Cool evolved stars at high angular resolution beyond 2040

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Abstract

Historically, observation of large cool evolved stars has been a driver for high angular resolution in general, and optical interferometry in particular (eg. Michelson & Pease 1921). In the past decades, IOTA, and then the VLTI and CHARA have gone beyond simple angular diameter measurements or shape estimations: photospheric images have been obtained for several red giants and supergiants stars (e.g., Paladini et al. 2018, Anugu et al. 2024, Planquart et al. 2024). Recently, the spatially resolved image of a star in the Large Magellanic Cloud has been obtained for the first time (Ohnaka et al. 2024). These observations reveal that these objects are more complex than initially thought: photospheres have been seen to evolve on a scale of weeks (Montargès et al. 2021) which unfortunately is the time needed to get the appropriate (u, v) coverage for proper image reconstruction and data analysis. To solve the enigma of dust formation and wind launching in a convective and shock-dominated outer envelope, high resolution spatially resolved spectroscopy will be needed to get accurate gas velocity measurements and chemical identifications. Recent results (Decin et al. 2020, Danilovich et al. 2024) have shown that the morphology of AGB star mass loss is vigorously impacted by binarity. For these cool stars, the visible is the preferred domain to unveil these close and potentially interacting companions. Modern instruments are all pursuing ever increasing sensitivity, but the key in understanding the chemical enrichment of the Universe lies with bright and large stars that still present an exciting science case for future instruments.

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