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Understanding the formation of small planets by searching for their cold giant siblings. The fundamental role of PLATO

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The exoplanet population with relatively short orbital periods around solar-type stars is dominated by small planets (SPs), i.e. super-Earths and sub-Neptunes. These planets are, however, missing in our Solar System, and the reason for that is unknown. By studying the impact of cold Jupiters (CJs) on the formation and/or migration of SPs, several theoretical works have predicted either an anti-correlation or a weak or strong correlation between CJs and SPs, thus reaching somehow contradictory results. Here we report on the search for and occurrence rate of CJs in a large sample of Kepler, K2 and TESS transiting systems with high-precision radial velocities. We find an occurrence rate of CJs in small-planet systems f(CJ|SE)~15%, which is considerably lower than previously reported by other groups, and revisit recent claims of a possible SP-CJ correlation at super-solar stellar metallicities. The considerably larger sample of transiting SP systems suitable for RV follow-up as provided by PLATO will be crucial to improve our measure of f(CJ|SE) as a function of planet composition and multiplicity, and stellar parameters. This in turn may provide fundamental clues on both the formation of short-period SPs and their absence in our Solar System.

Primary author: BONOMO, Aldo Stefano (Istituto Nazionale di Astrofisica (INAF))

Presenter: BONOMO, Aldo Stefano (Istituto Nazionale di Astrofisica (INAF))

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