Studying the Variability of Nearby M Dwarfs from Hours to Months to Decades with TESS and the CTIO 0.9 m

Aman Kar, Todd J. Henry, Madison LeBlanc, Andrew A. Couperus, Wei-Chun Jao and RECONS Team
Georgia State University, Atlanta, GA 30302
RECONS Institute, Chambersburg, PA 17201

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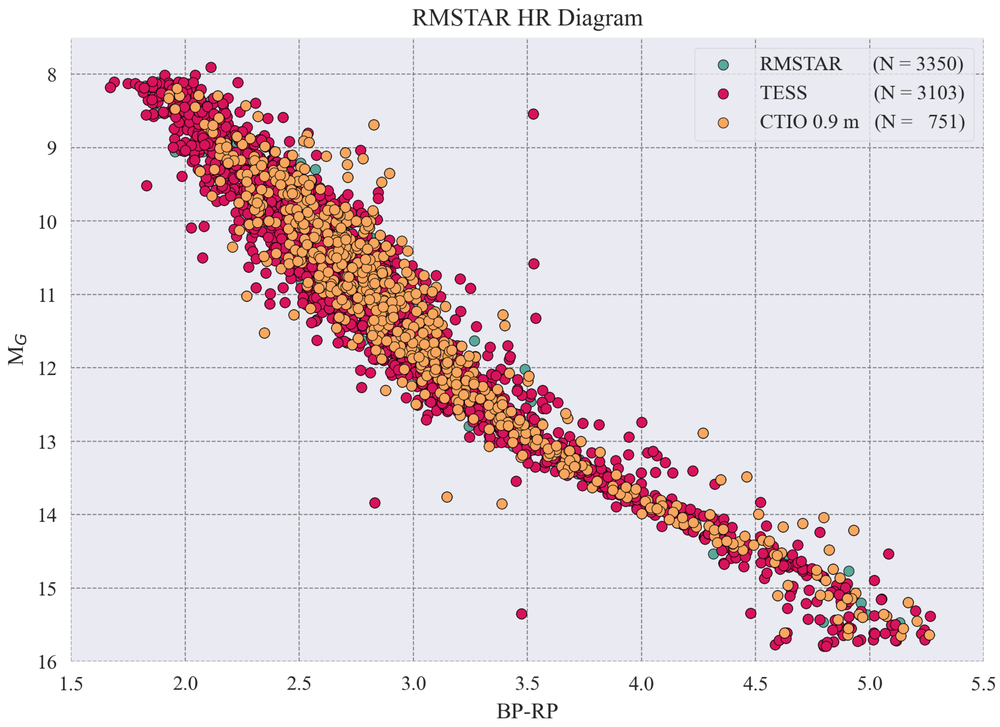
Introduction

M dwarfs account for 3 out of every 4 stars in the Solar neighborhood and presumably offer enduring and stable environments for planetary systems. In our project, ATLAS (A Trail to Life Around Stars), we are compiling a variability catalog of M dwarfs to find the most and least variable stars in the Solar neighborhood. Here we present our assessment of stellar variability at different timescales: mid-term (hours to months; due to stellar rotation), and long-term (years to decades; due to stellar cycles).

