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Multiwavelength study of circumbinary disks around evolved binary stars with SPHERE

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Circumstellar disks surrounding both single and binary stars have been extensively investigated in the context of young stellar objects. However, in this talk, we shift the focus to the late stages of stellar evolution where stable compact disks were discovered around low-mass dying binary stars, such as post-Asymptotic Giant Branch (post-AGB) binaries. Observational studies have shown that post-AGB circumbinary disks appear to be surprisingly similar to protoplanetary disks in terms of Keplerian rotation, IR excesses, dust disk mass, chemical depletion and dust mineralogy. However, a significant difference lies in the formation history and lifetime of post-AGB circumbinary disks, which persist for ~10^4-10^5 years compared to a few Myr lifetime of protoplanetary disks. In this talk, we present the results of the first polarimetric differential imaging survey of eight post-AGB binary systems with circumbinary disks. Using the state-of-the-art Spectro-Polarimetric High-contrast Exoplanet Research instrument (SPHERE) of the 8-meter Very Large Telescope (VLT) at the European Southern Observatory (ESO), we successfully resolved the complex morphologies of the circumbinary disks. One of the highlights of our study is the observation that certain post-AGB systems with lower metallicities exhibit smaller resolved disk sizes, potentially due to reduced levels of dust production during the AGB or RGB phase of the primary star. Moreover, our multiwavelength polarimetric study of IRAS 08544-4431 provided wavelength dependence of scattering and polarizing disk properties, shedding light on dust grain characteristics. These findings coupled with spectroscopic and interferometric studies establish post-AGB binary disks as invaluable laboratories for studying circumbinary disk evolution, including the potential formation of second-generation planets around evolved binary stars.

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