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# Fascinating Transit Timing Variations of Hot Jupiters: Evidence of Planet Migration

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Transit timing variations (TTVs) of hot Jupiters can reveal signatures of multiple physical processes, including apsidal precession, the Rømer effect, and notably, planetary migration. Hot Jupiters are believed to form at significant distances from their host stars and later migrate inward, a scenario that can be directly supported by TTV measurements. Detecting TTVs requires a long observational baseline and high precision in determining transit midpoints. Leveraging the full-sky coverage and continuous monitoring capabilities of TESS, we have launched a campaign to monitor the long-term TTVs of known hot Jupiters. As part of this effort, we have reported TTV detections for WASP-161b, K2-237b, and XO-3b, augmenting our observations with additional data from approved proposals using CHEOPS and ground-based telescopes. Our analysis suggests that a period decay model best explains the TTVs of WASP-161b. However, the inferred tidal quality factor is remarkably low—comparable to that of rocky planets in the Solar System—despite WASP-161b being a gas giant. This rapid orbital decay likely indicates an exceptionally efficient transfer of orbital energy into the planet's or host star's interior, or it may be driven by alternative mechanisms, such as magnetic interactions. For K2-237b, we detected a period decay, with additional evidence suggesting the presence of a circumstellar disk. Infrared excess was observed at a significance level of 1.5σ in the WISE W1 and W2 bands, and at 2σ in the W3 and W4 bands, based on spectral energy distribution fitting. To further investigate the physical origins of the period decay, we are developing a star-planet interaction model that considers both magnetic and tidal interactions simultaneously. For magnetic interactions, the package incorporates the magnetic topology of the host star and the orbital characteristics of the planet. For the tidal interaction, the package includes empirical equations for both equilibrium and dynamic tides.

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