

Challenges in High-Contrast Imaging of Massive Stars

RESULTS FROM VLT/SPHERE

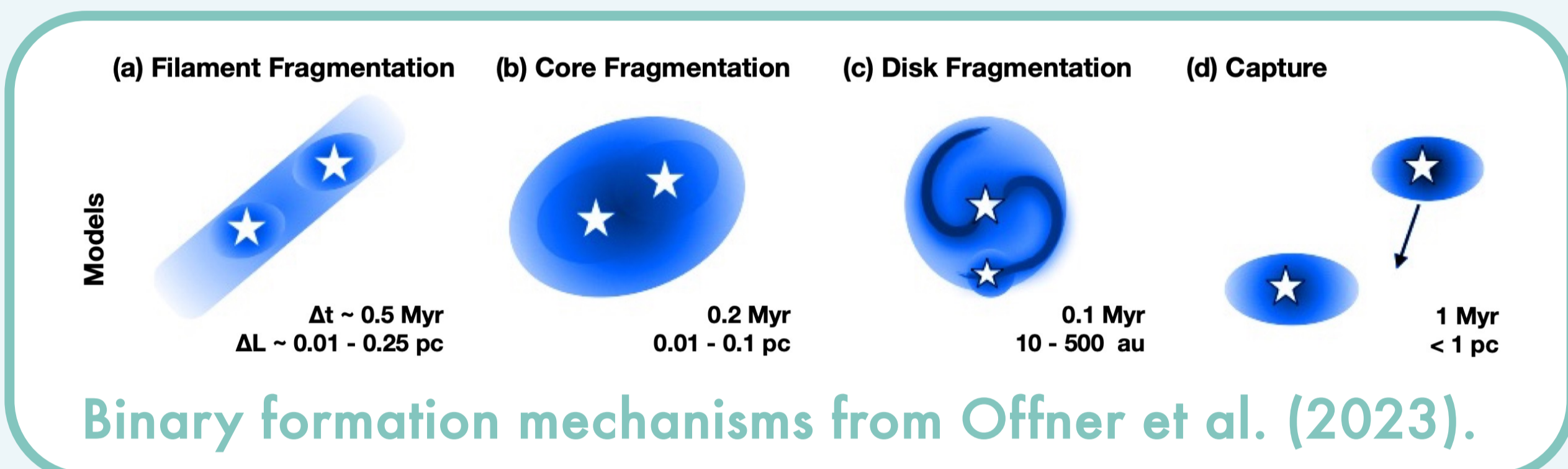
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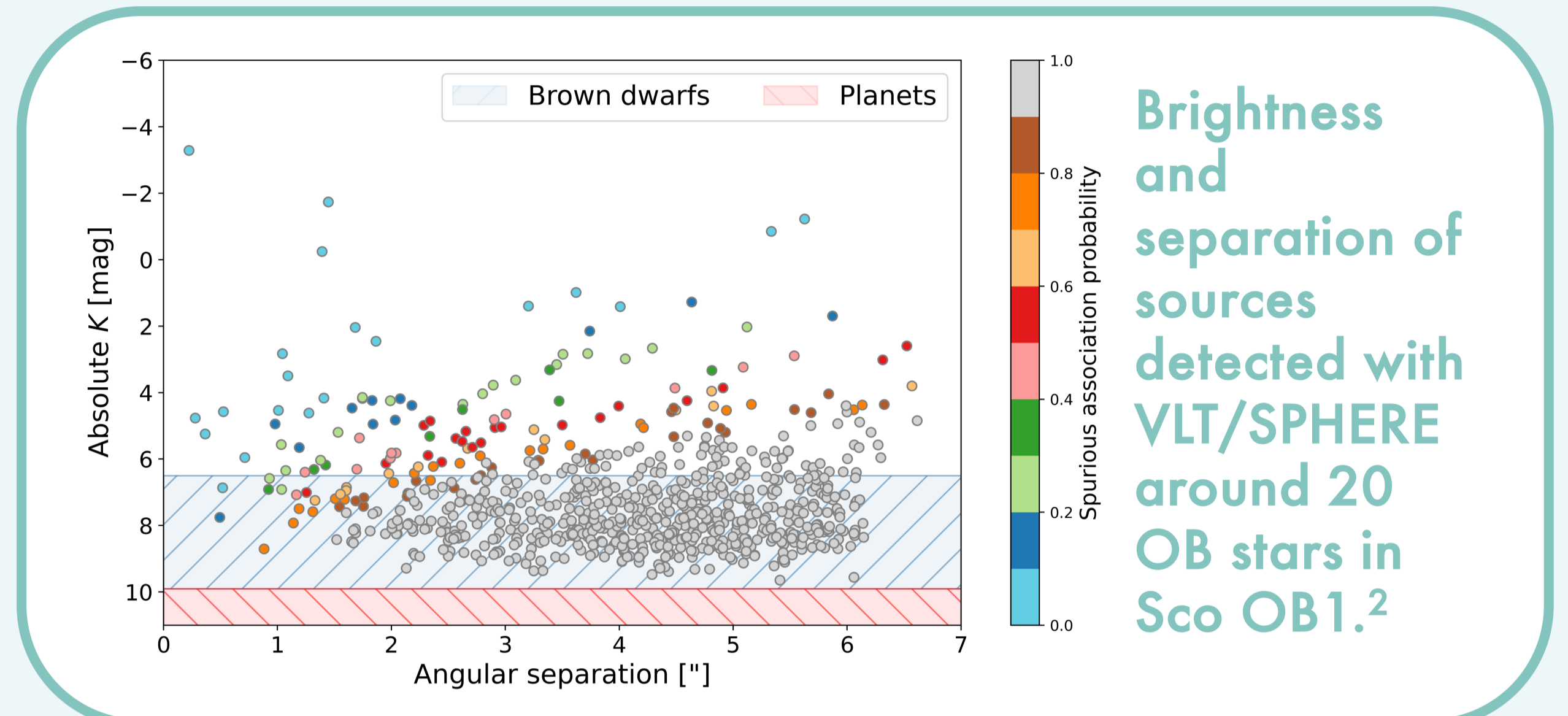
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UNDERSTANDING MASSIVE STAR AND BINARY FORMATION

