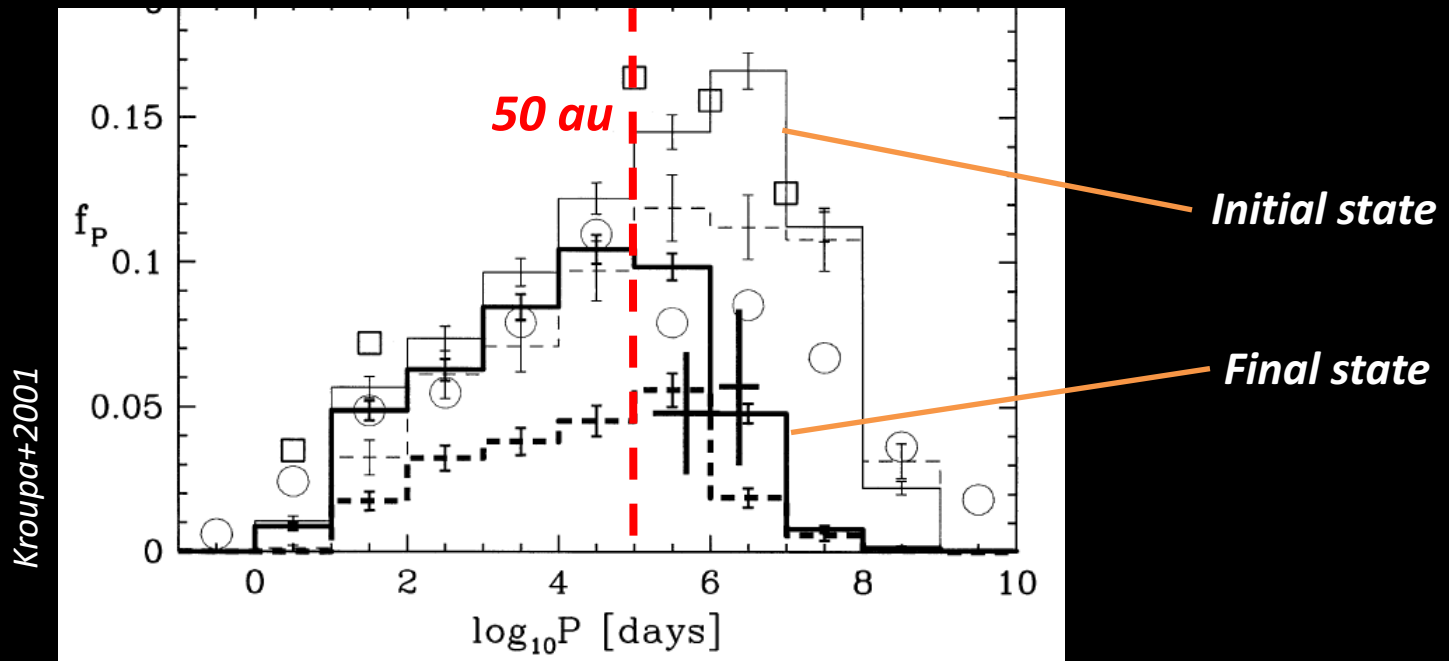
Occurrence rate of visual binaries



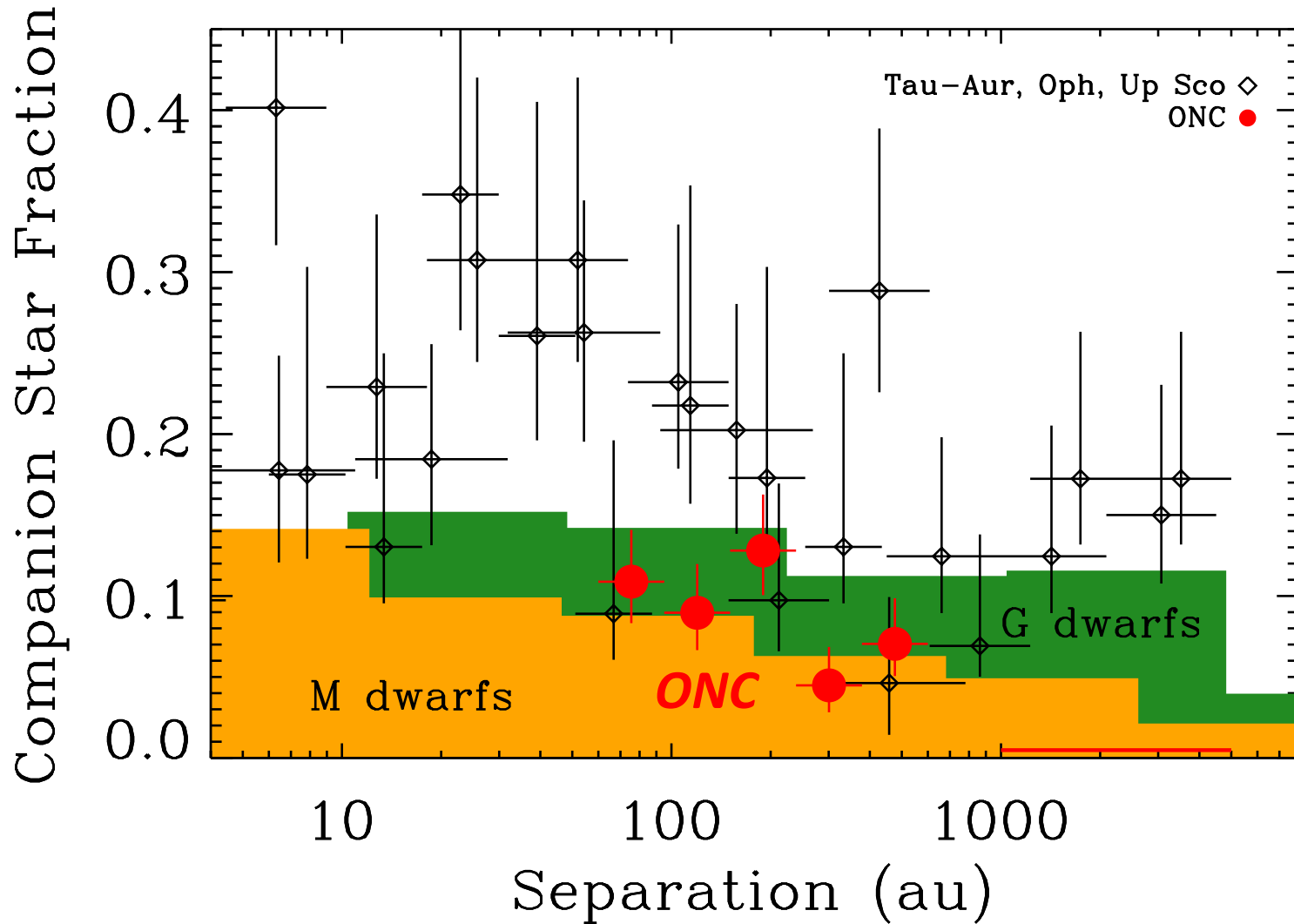
 Duchêne G, Kraus A. 2013. Annu. Rev. Astron. Astrophys. 51:269–310

Universality & a tale of dynamics

- A coherent picture was proposed:
 - All star-forming regions produce a universally rich population of multiple systems (\approx Taurus)
 - Clusters internally destroy wide systems in ≈ 1 Myr

