National Aeronautics and Space Administration

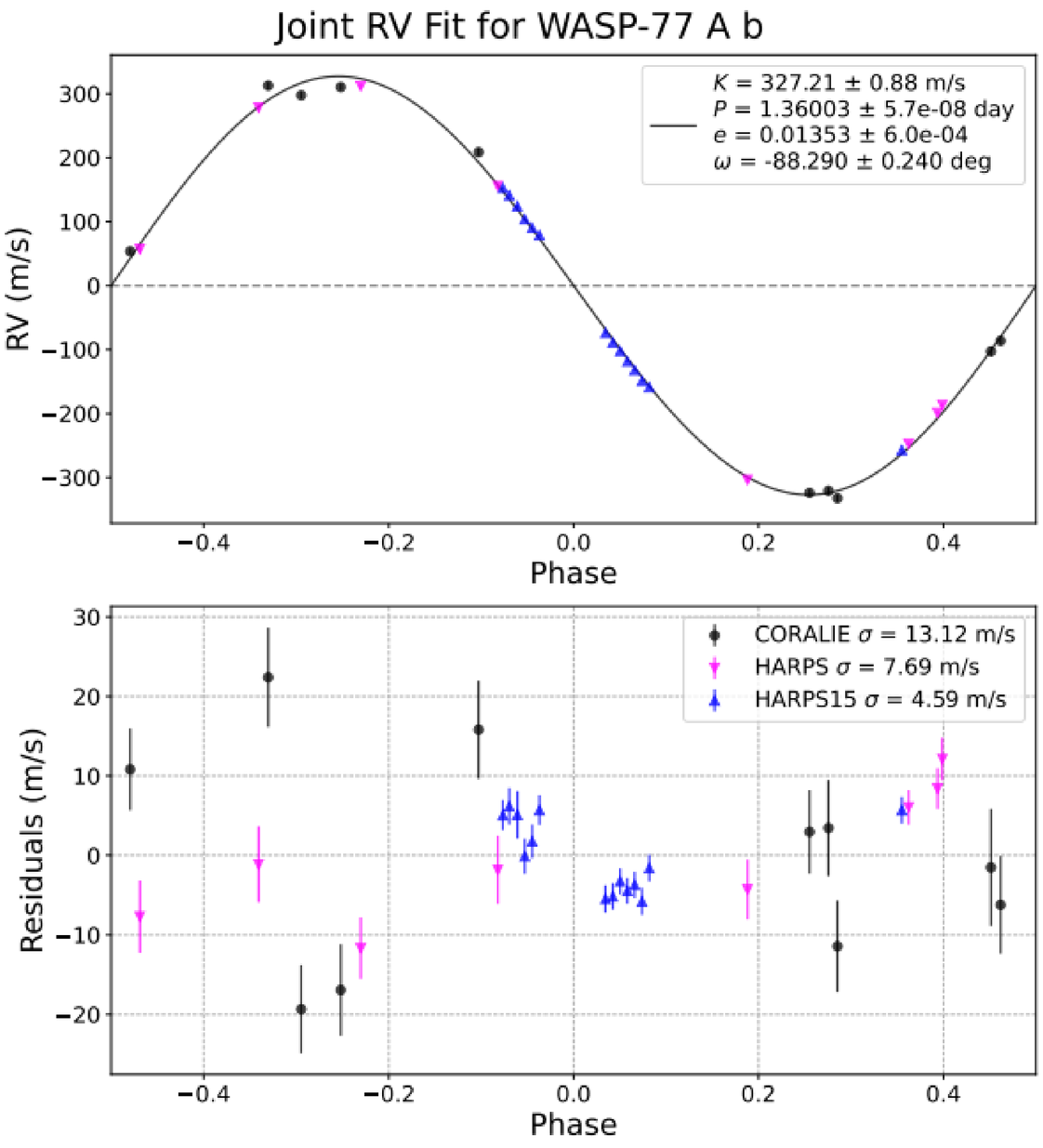
FY24 Strategic University Research Partnership (SURP)