Investigating the low-mass end of the companion mass function around massive stars is important to understand the formation of extreme mass ratio binaries and the potential survival of low-mass (sub-) stellar companions in the UV-rich environment of massive stars.



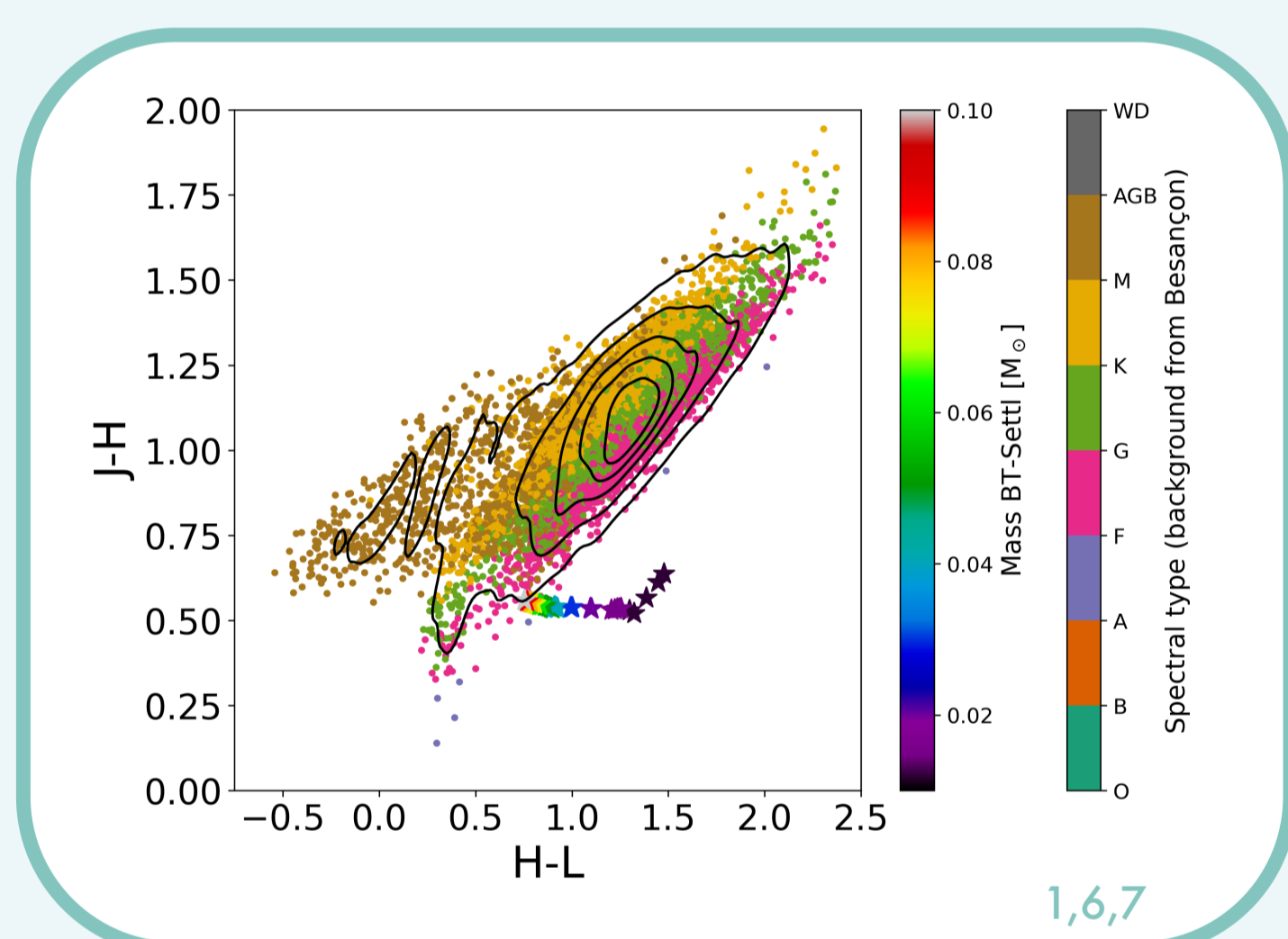
FINDING BROWN DWARFS (BUT NOT YET EXOPLANETS)



VLT/SPHERE coronagraphic observations of OB stars have shown that high-contrast imaging is a powerful method to detect and characterize sub-stellar companions around massive stars.^{1,2,3,4,5}

ALTERNATIVE SOLUTION?

