NIR Metallicities, Radial Velocities and Spectral Types for 447 MEarth M dwarfs

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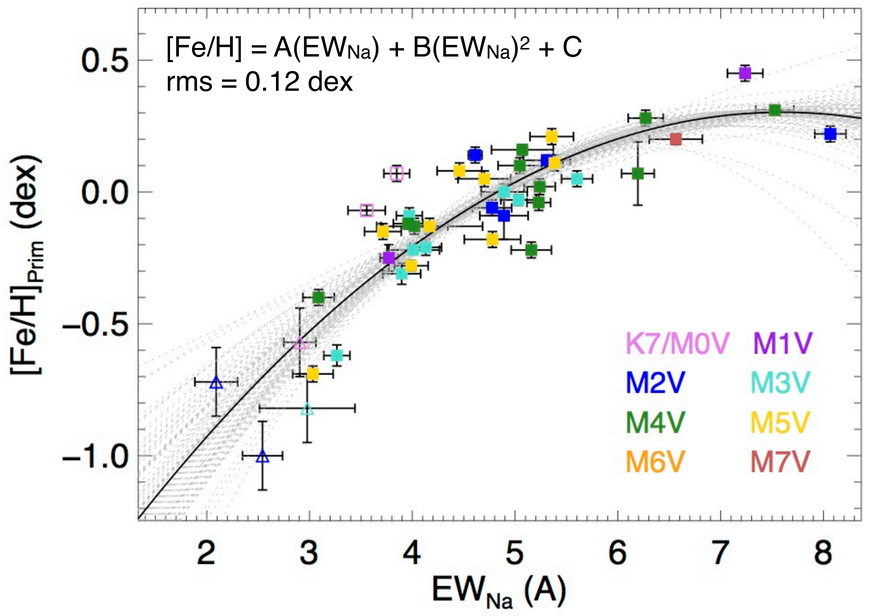
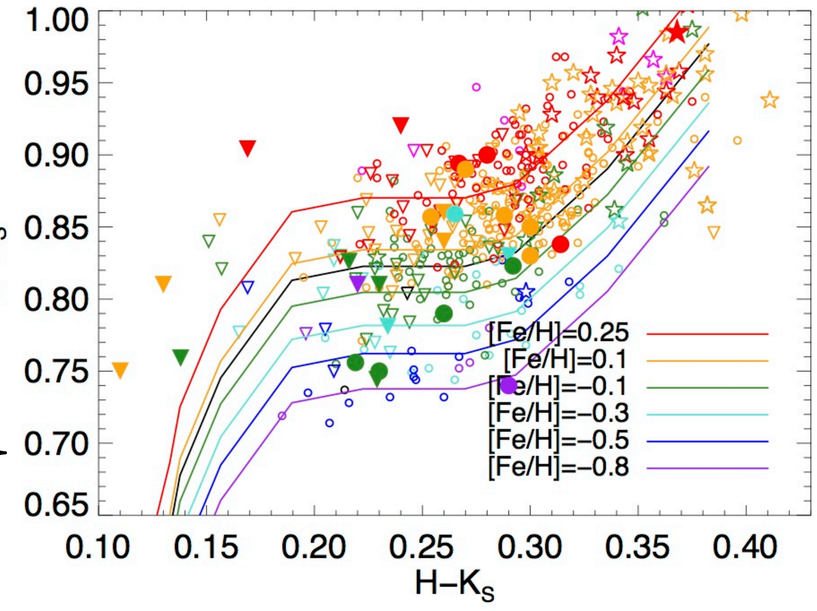
Introduction: M dwarfs present a unique opportunity for the detection and characterization of habitable Earth-sized planets and for testing theories of planet formation. In contrast to solar type stars, the physical parameters of M dwarfs are not in general well understood and present a major hurdle for studying transiting planets orbiting M dwarfs. In this work, **we present our observations and analysis of near infrared (NIR) moderate resolution (R~2000) spectra of 447 M dwarfs** collected using the SpeX instrument on IRTF (Rayner et al. 2003). **These M dwarfs are targets of the MEarth survey**, a transiting planet survey searching for super Earths around mid-to-late M dwarfs within 33pc.