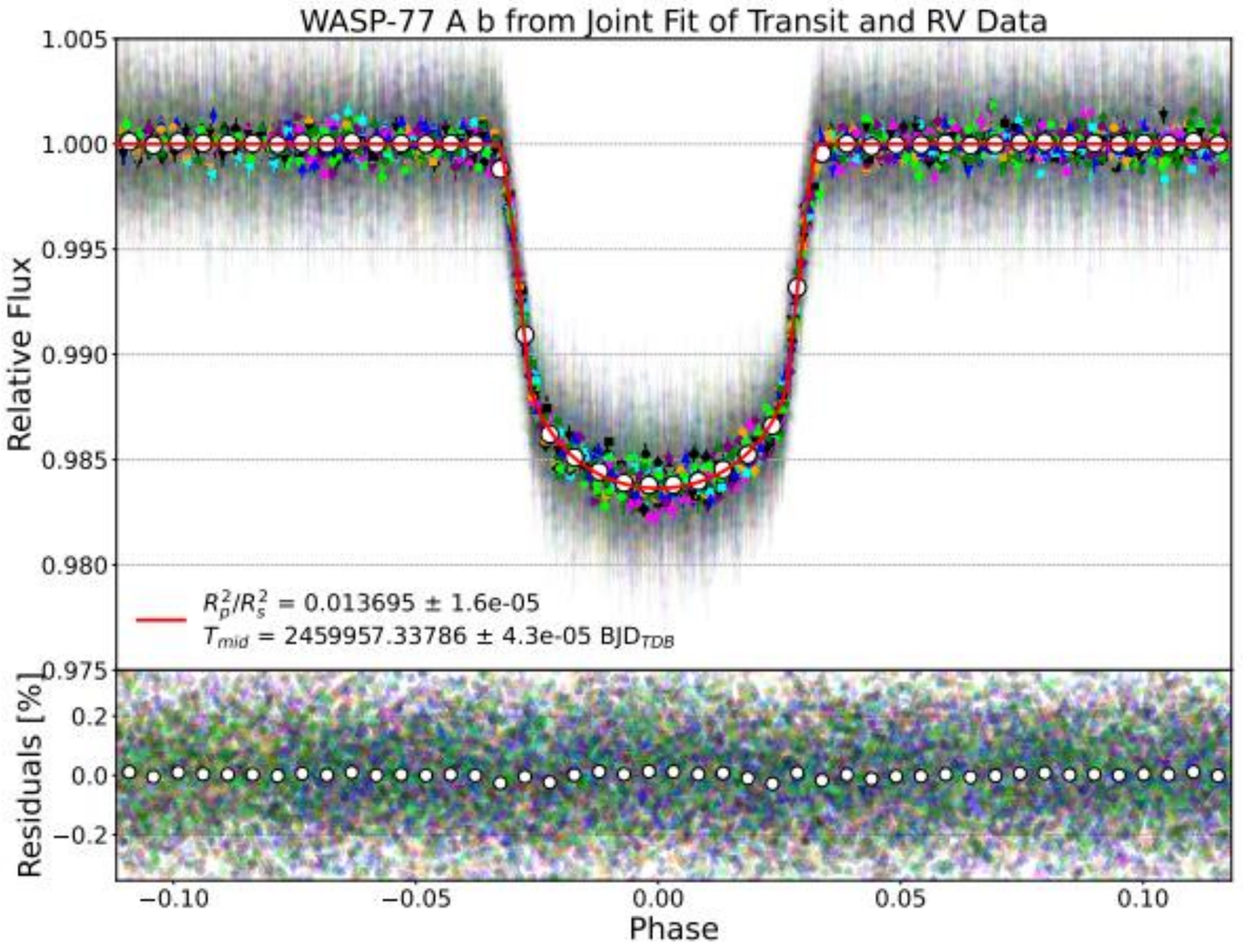
Refining Exoplanet Parameters Through Global Collaboration

Principal Investigator: Kyle Pearson (398)**; Co-Investigators:** Jennifer Burt (326), Molly Simon (Arizona State University), Fred Noguer (ASU), Suber Corley (ASU), Bradley Hutson (ASU), Tara Fetherolf (UCR/CSUSM), Robert Zellem (326)

Objectives

The primary objective of this research is to refine the orbital parameters and physical properties of exoplanets by leveraging the power of coordinated ground-based telescope networks and combining expertise across disciplines, including planetology, astrophysics, and stellar activity studies. The project aims to provide critical data for detailed transit timing and duration analyses, complementing space-based missions like TESS, and enhancing the science returns of NASA missions such as Pandora, JWST, Roman, and the CASE contribution to ESA's Ariel.





Results

One notable accomplishment was our thorough study of WASP-77 A b, where we combined 64 ground-based transit, 6 space-based eclipse, and 32 radial velocity observations. This culminated in the most precise orbital solution for this target to date (Noguer et al., 2024), facilitating future JWST and Ariel atmospheric studies of WASP-77A b. Our findings underscored the value of integrating citizen scientist data alongside space-based observations for improved analysis.

Another significant achievement was the creation of tools to query various radial velocity archives, standardizing data formats and easing access for researchers (Hutson et al., in prep.). Currently, we're studying HAT-P-23 b using insights and tools gleaned from our WASP-77 A b research.

Significance and Benefits to JPL

The research conducted through this project has significant implications for the *Exoplanet Watch* program and the broader field of exoplanet science. By refining the orbital parameters and physical properties of selected exoplanetary targets, we are contributing to a more accurate understanding of the dynamics and characteristics of multi-planetary systems. This knowledge is crucial for guiding future observations and interpreting data from current and upcoming NASA missions. The development of tools to query radial velocity archives and the integration of radial velocity analysis capabilities into our data analysis software will have a lasting impact on the efficiency and effectiveness of exoplanet research within the *Exoplanet Watch* project. Furthermore, the collaborative nature of this project, which brings together amateur astronomers, professional scientists, and undergraduate students, fosters a diverse and inclusive research environment that strengthens the foundation of the Exoplanet Watch program. By engaging citizen scientists and early-career researchers, we are building a strong community of passionate individuals who will continue to contribute to the success of the Exoplanet Watch project and advance our understanding of exoplanetary systems.

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

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Publications:

Noguer, F. R., *Enhancing Exoplanet Ephemerides by Leveraging Professional and Citizen Science Data: A Test Case with WASP-77 A b,* Publications of the Astronomical Society of the Pacific, vol. 136, no. 6, Art. no. 064401, IOP, 2024. doi:10.1088/1538-3873/ad57f5.