Investigating the brown dwarf (BD) nature



For BD candidate companions, a color-color diagram (CCD) can help distinguish them from background stars with a different spectral type. Caveat: BDs exposed to strong UV irradiation may show peculiar colors.



FOLLOW-UP OF CANDIDATE COMPANIONS

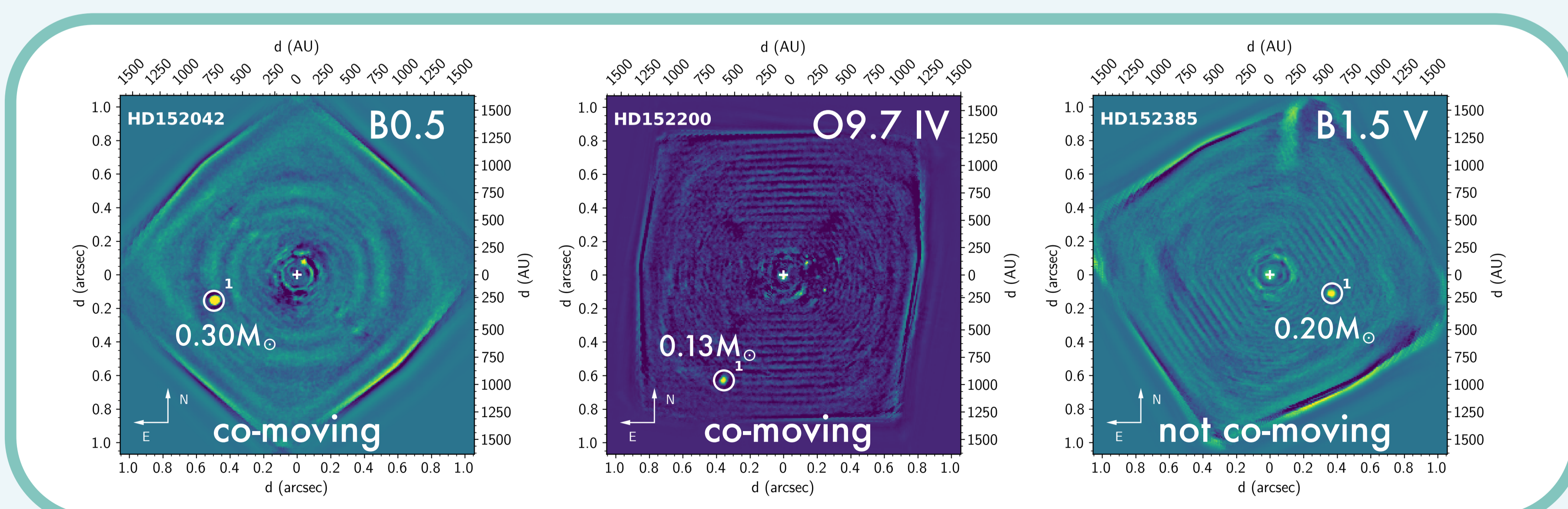
Problem: massive stars are found in clusters far away (≥ 1.5 kpc)



- SPHERE IWA ~ 225 AU: orbital periods $\geq 10^3$ yrs
- Proper motion similar to background sources
- Small parallax (0.67 mas at 1.5 kpc)

LOW-MASS (SUB-)STELLAR COMPANIONS AROUND MASSIVE STARS IN SCO OB1: SPHERE DATA OF 20 OB STARS

One B-type star has two BD candidate companions and four OB stars have a low-mass stellar ($\leq 0.3M_{\odot}$) candidate companion within $1''$. We obtained follow-up VLT/SPHERE observations for three OB stars with stellar candidate companions.



CONCLUSION

Characterizing low-mass companions around massive stars is challenging because of their brightness, large distance and small proper motion. Nevertheless, investigating the existence and properties of these companions is important to understand the formation and survival of low-mass objects in the presence of extreme UV irradiation.

The two co-moving candidate companions have spurious association probabilities of 8×10^{-4} and 9×10^{-3} .

REFERENCES

- 1) Pauwels+ (submitted)
- 2) Pauwels+ (2023)
- 3) Reggiani+ (2022)
- 4) Rainot+ (2022)
- 5) Rainot+ (2020)
- 6) Robin+ (2022)
- 7) Allard+ (2014)
- 8) Binary illus.: Chris Smith (USRA)



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