The RKSTAR (RECONS K STAR) Catalog of 4480 Nearby K Dwarf Systems

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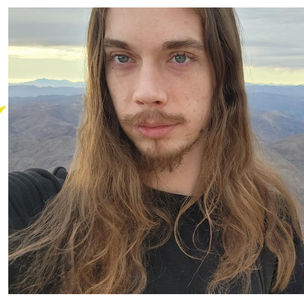

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Abstract

K dwarfs account for 11% of the stars in the solar neighborhood, making them the second most common star throughout the Universe. Exobiology studies indicate that they are less active and likely host more ideal environments to produce and sustain life than their more active cousins, the M dwarfs. Our RKSTAR (RECONS K STAR) sample is the most extensive compendium of K dwarfs ever created, made possible with Gaia Data Release 3 (GDR3), as well as historical data for stars not in GDR3. With RKSTAR, we tackle the fundamental question: What do the stellar and planetary orbital architectures of companions to K dwarfs look like?

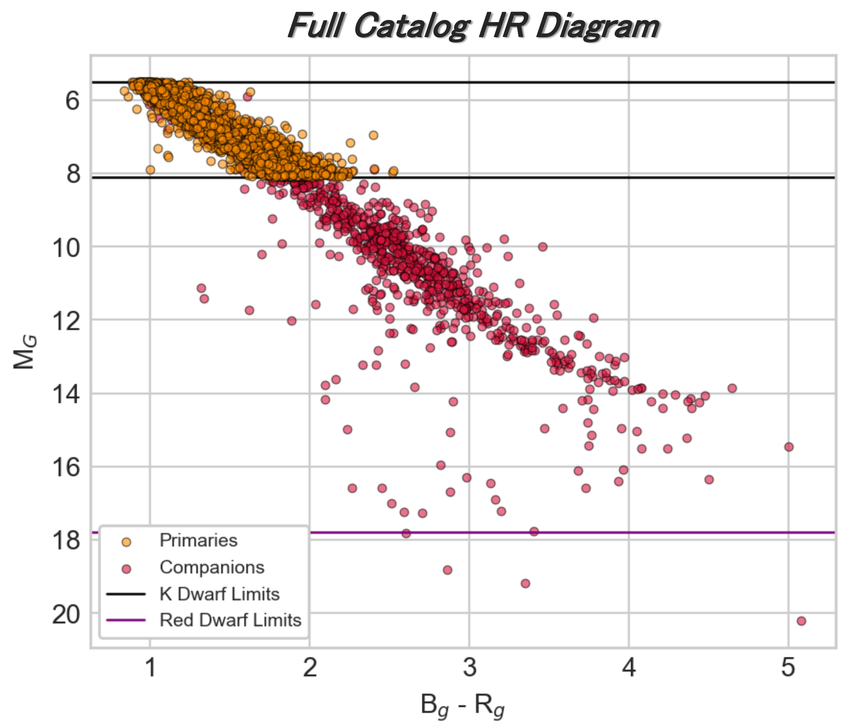
Here we present the RKSTAR census of 4480 K dwarf systems within 50 pc, with details about the primaries as well as statistics of companions found via GDR3, our speckle imaging and radial velocity surveys, and other supplemental data.

We provide details to date for our radial velocity survey of a subset of 1092 K dwarfs within 40 pc and declinations -30 to +30, where we reveal Jovian-sized exoplanets, brown dwarfs, and hidden stellar companions with the use of CHIRON.

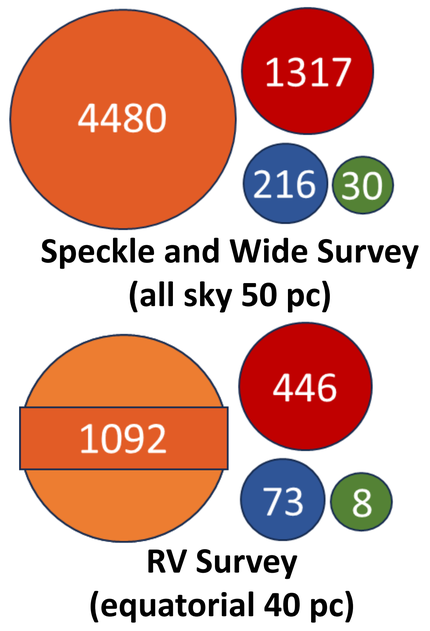
RKSTAR will enable a wide range of scientific investigations, including everything from the mass contribution of K dwarfs to the Milky Way to identifying the best targets for future habitable exoplanet surveys.