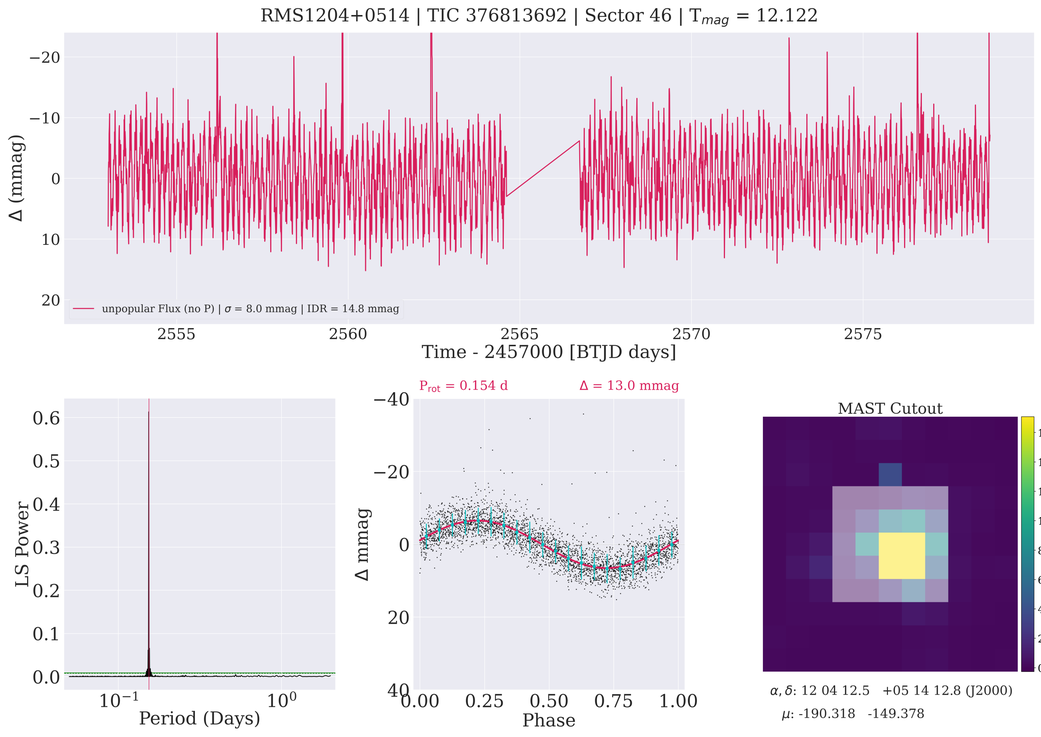
I. We have identified **3350** M dwarf primary systems within 25 pc via *Gaia* DR3 parallaxes where **3103** have *TESS* coverage and **751** have been observed at the CTIO 0.9 m telescope.
II. The mid-term results are based on the *TESS* data where we use the *unpopular* package to extract amplitudes and rotation periods and can preserve stellar signals for very fast and very slow rotators.
III. The long-term results are based on the 24-year RECONS effort at the SMARTS 0.9 m telescope at CTIO. GJ 1061 shown here exhibits cycle-like behavior over 23.3 years.
IV. Out of the long-term variability results on 751 M Dwarfs, we highlight here in detail 32 M dwarfs with confirmed exoplanets of which 23 have TESS data (Kar et al. 2024).

Overall, it is clear that some M dwarfs are more photometrically stable than others across all timescales, suggesting that specific stars warrant further attention in the search for habitable worlds.

