

Systematic Analysis of Multi-Planet Systems: The EXO-RESTART Project

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The EXO-Restart project at Sofia University aims to detect and dynamically characterize multi-planetary systems using various methods, including transit, radial velocities (RVs), and transit timing variations (TTVs). Studying the dynamical architecture of multiple-planet systems is vital since it reveals information about their formation mechanism and evolution. To gain deeper insights into planet formation, we focus on the dynamical properties of these systems, particularly retrieving the osculating orbital parameters using N-body models, as opposed to relying solely on the Keplerian best-fit parameters reported in the literature. We developed the “Exo-Striker” toolbox as a powerful and efficient Python library designed for exoplanet orbital analysis and N-body simulations for our needs. In our project, we combine original exoplanetary data from spectroscopic facilities like HARPS, HIRES, and CARMENES, which include more than 5000 unique stars, as well as the TESS transit photometry survey data. Finally, our work includes extensive long-term stability and dynamical analysis to ensure accurate modeling and predictions of planetary system behavior.

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