This effort has been supported by the NSF through grant AST-1910130, by NASA through grant 22-XRP22_2-0187, and via observations made possible by the SMARTS Consortium.

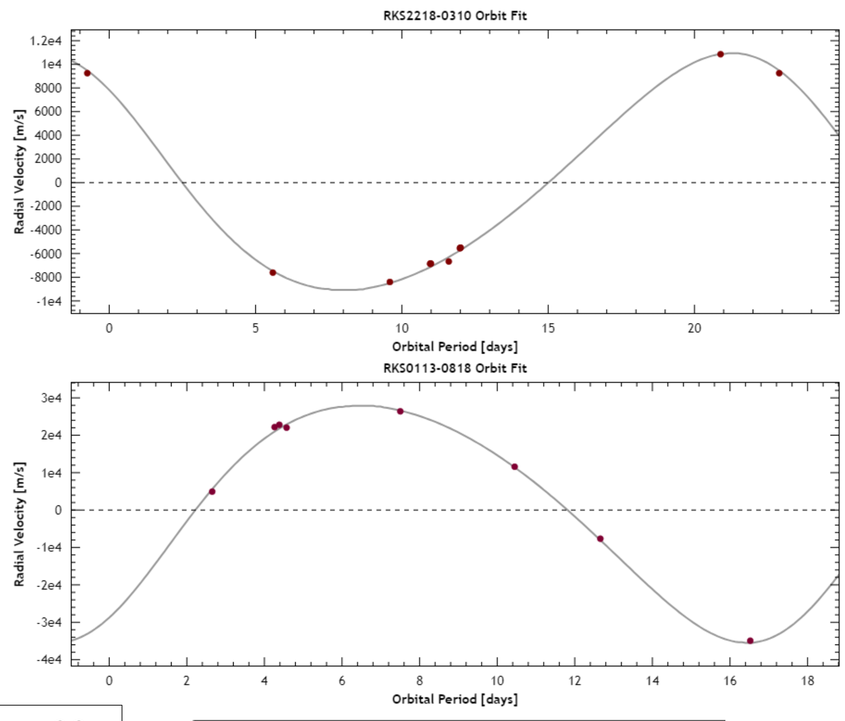
RKSTAR Catalog



K dwarf primaries recovered through Gaia DR3/DR2/Hipparcos



New Stellar Orbits



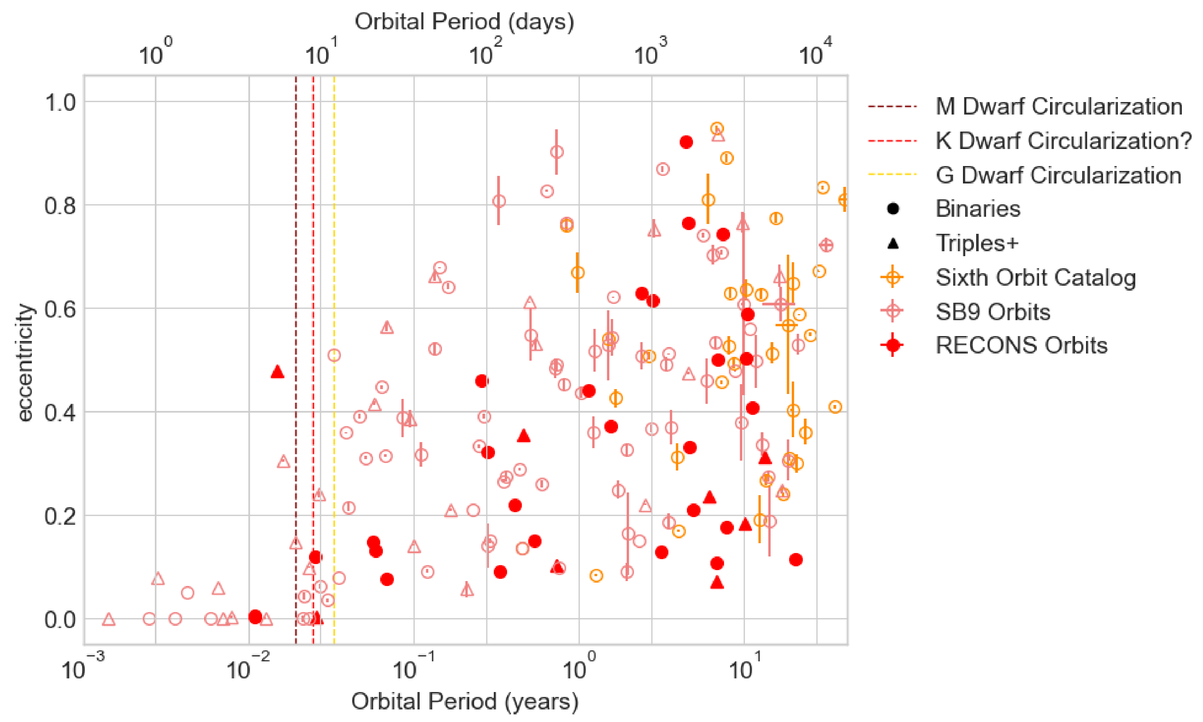
P = 23.61 ± 0.01 days