Metallicities

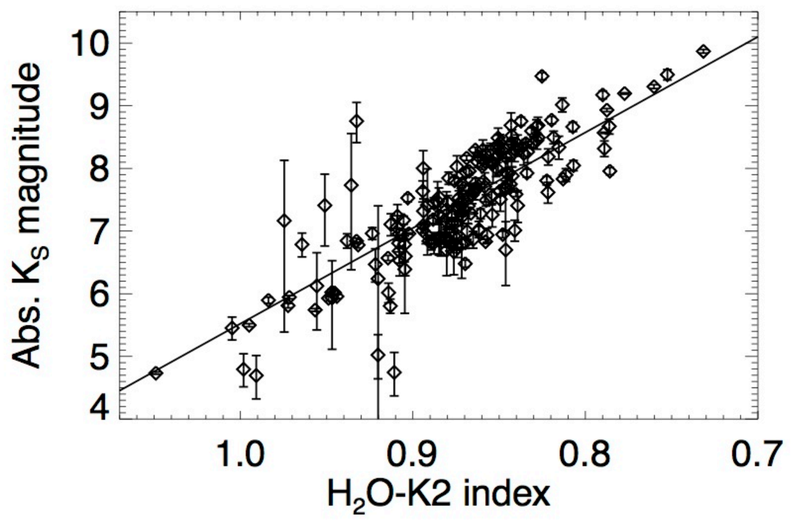


We present a new, one-parameter empirical metallicity calibration using M dwarfs in common-proper motion pairs with an F, G or K-type star.[1,2] We validated pairs using proper motions, distances and radial velocities.

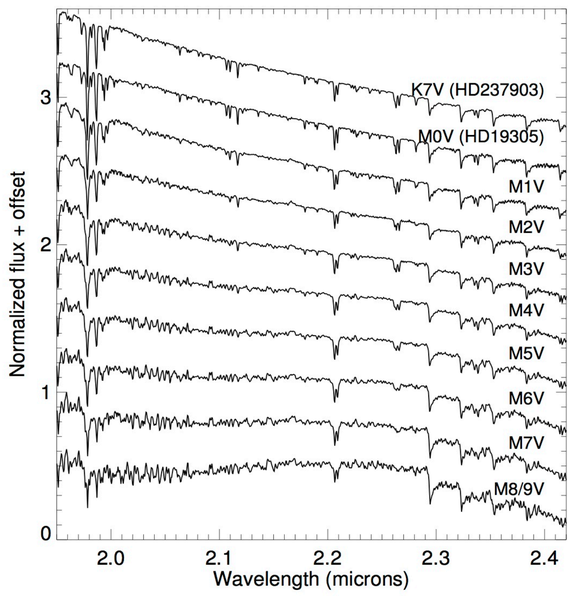
We present a new color-color metallicity relation. We related the vertical (J-K_s) distance from the Bessell & Brett (1988) main sequence to EW$_{Na}$. Using our metallicity calibration, we related NIR colors to metallicity.



Spectral Types



We created a **new spectroscopic distance calibration** using M dwarfs with parallaxes and 2MASS K_s magnitudes. Our relation has a **scatter of 14% in distance.**

