# Evolved stars at the focal point of the new generation of high angular resolution instruments L<sub>2</sub> Puppis & Betelgeuse

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photos: Y. Beletsky

## Angular resolution



# L<sub>2</sub> Puppis

- M5III, SRa (Mira-like) star with P=141d
  Mass : 0.65 Msun (Kervella et al. 2016)
  Second nearest AGB star (64 ± 4 pc, mv~5) after R Doradus (55 pc)
- Long term, slow dimming event ongoing since 15 years (Bedding et al. 2002)

#### 0.65 µm (SPHERE/ZIMPOL)



Kervella et al. 2015, A&A, 578, A77

### Degree of linear polarization



Kervella et al. 2015, A&A, 578, A77





Cycle 3, special extended configuration (16 km)
Band 7, CO J=3-2 emission + others (346 GHz)
Maximum angular resolution 0.015"









Kervella et al. (2017, A&A, 596, A92)

Position-velocity diagram (PVD) gas only gas + dust 40 Background : West TEMPERATURE 30 25 20 ~1000K ~500K <50K 15 2500k Velocity (km/s) 10 0.9 Δ VELOCITY 5 Keplerian sub-Keplerian 0.4 0.9 0.5 1 2 10 20 5 2ÅU Radius (AU) 6AU 23AU

- Stellar mass =  $0.653 \pm 0.011 \pm 0.041 M_{\odot}$
- Sub-Keplerian rotation beyond 6 au

Homan et al. (2017, A&A, 601, A5)



Kervella et al. (2017, A&A, 596, A92)

4000

0.50



## Betelgeuse

• M2lab, 3700 K • 220 ± 40 pc (Harper et al. 2017, AJ, 154, 11) • ~15 Msun • 150.000 Lsun • 5 AU radius (IR) • Density ~20 mg/m<sup>3</sup> =  $10^{-8}$  x Sun



# ALMA band 7



- Reconstructing beam 15 x 13 mas
- RMS noise level 80 µJy/beam, peak flux 70 mJy/beam

O'Gorman, Kervella et al. (2017, A&A, 602, L10)





VLT/SPHERE (645 nm) March 2015 ALMA (890 µm) November 2015



0.05"