Msin(i) = 0.144 M⊙

P = 17.85 ± 0.01 days
Msin(i) = 0.496 M⊙

663/1092 surveyed. Up to 92 potential new RV companions.

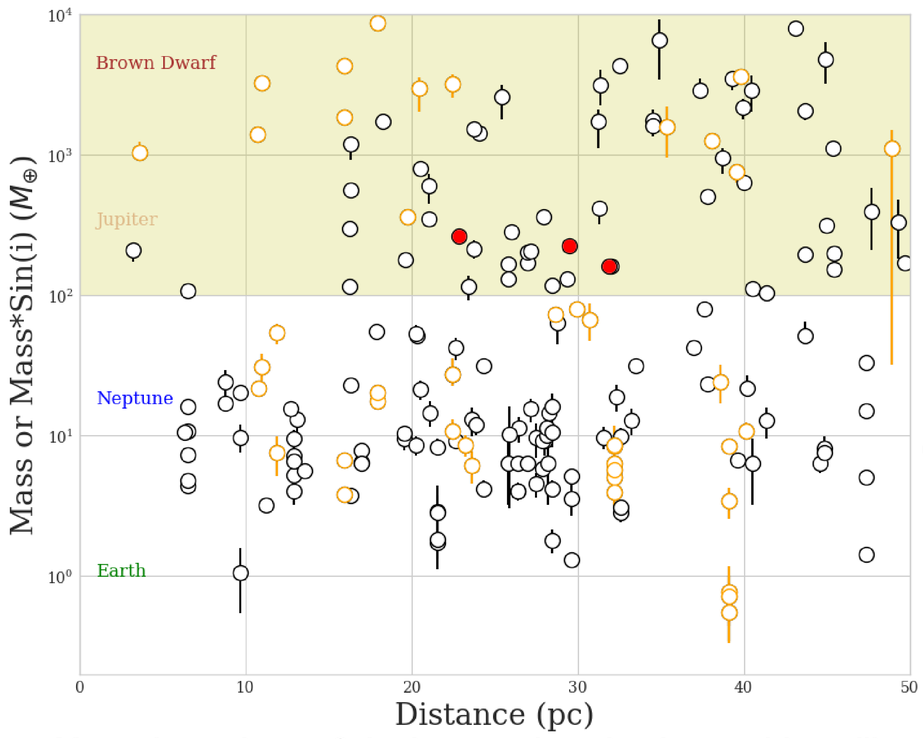
Sample	Total Ks	HIRES/HARPS/SB9	CHIRON
0 - 40 pc	1092	313	350

Stellar Companions with Orbits



At what orbital periods do K dwarfs tidally circularize their stellar companions? Appears to be roughly 9 days.

