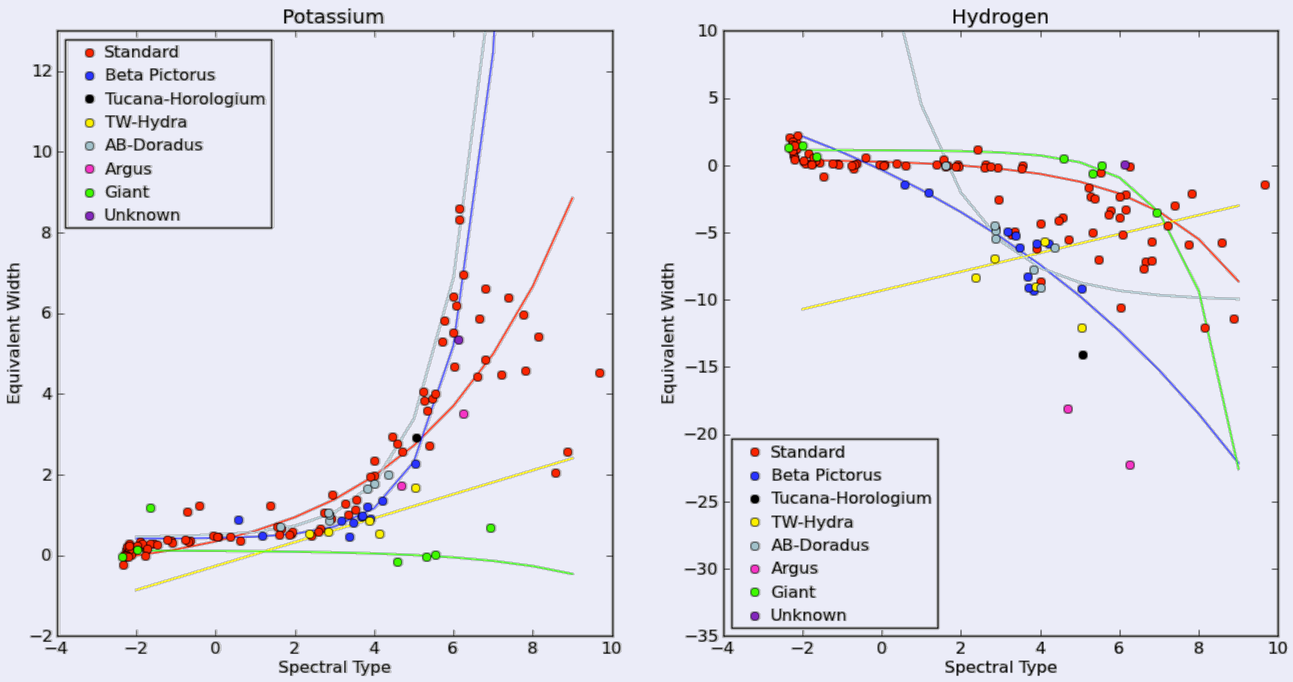
Dating Unknown Stars: Finding the Ages of Unknown M Type Stars by Comparing their Spectral Features to Known M Type Stars

by Nikhil Vanderklaauw, Emmett Goodman-Boyd & Sean Samaroo with Adric Riedel

Our project aimed to find ages of unknown M type stars using a training sample of M type stars with known ages. We used the equivalent widths of specific spectral features and compared these features with the spectral types of the stars. We focused on specific elemental features: Hydrogen Alpha, Potassium, the Sodium doublet, Iron I, and Calcium II. We developed a plot of the different stars and the trends they followed based on their ages and moving groups. By plotting unknown stars on these trends we were able to determine which groups/clusters they fell into, and thus determined their relative age. In doing this we can classify stars that may potentially have planetary systems in the process of forming.



This graph shows the hydrogen alpha and potassium emissions' equivalent width measurements. The specific spectral features we measured are affected by gravity and temperature, and differ in standards and giants. As you can see, we can find distinct trends followed by different star groups. We used these trends as a training sample to gather information about unknown stars. By plotting unknown stars (see purple), we found how close they fitted to certain trends of specific groups of stars with similar features.