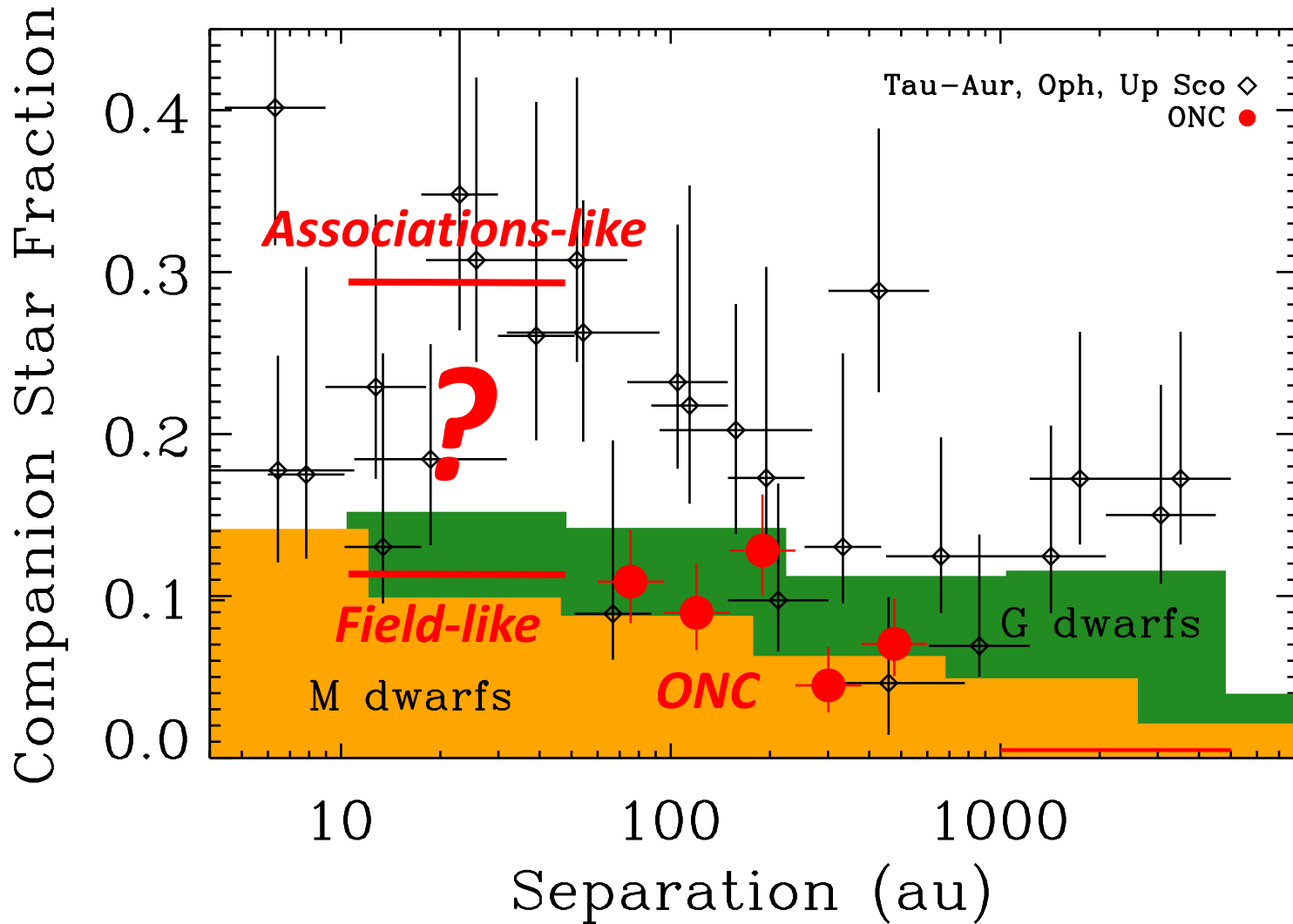


Separation distribution



Raghavan+2010, Ward-Duong+2015
Kraus+2008, 2009, 2011, Cheetham+2015
Reipurth+2007, Scally+1999

Close binaries in the ONC are pristine

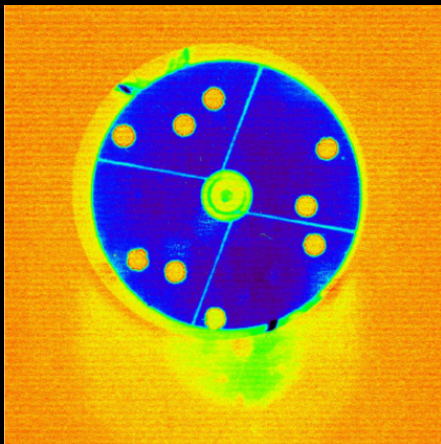


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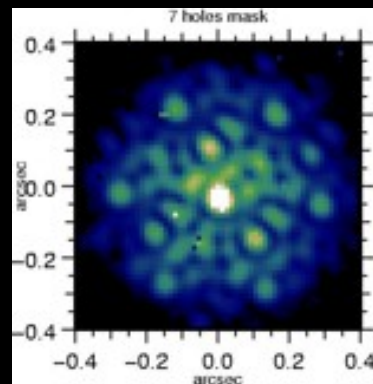
Tight binaries (< 50 au) in the ONC

