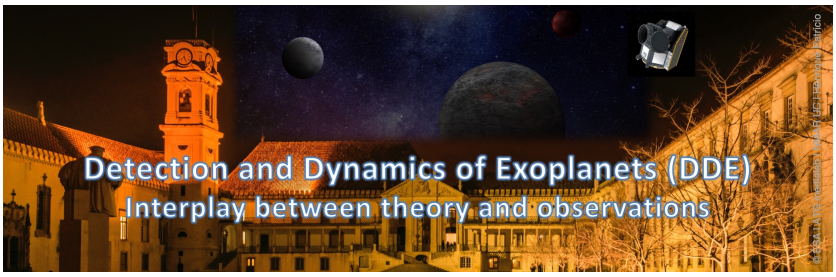

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A High Stellar Multiplicity Rate in the Neptunian Desert using Gaia DR3 Astrometry

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An anomalous population of planets has recently been discovered in the previously barren Neptunian Desert. To understand these unusual planets it is important to recognise system and planetary properties that the Desert shares with more populous and well-studied types of exoplanets. In this work, we aim to discover whether a high stellar multiplicity rate is another of these features, shared by the Neptunian Desert planets and Hot Jupiters. We use astrometric data from Gaia DR3 to search for wide companions with consistent parallaxes and common proper motions to samples of 1779 known exoplanet hosts and 2927 exoplanet candidate hosts from the TESS mission, both within 650 pc. We find overall stellar multiplicity rates of 16.6±0.9% and 19.8 ± 0.6% for confirmed and candidate exoplanets, respectively, which are in agreement with previous studies. Splitting this sample using planetary orbital period and radius, we find stellar multiplicity rates of 16.7 ± 5.8% and 27.5 ± 2.6% for confirmed exoplanets and candidates in the Neptunian Desert, respectively. Hot Jupiter host stars were found to have rates of 25.8 ± 2.1% and 22.9 ± 1.3%. For the sample of candidate exoplanets from TESS, we find higher stellar multiplicity rates for stars hosting both Hot Jupiters and Neptunian Desert planets, compared with a control sample of similar stars not known to host planets. For the sample of confirmed exoplanets an increased multiplicity rate is seen for Hot Jupiter hosts, but cannot be significantly determined for Neptunian Desert planet hosts, due to small sample size. If the candidates from TESS are indeed planets, the increased multiplicity rate observed could indicate that the Neptunian Desert and Hot Jupiter populations share similar formation mechanisms and environmental conditions. Alternatively, the TESS candidate high multiplicity rate could imply a prevalence of false positives related to binary and triple stars in this parameter space.

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