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Multi-methods extraction of TTVs for (near-)resonant systems in Kepler, TESS and PLATO

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The detection of exoplanets rely heavily on space-based transit surveys such as Kepler, TESS and PLATO. In these surveys, detecting and characterising small planets pose challenges due to their low signal-to-noise ratio (SNR). Standard methods, such as the Box least square (BLS) algorithm, exploit the periodic nature of orbits to enhance the SNR. But these methods are fundamentally limited when gravitational perturbations between the planets disturb the periodic nature of their orbit. These perturbations lead to transit timing variations (TTVs), causing smearing of the transits and reduction of the detection significance. This can lead to an underrepresentation and inaccurate characterization of small planets embedded in resonant systems. Consequently, there is a necessity for flexible approaches that capture these signals. Prominent examples include for example QATS [Carter et al. 2013], RIVERS [Leleu et al. 2021] and an adapted approach of the Radon algorithm [Copeland et al. 1994]. After exposing the problem of detecting quasi-periodic signals, I will present adapted methods and my ongoing work to improve them. I will also present a comparison of the performance of these methods on real and synthetic data, before illustrating these results by the confirmation and characterisation of a new resonant pair of planets.

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