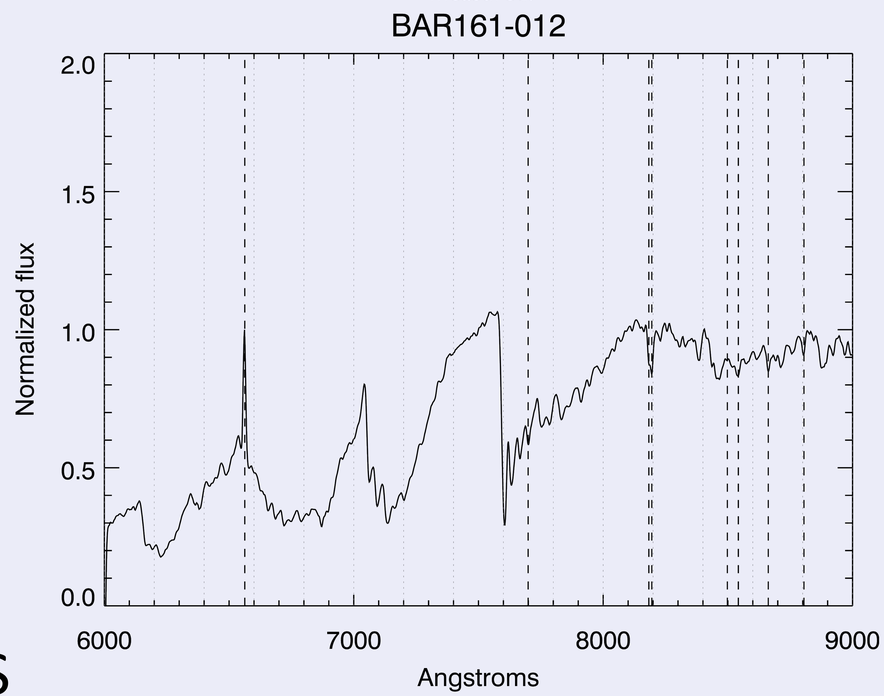
Key Terms:

Moving Groups: A group of stars that form and move through space together but but aren't gravitationally bound to one another

Equivalent Widths: the strength of the absorption/emission
This measurement is equal to the area under the continuum line (which is the pseudo line that represents the spectra without absorption or emission) minus the area under the absorption dip divided by the area under the continuum.

Spectral Type: The group in which a star is classified according to its spectrum-- a proportionate of the temperature of a star

This is a plot of M type star showing the locations of the spectral features we measured.



OUR RESULTS

Giants (43)		Young (20)
2MA0451-3402	LP788-001	2MA0746+2000
2MA0534-6921	NLTT30359	DEN1306-7722
2MA0921-2104	SCR0623-1005	G161-071
2MA1155-3727	SCR0750-5054	GJ0465
CD-24-17228	SCR0753-5506	GJ1151
CD-35-13495	SCR0757-7114	GJ1156
CD-45-13476	SCR0910-7214	LHS2065
CD-58-07828	SCR0932-2806	LHS2852
CD-61-06505	SCR1206-5019	LHS3263
CHXR11	SCR1230-3411	LKCA1
DEN1048-3956	SCR1316-5206	LKCA5
DEN2024-2944	SCR1317-4643	LP944-020
GJ1111	SCR1458-4102	P0255-1
GJ1207	SCR1658-6350	P0503-213
HD268899	SCR1701-6013	P0783-2
HD2700923	SCR1848-6855	SCR0040-2747
IRA08583-253	SCR2024-2500	SCR0711-3600
IYHYA	SCR2055-6001	SCR1425-4113
KTEri	SCR2305-3054	SCR2244-6650E
L087-002	SIP1054-8505	SSS0828-1309
LHS0288	SIP1141-3624	
	SWVIR	

Our data shows that the unknown stars to the left are classified as giants and young stars. Due to a lack of comparison objects, we were unable to further classify them into smaller sub-groups (see age legend). The way we distinguish between giants and young stars, is to measure the stars H-alpha emission. Giants no longer burn hydrogen making them have zero H-alpha emission. Young stars (younger than 120 millions years) are active and thus exhibit H-alpha emissions. The stars that have been classified as young should be further studied to identify possible proto-planetary systems.

AMERICAN MUSEUM OF NATURAL HISTORY

RECONS
Research Consortium on Nearby Stars

NASA
AMNH
Adric Reidel
Brian Levine
Allers et al. (2007)
Cruz et al. (2002)
Kirkpatrick et al. (1991)
Schlieder et al. (2012)
West et al. (2008)
Torres et al. (2008)
Reid et al. (1995)

AGE LEGEND
TW Hydra: 8 Myr
Beta Pictoris: 10 Myr
Tucana-Horologium: 30 Myr
Argus: 50 Myr
AB Doradus: 120 Myr
Main Sequence: 200-13000 Myr

The Science Research Mentoring Programs are supported by the National Science Foundation under Grant No. DRL-0833537, and by NASA under grant award NNX09AL36G.