- At 400 pc, separations of 0.025 - 0.1"
- Even with adaptive optics on large telescopes, this is a very challenging task!
 - The ideal case for using aperture masking

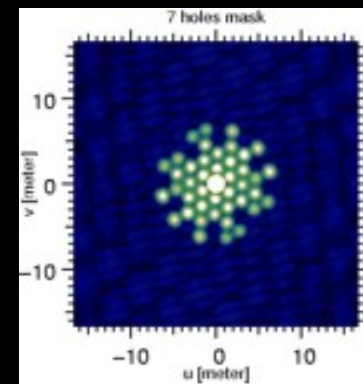
Place this in pupil plane



Take an image



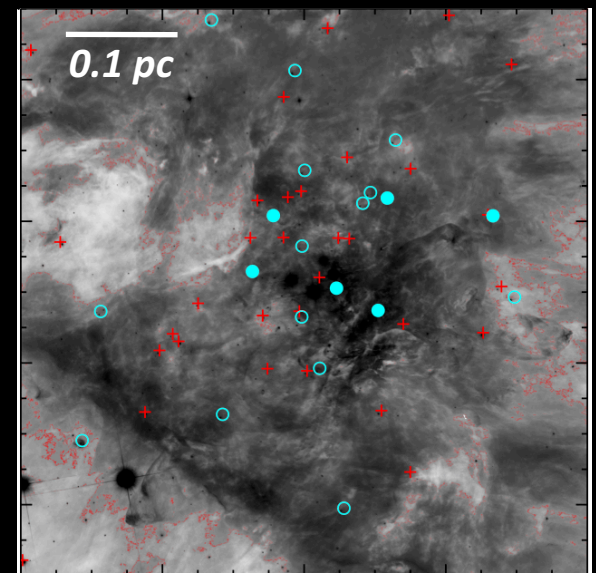
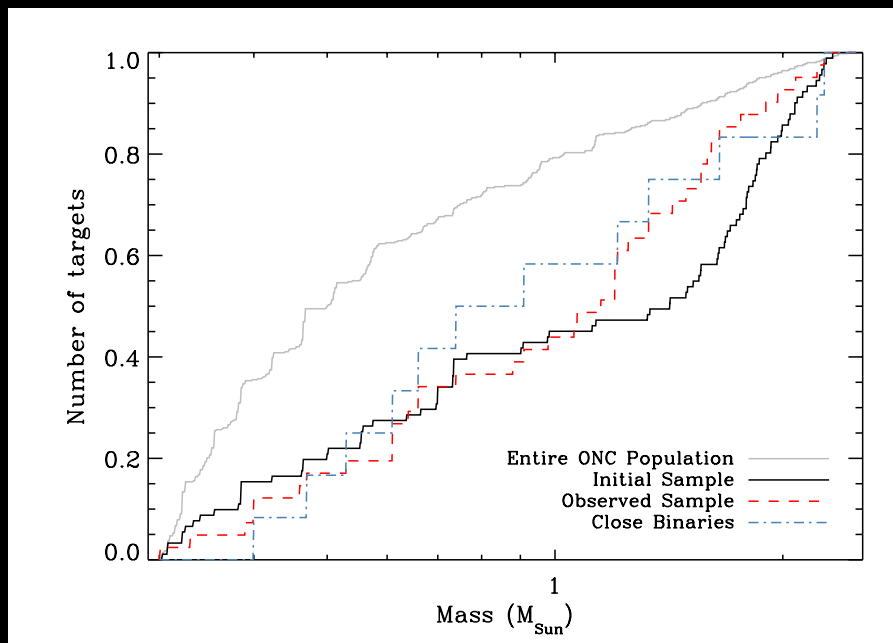
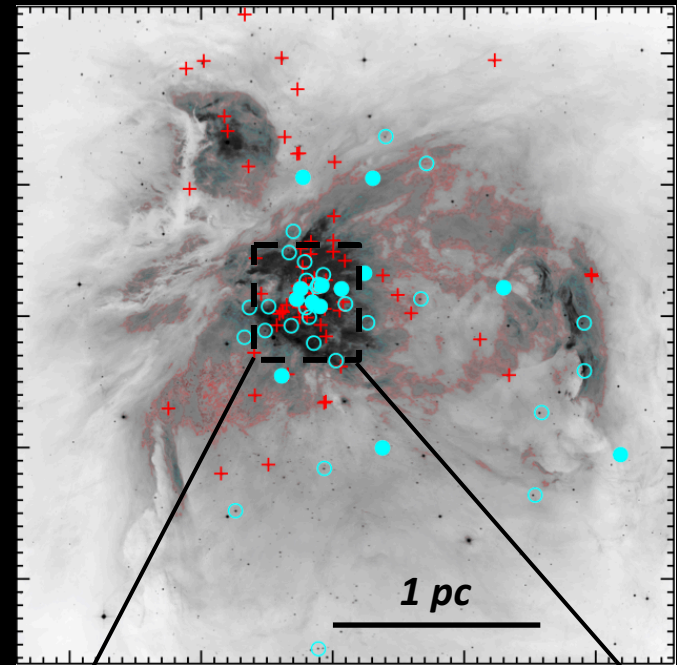
Take Fourier Transform



