The Great Escape: How Exoplanets and Smaller Bodies Desert Dying Stars

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Mounting discoveries of extrasolar planets orbiting post-main sequence stars motivate studies aimed at understanding the fate of these planets. In the traditional "adiabatic" approximation, a secondary's eccentricity remains constant during stellar mass loss. Here, we remove this approximation, investigate the full two-body point-mass problem with isotropic mass loss, and illustrate the resulting dynamical evolution. The magnitude and duration of a star's mass loss combined with a secondary's initial orbital characteristics might provoke ejection, modest eccentricity pumping, or even circularisation of the orbit. We conclude that Oort clouds and wide-separation planets may be dynamically ejected from 1-7 Solar-mass parent stars during AGB evolution. The vast majority of planetary material which survives a supernova from a 7-20 Solar-mass progenitor will be dynamically ejected from the system, placing limits on the existence of first-generation pulsar planets. Planets around >20 Solar-mass black hole progenitors may easily survive or readily be ejected depending on the core collapse and superwind models applied. Material ejected during stellar evolution might contribute significantly to the free-floating planetary population.

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