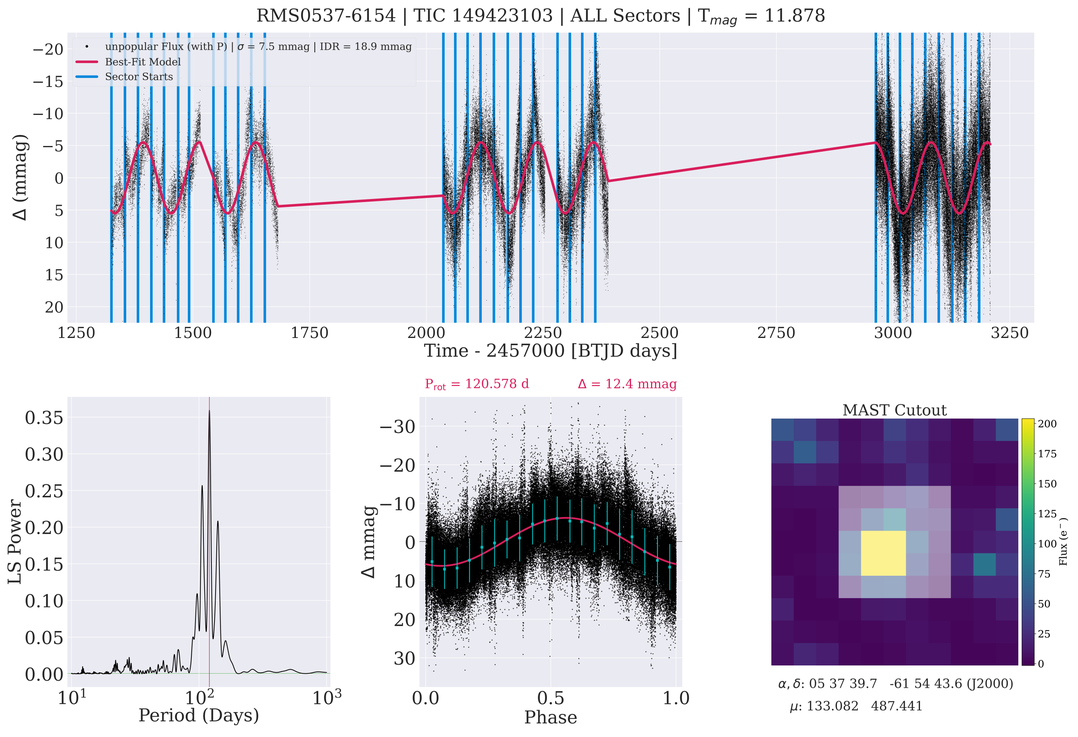
I. RMSTAR 25 Parsec Sample



II. Stellar Rotation via TESS

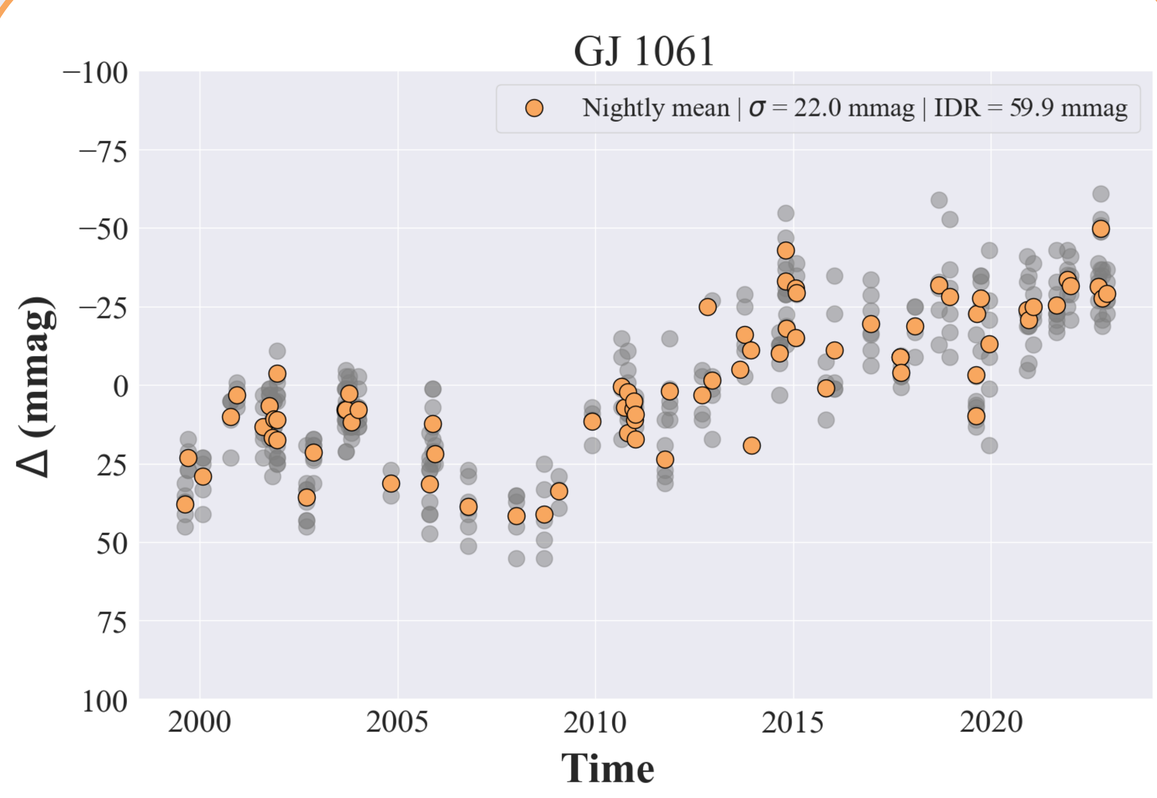


Ridiculously Fast Rotator @ P_{rot} ~ 3.7 hrs!