Fit binary model

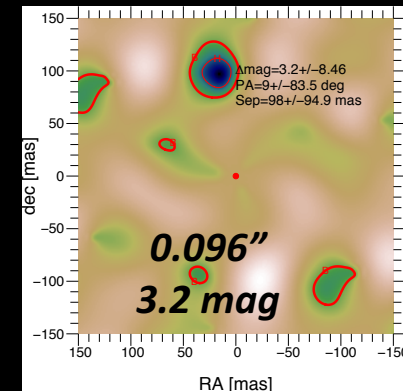
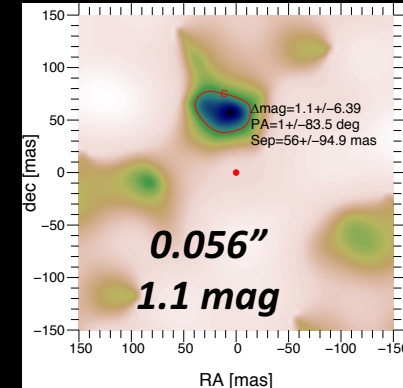
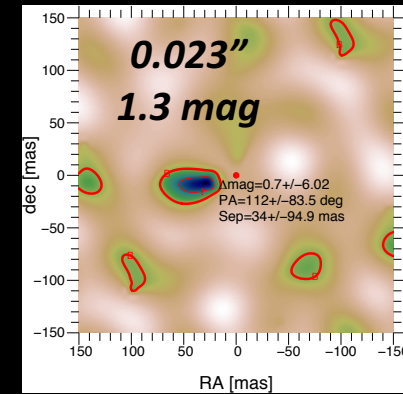
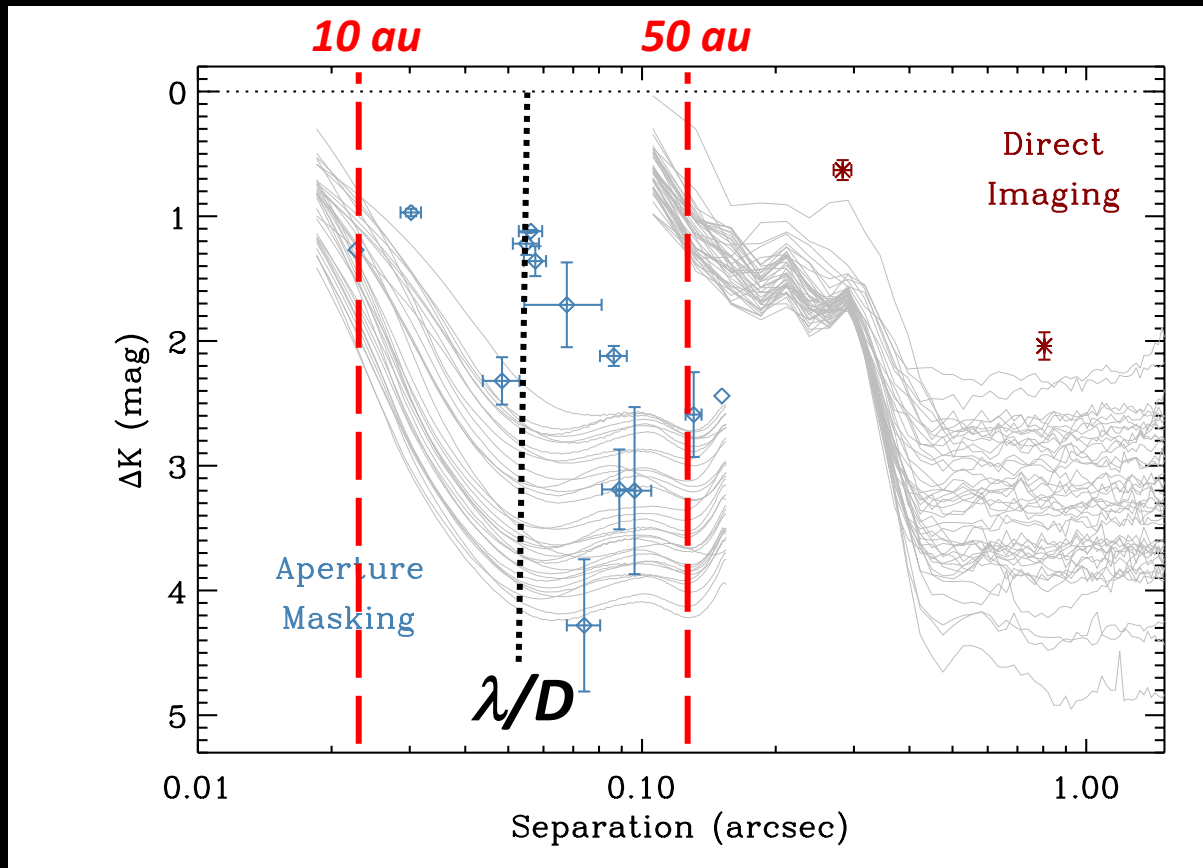
Survey design