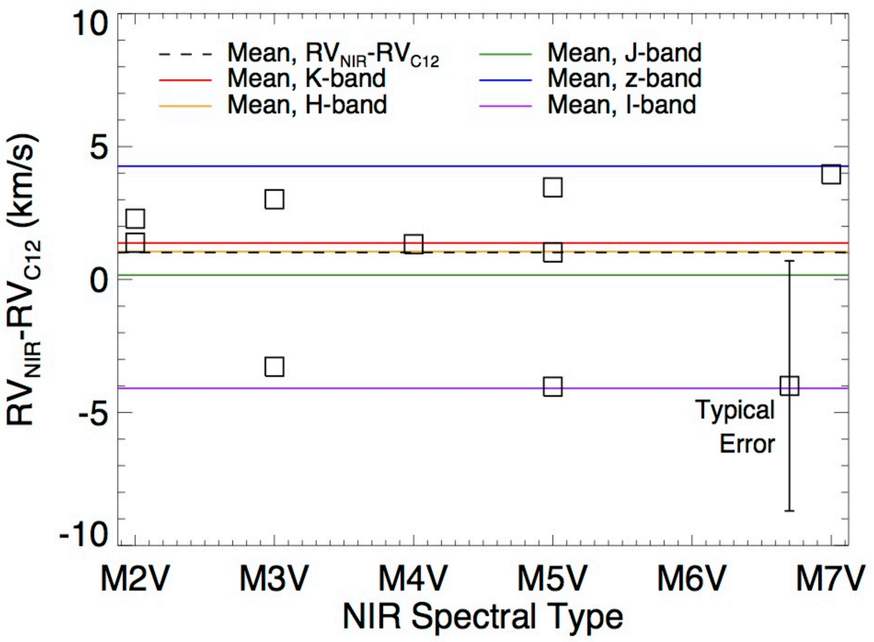


IRTF Spectral Library
(Cushing et al. 2005; Rayner et al. 2009)

We combined spectra of solar-metallicity M dwarfs to create **new IRTF spectral templates.**

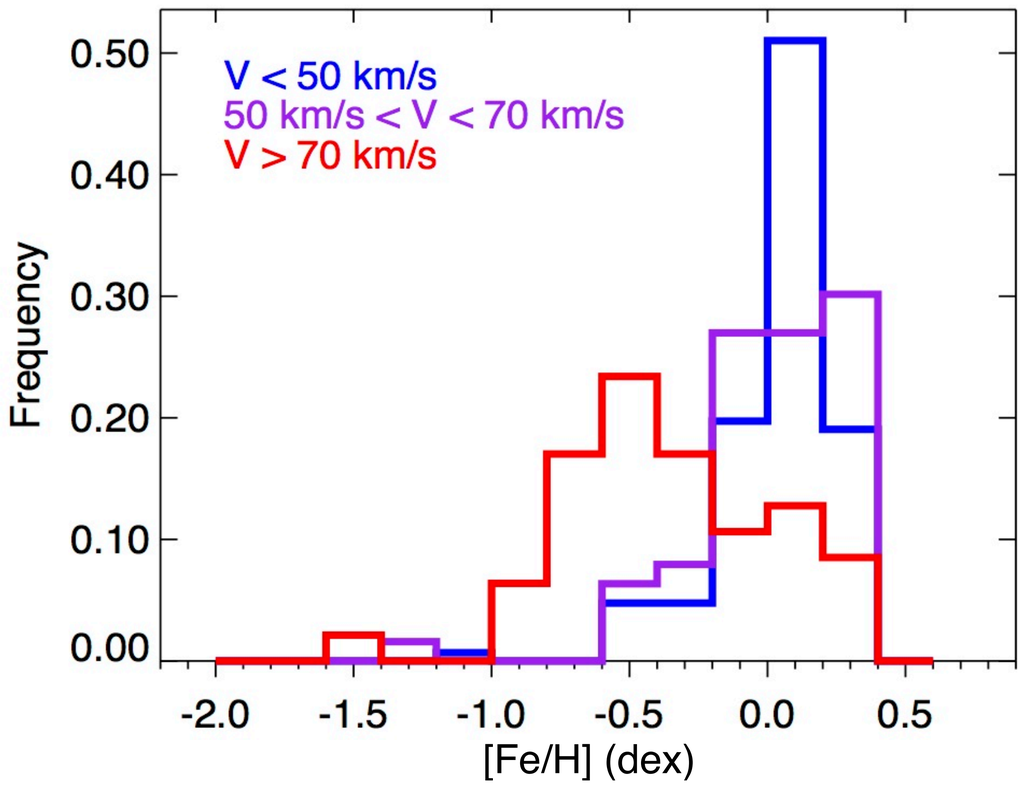
Radial Velocities

To wavelength calibrate our spectra, **we used a theoretical atmospheric transmission spectrum to model telluric absorption**. We then cross-correlated each science spectrum with that of an RV standard.



We use RVs from Chubak et al. (2012) to correct for the systematic RV offset and **demonstrate 4 km/s accuracy across the M dwarf spectral sequence.**

Distribution of metallicities and kinematics



References - 1: For use of FGK-M pairs, see e.g., Gizis & Reid (1997), Bonfils et al. (2005); 2: Following Rojas-Ayala et al. (2010, 2012), we use EWs of NIR lines to trace [Fe/H]
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