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The Dynamical Evolution of Planets Orbiting Interacting Binaries

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About 15% of solar-type stars are in such close binaries that interaction is bound to occur as the stars evolve and swell. Around 5600 planets have been detected in solar types of stars. However, only about twenty circumbinary planets have been identified. Understanding the intricate dynamics within such complex systems is crucial for unraveling the processes of planet formation and binary evolution and constraining the detection of planets in binary systems. The tightest orbit binaries would harbor the most dynamically stable and enduring circumbinary planetary systems; however, they are also prone to experience mass transfer, common envelope evolution, or stellar mergers. Subdwarfs are one of the most common products resulting from binary evolution. They are both long-lived and easy to recognize. Understanding the impact of subdwarf formation on the surrounding planetary system constitutes one of the most promising avenues for revealing how binary evolution, in general, affects planetary systems. We have developed an integration framework to unravel the complex dynamics of planets around evolved and interacting binaries. This framework seamlessly combines binary evolution data from the MESA stellar evolution code with a detailed N-body simulation within the REBOUND environment. To ensure numerical robustness, we have devised a binary star model including a circumbinary planet and implemented a recalibration method to address errors stemming from updates in binary properties during dynamical computations. Our findings indicate that the closest stable orbital separation for circumbinary planets is approximately 2.5 times the binary separation following mass transfer. In this presentation, I will introduce our new model and our latest results of the evolution of planets orbiting binaries that evolve into white dwarfs or subdwarf systems.

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