FeH Absorption in the Spectra of Ultra-Cool Dwarfs

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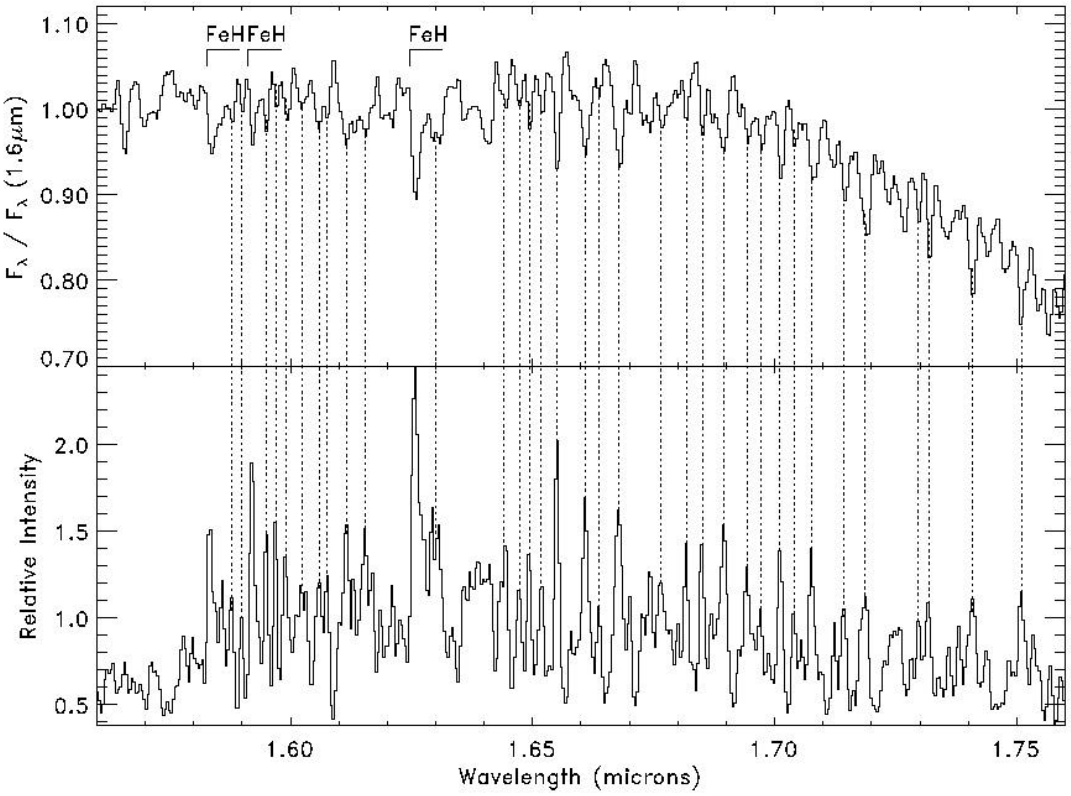
Brown dwarf fill in the gap between the more massive stars and the less massive planets like Jupiter and Saturn. The stars near the stellar-substellar border and all the brown dwarfs are collectively known as ultra-cool dwarfs. The fundamental properties of these objects such as their mass, temperature, and surface gravity are difficult to obtain without relying on theoretical atmospheric models. Unfortunately, the atmospheres of ultra-cool dwarfs are complicated by dust and cloud formation, upwelling, and weather, all of which are difficult processes to model. Spectra of these objects are useful not only to estimate their fundamental properties but to constrain the models.

For the past two years, we have been conducting an infrared spectroscopic survey of ultra-cool dwarfs using SpeXon the IRTF. Until recently, only a few FeH absorption features had been identified in the infrared spectra of these objects. SpeX has allowed us to identify nearly 100 new FeH absorption features throughout the infrared spectra of ultra-cool dwarfs (Cushing, et al. ApJ, accepted). Some regions of the spectra (see below) are completely dominated by FeH absorption.

The top spectrum shows the H-band spectrum of the cool star VB 10 which has a surface temperature of ~2000 K while the bottom panel shows an laboratory emission spectrum of FeH obtained at a temperature of ~2300 K. We have connected features that appear in the FeH spectrum and in the VB 10 spectrum with dotted lines. These FeH absorption features are not included in the latest theoretical models. Once included, our results will allow us to estimate the abundance of FeH in the atmosphere of these ultra-cool dwarfs.

The top spectrum shows the H-band spectrum of the cool star VB 10 which has a surface temperature of ~2000 K while the bottom panel shows an emission spectrum of FeH obtained from a King furnace at a temperature of ~2300 K. We have connected features that appear in the FeH spectrum and in the VB 10 spectrum with dotted lines. These FeH absorption features are not included in the latest theoretical models. Once included, our results will allow us to estimate the abundance of FeH in the atmosphere of these ultra-cool dwarfs.


FeH
FeH
FeH
1.10
1.00
0.90
0.80
0.70
F_λ / F_λ (1.6μm)
2.0
1.5
1.0
0.5
Relative Intensity
1.60
1.65
1.70
1.75
Wavelength (microns)