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Space Odyssey: Journeying through circumbinary disks in post-AGB nebulae

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Abstract

There is a class of binary post-AGB stars (binary systems including a post-AGB star) that systematically present circumbinary disks with Keplerian dynamics. These sources tend to present remarkable near-infrared (NIR) excess and narrow CO line profiles characteristic of rotating disks. The IR data of these sources reveal the presence of highly processed dust grains, which implies that these disks must be stable structures. Thanks to mm-wave interferometric observations and accurate and quantitative models, we can characterize these rotating disks together with the outflowing gas that is escaping from the rotating component. We find a double dichotomy: I) Based on the disk to total mass percentage, sources are categorized as either disk-dominated (the disk holds a majority of the nebular mass, ranging from 85% to 95%) or outflow-dominated (the outflow represents more than 65% of the total nebular mass), with no intermediate objects between both subclasses. II) Furthermore, based on the ratio of 12 μm- and mm-luminosity to the total nebular mass, disk-dominated sources have higher reservoirs of large dust grains compared to outflow-dominated ones. This behavior suggests that outflow mass depends on the amount of processed material in the disks. Specifically, outflow-dominated disks with much less large dust grains will be more prone to launch a disk-wind via stellar radiation pressure on small grains, forming larger and more massive extended structures. We also note that circumbinary planets could exist orbiting these sources. These presumed planets could be of two types: survivors from the evolution of the stellar system; or second-generation planets/planetoids forming and growing within these circumbinary disks, most likely in the disks of disk-dominated sources where the content of large dust grains is higher.

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