Georgia State University
Department of Physics and Astronomy

Ph.D. Dissertation Defense

Hodari-Sadiki Hubbard-James

Friday, June 30th, 2023 1:00 PM EDT
Virtual Meeting Link (Full Meeting Information Below)

"Spectral Characterization of a Complete Equatorial Sample of 615 K Dwarfs"

We present the results of a spectroscopic study to determine the stellar properties, activity levels, space motions, and ages of the nearest K dwarfs. The targeted stars are members of RKSTAR (RECONS K Stars) Survey that includes ~5000 K dwarf primaries within 50 pc. An initial study established a benchmark calibration set of 35 K dwarfs with known ages of 20 Myr to 5 Gyr and high resolution (R=80000) spectra acquired on the CHIRON echelle spectrometer on the SMARTS 1.5m telescope at CTIO. Two known spectral indicators of activity and youth — the Hα absorption line (6562.8 Å) and the Li I resonance line (6707.8 Å) — showed strong trends in the training set. A sample of 615 K dwarfs within 33 parsecs and found between declinations +30 ◦ and −30 ◦ has now been observed with CHIRON and analyzed relative to the stars in the benchmark calibration set. Surprisingly, it appears that as many as ~8% of these K dwarfs have spectroscopic features indicating that they are young and/or active. As expected, Galactic U V W space motions indicate that most of the stars fall into the thin (80%) and thick (20%) disk populations, with a single outlier, HD 134439, which is a known halo star. Overall, we find a set of metal-poor K dwarfs with [Fe/H] values of −0.5 dex or less that account for 4% of the population in the solar neighborhood.

Empirical SpecMatch has been used to measure stellar properties for this sample of K dwarfs: temperatures range from 3600–5500 K, metallicities range from $-0.6 < [Fe/H] < +0.55$, and rotational velocities (vsini) range from less than 10 km/s to more than 50 km/s. Surface gravity values (log g values) have also been determined, although they are less reliable than the other quantities. Cross-matching with NASA's Exoplanet Archive reveals that only 42 K dwarf host stars among our sample, highlighting the limited focus on mid and late-type K dwarfs ($T_{eff} < 4800$ K) in large exoplanet surveys. As a result of this work, we have identified 500 K dwarfs that are calm host stars worthy of detailed efforts to detect terrestrial planets. This work will serve as a key resource for assessing host star suitability for exoplanet habitability.

Full Virtual Meeting Information:

Hodari's PhD Dissertation Defense: (Friday- June 30th, 2023)
Hosted by Hodari-Sadiki James

https://gsumeetings.webex.com/gsumeetings/j.php?MTID=m8c13ee4ee693a7bf2ee21bea23dc430e
Friday, June 30, 2023 12:50 PM | 3 hours | (UTC-04:00) Eastern Time (US & Canada)
Meeting number: 2624 312 2849
Password: jV9M44aUAXg
Agenda: Spectral Characterization of a Complete Equatorial Sample of 615 K Dwarfs

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