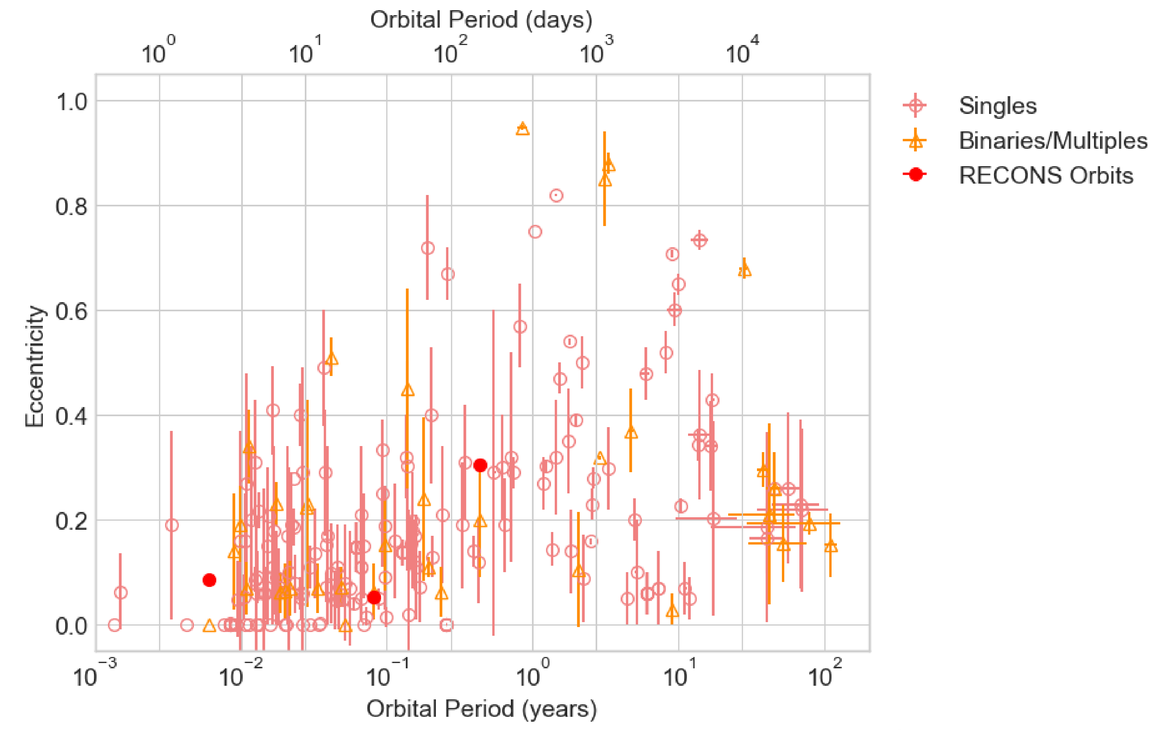
Planetary Companions



Lots of Neptune-analogs, not many Jovians. Our RV survey targets the Jupiter-analog exoplanet regime.

More detections of Jupiter-analogs in short orbits will reduce the amount of K dwarf systems future exoplanet detection/characterization surveys will target.

Planetary Companions with Orbits



No real relationship between period and eccentricity of an exoplanet around its host K dwarf.

This research utilizes:

"RKSTAR Survey" Paredes L. A., Henry T. J. et al. 2021, *AJ*, 162, 176.

"SB9" Pourbaix, D., Tokovinin, A. A. et al. 2004, A&A, 424, 727.

"Gaia DR3" Gaia Collaboration et al. 2023, A&A, 674, A1.

"OC6" Hartkopf, W. I., Mason, B. D., & Worley, C. E. 2001, AJ, 122, 3472.