- VLT/NaCo SAM observations
- 42 ONC members
 - $-7.5 < K < 9.5$
 - $0.3 - 2.5 M_{\text{sun}}$

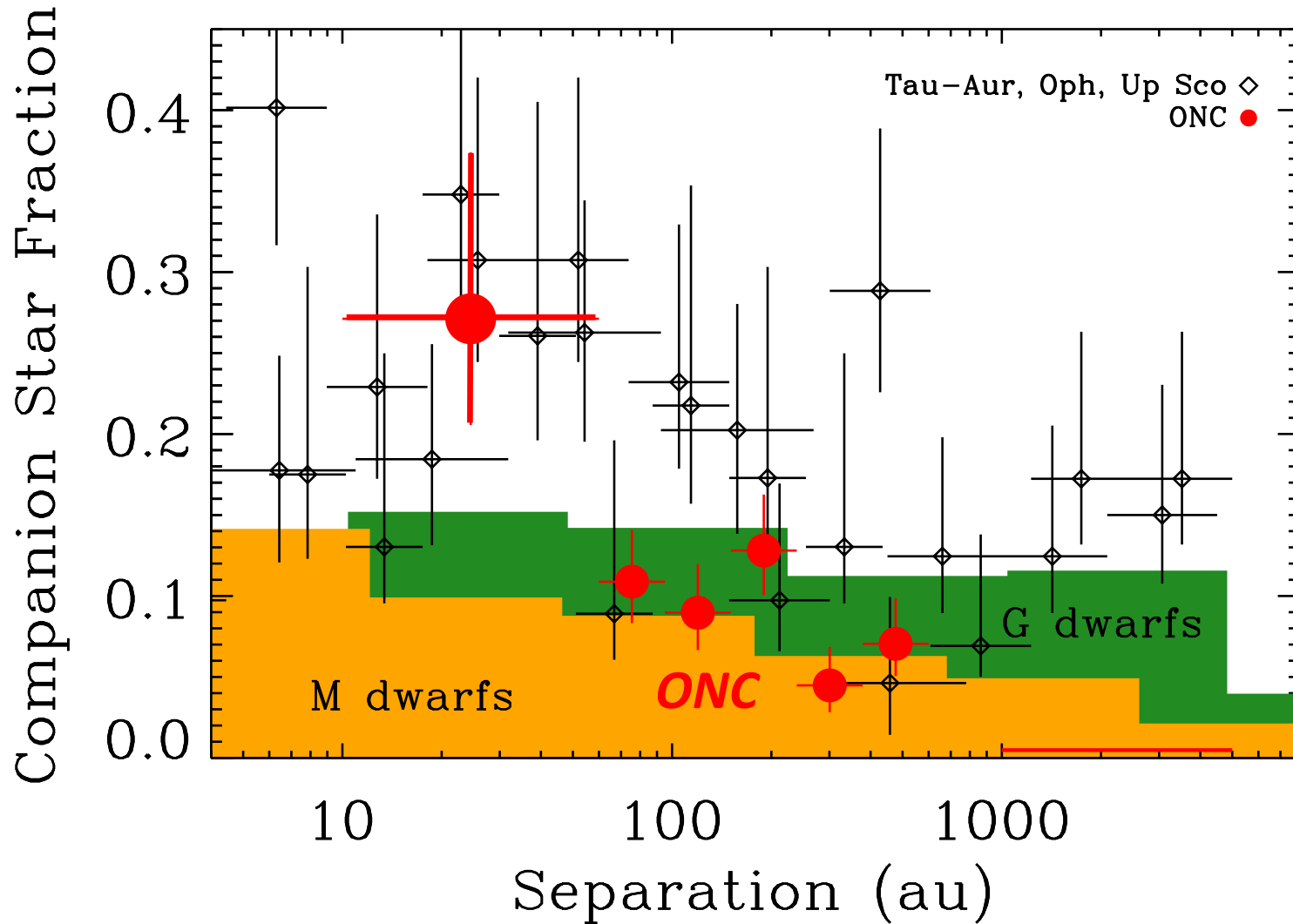


Survey results

- 13 companions in 0.02-0.2" range
 - No trend with location, stellar mass



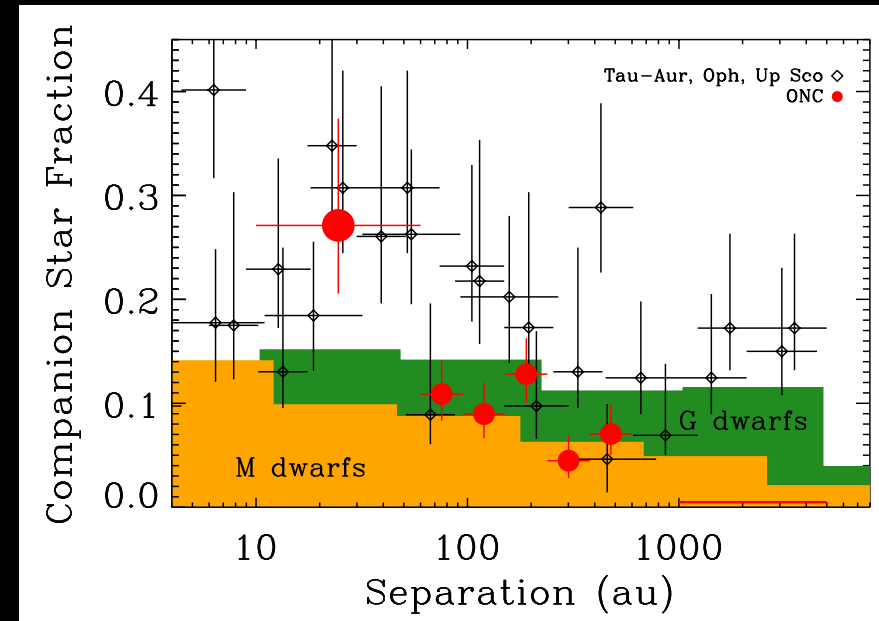
High multiplicity in the ONC!



Raghavan+2010, Ward-Duong+2015
Kraus+2008, 2009, 2011, Cheetham+2015
Reipurth+2007, Scally+1999

Conclusions & implications

- The ONC is as binary-rich as Taurus (< 50 au)
- Multiplicity may indeed well be universal at birth and subsequently dynamically evolved
- But then, **where do field stars come from?**
 - Not from associations
 - Nor ONC-like clusters
 - Even denser clusters?
 - Unlikely (cluster counts)



Duchene+ (in prep.)

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- Multiplicity may indeed well be universal at birth and subsequently dynamically evolved
- But then, **where do field stars come from?**
 - Not from associations
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 - Even denser clusters?
 - Unlikely (cluster counts)
 - **Do close binaries evolve?**

Duchene+ (in prep.)