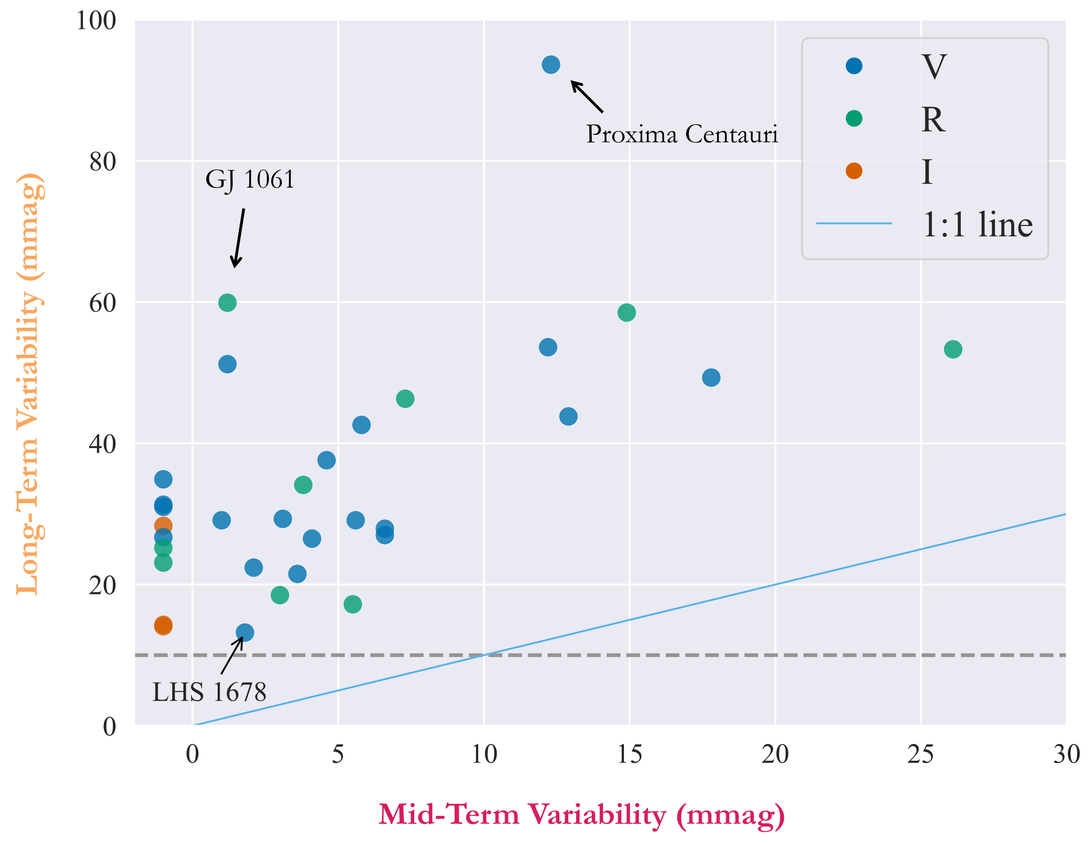


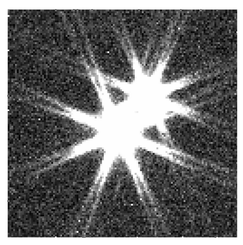
Relaxed Slow Rotator @ P_{rot} ~ 121 days!

III. Stellar Cycles via CTIO 0.9 m



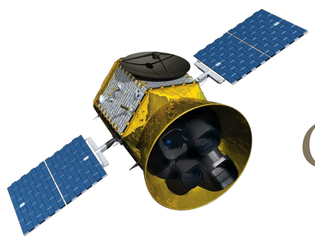
IV. Long-Term vs Mid-Term Variability





RECONS
Research Consortium on Nearby Stars

ATLAS
A Trail to Life Around Stars



Georgia State University

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