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Binaries in 47 Tuc: Confronting cluster simulations with observations

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Binaries are key objects in Globular Clusters and they influence their structure and dynamics. Especially interesting are pairs of stellar remnants as potential sources of gravitational wave events. Spectroscopic observations of binary stars in Globular Clusters allow to shed light on the poorly constrained period, eccentricity and mass ratio distributions, to develop an understanding of the formation of peculiar stellar objects and to probe the populations of dark stellar remnants. These results are then important benchmarks for cluster simulations. Using MUSE multi-epoch observations we monitored 11 wide-field-mode fields within the half-light radius of 47 Tuc, one of the most massive Galactic Globular Clusters with a large population of blue stragglers and a predicted but as yet elusive population of up to hundreds of stellar-mass black holes. Over a period of 8 years, we obtained nearly 250000 radial velocity measurements for 22000 stars after applying quality cuts. In this talk, we present the results from this radial velocity monitoring. We derived the binary properties, namely the period distribution, the binary fraction of different stellar evolution stages, and the number of compact companions. Using dedicated state-of-the-art model Cluster Monte-Carlo simulations, we constructed mock observations with properties resembling the real observations. This enables to control the detection efficiency and allows a thorough comparison between models and observations, revealing an unexpected absence of short-period binaries and binaries with massive companions, highlighting the need to improve our understanding of stellar and dynamical evolution in binary systems. We discuss possible reasons for this discrepancy.

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