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Characterisation of young multi-planetary systems with CHEOPS

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One of the primary and long-standing goals of the planetary science community is to understand planet formation and evolution. Most studies so far have been limited to planets around fully evolved stars, including those in the Solar System. However, models predict that the major phases of planetary evolution—such as formation (<3 Myr), disk migration (<5 Myr), evolutionary cooling (3–400 Myr), and dynamical migration (100–1000 Myr)—occur within the first billion years after formation. Planetary evolution is fastest in the early stages of formation and it is also the phase where differences in the model predictions are visible. Accurate and precise characterization of young exoplanets provides a crucial pathway for testing planet formation and evolution models. However, the young stars hosting these planets are often magnetically active, leading to stellar surface inhomogeneities such as spots and plages, which hinder accurate characterization. Multiple studies have found a prevalence of resonant configurations in young planetary systems (Dai et al. 2024, Hamer et al. 2024). This provides an opportunity to constrain planetary masses and measure bulk densities, enabling studies of planetary composition and interior structure—both of which are vital for understanding planet formation and evolution. In this talk, I will present our work on two young, resonant, multi-planetary systems—HIP 67522 (17 Myr) and TOI-942 (<100 Myr)—using high-precision photometry from the CHEOPS satellite. CHEOPS' higher sensitivity at blue wavelengths allows us to better constrain activity-induced biases in inferred planet properties, including transit timings and depth. For HIP 67522, we observe transit depth variations of up to 30% between individual observations. These variations evidently correlate with the star's rotational variability signal, pointing to varying spot coverage as their cause. For TOI-942, we identified transit timing variations with an amplitude of approximately 20 minutes, enabling us to dynamically measure planetary masses.

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