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Long-term evolution of circumbinary exoplanets

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Notwithstanding the tremendous growth of the exoplanetary field in the last decade, circumbinary planets (CBPs) remain a small fraction of the total discoveries to date: around fifty CBPs have been identified out of nearly six thousand exoplanets, primarily detected through eclipse timing variations and transits. Almost a third of these orbit post-main-sequence stars, which suggests their ability to survive the demise of their binary hosts. Given the ubiquity of binary and multiple star systems in the Milky Way, CBPs should be widespread. However, current observational biases may be hindering their detection. Considering the limited sample of discovered CBPs, their statistical characterisation still requires theoretical investigation.
In this talk, I will discuss the long-term evolution of CBPs from a population perspective. We simulated the temporal evolution of giant CBPs, tracing their development from the main sequence to white dwarf stages, up to the age of the Universe, in order to provide theoretical constraints on their parameter space.Between 23% and 32% of all CBPs survive to eventually orbit a double-white-dwarf host, which we have labelled "Magrathea" planets. These gas giants can survive the death of their hosts if they orbit at a sufficient distance to avoid engulfment and instabilities. Magratheas are a natural outcome of CBP evolution and are likely to be relatively common in the whole Milky Way, where they could be detected via gravitational waves with the future ESA-LISA mission.

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