People – Betelgeuse (α Ori) may not be single after all !

Exclusive: detailed investigation on a secret relationship, hidden in plain sight, by our team of watchful astrophysicists.

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1. Introduction

Population synthesis models and observations converge to predict that **massive stars (M_{init} > 8 $M_\odot$) are never single** (Sana+ 2014). Yet, despite several false-alarm detection throughout the XXth century an catalog listings (e.g. Proust et al. 1981, Karovska et al 1986, Wycoff et al. 2006), the most studied red supergiant (RSG) star, **Betelgeuse (α Ori), has remained, until now, without confirmed companion.**

This forced several teams to invoke mechanisms to explain its loneliness, its walk-away systemic radial velocity and its high rotation rate (T ~ 30 yr with R ~ 750 $R_\odot$): merger, anterior SN explosion of the companion, below photosphere orbit...

2. Predictions from the light curve

Recently, **two teams inferred the presence of a companion** from the long secondary period (LSP) of the light curve, and of the radial velocity (Goldberg+ 2024, MacLeod+ 2025). The companion is modulating the dust distribution on its orbital path, creating the light variation.

The orbital period is ~ 6 yr with a maximum elongation of 2 $R_\star$ predicted for December 2024.

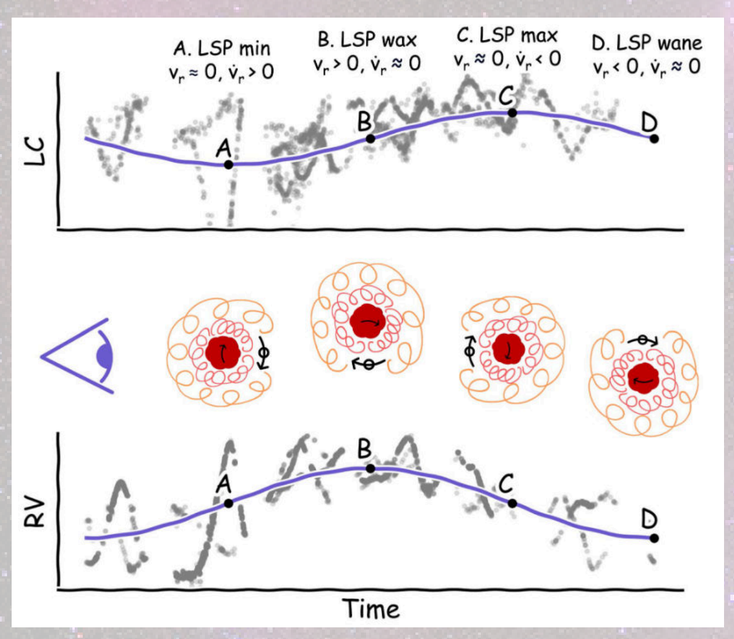

Fig. 1. Sketch of the light / radial velocity curves modulation created by the companion (Goldberg+ 2024).

3. Tentative detection with speckle interferometry

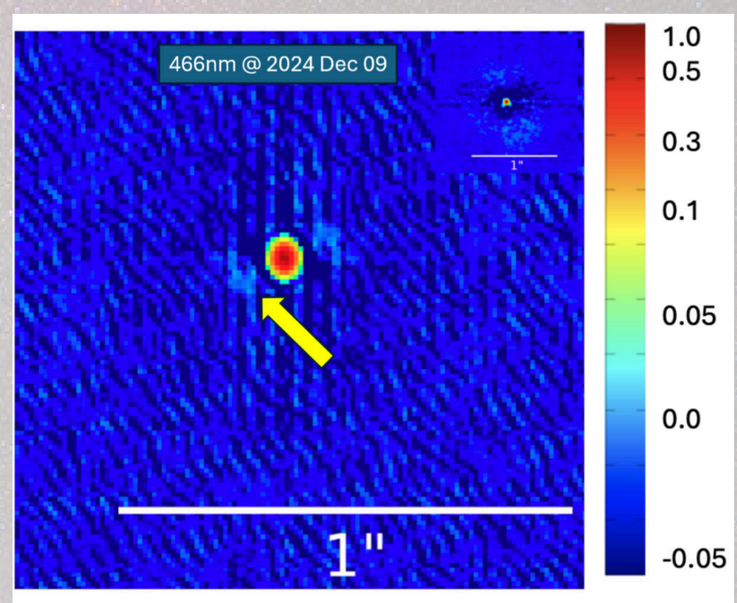

Fig. 2. Speckle interferometry **detection at 1.5σ** with 'Alopeke @ Gemini North (Howell+ 2025)

4. Our firm detection with VLT/SPHERE (under embargo)

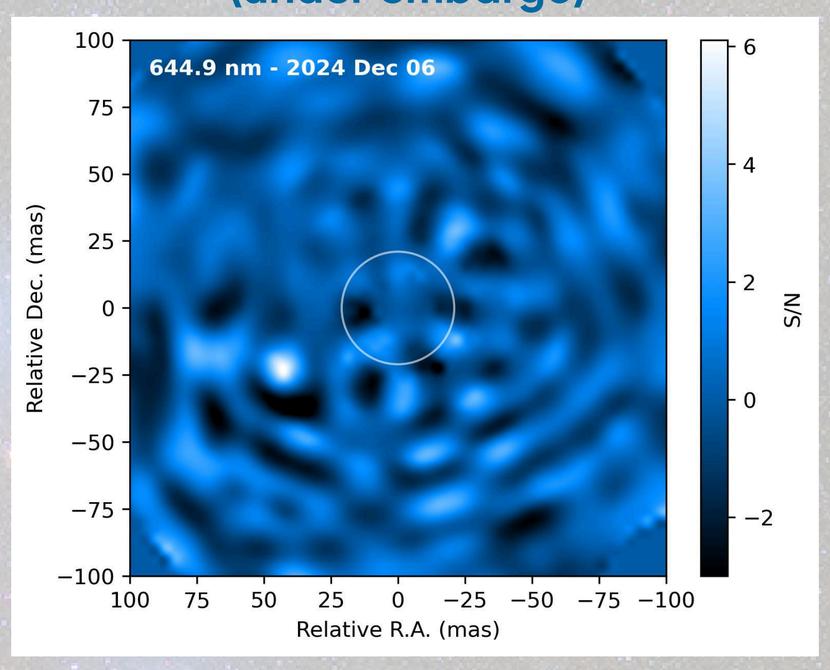

Fig. 3. Adaptive optics imaging with SPHERE @ VLT using the PACO ASDI processing (Flasseur+ 2020 a,b). **The detection level is 6σ** (Montargès+ in press.). The white circle represents the primary photosphere.

5. Implications, future work

Betelgeuse B, the companion, is a 2.6 – 3.1 $M_\odot$ B-type young main sequence star. It **can explain the high rotation rate** (through tidal interactions), and **helps constraining the distance of the system** with its orbital properties (the parallax is smaller than the angular diameter of the primary !).

This opens a new avenue for detecting and characterizing nearby interacting companions around evolved stars, **those who can modify evolutionary pathways.**

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