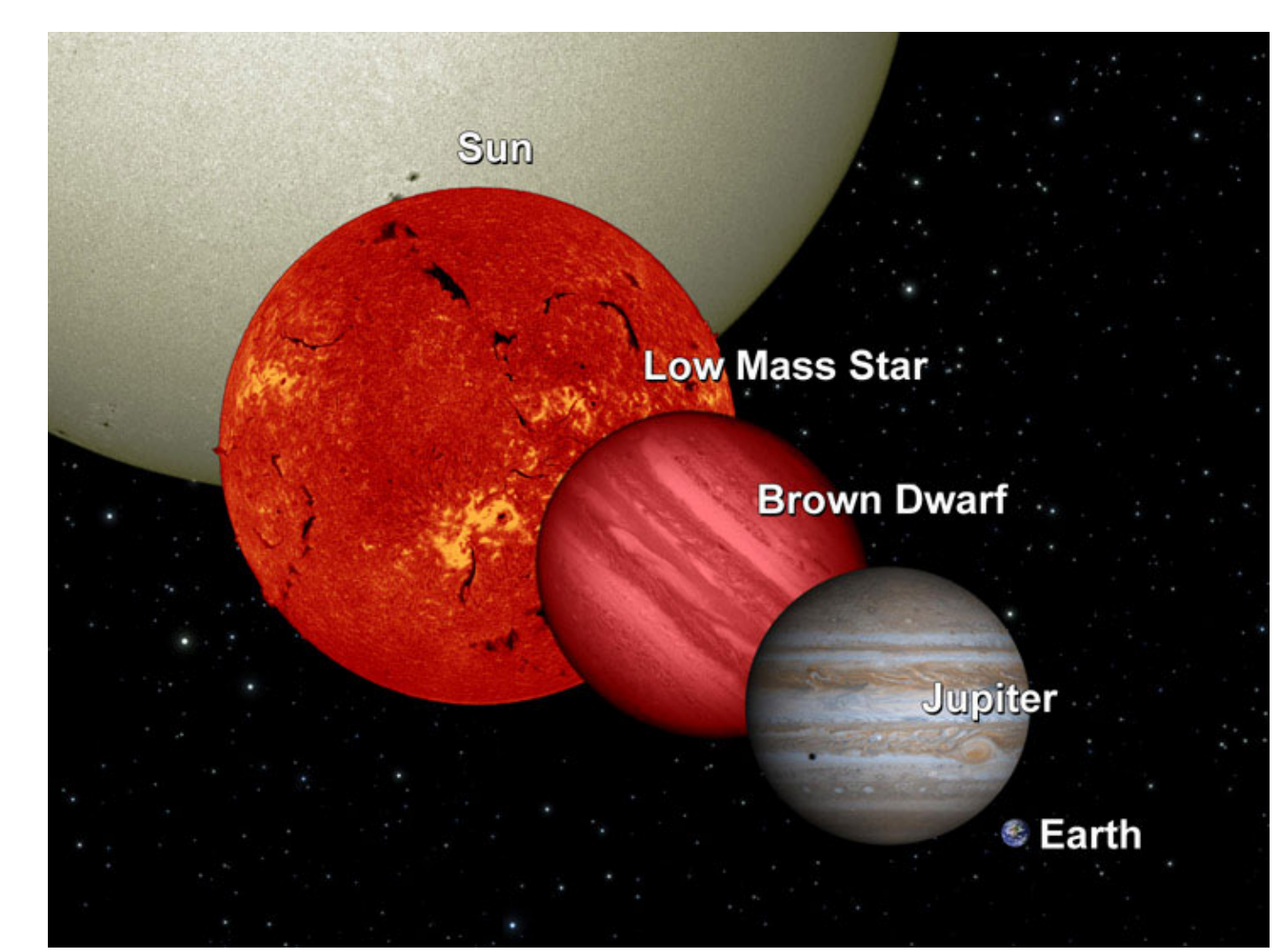


# Stellar Speeds For Not So Stellar Objects: Classifying Brown Dwarfs via Proper Motion

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## Brown Dwarfs

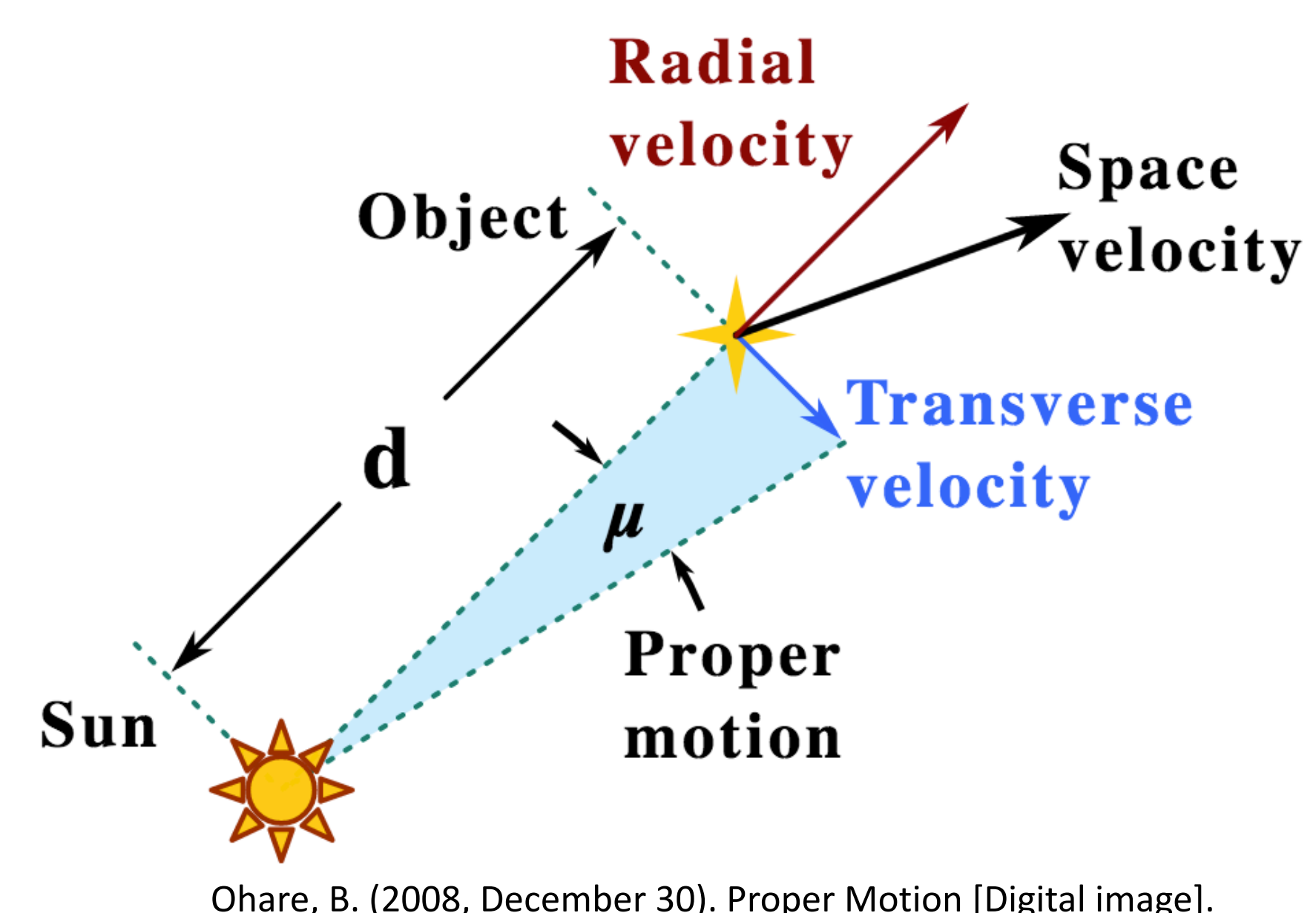
*Brown dwarfs* are about the size of Jupiter and are not massive enough to be classified as a star, but they are too massive to be considered a planet. Brown dwarfs are grouped into 4 spectral types: M, L, T, and Y.



Brown Dwarf Comparison [Digital image]. (2009, November 17).

## Proper Motion

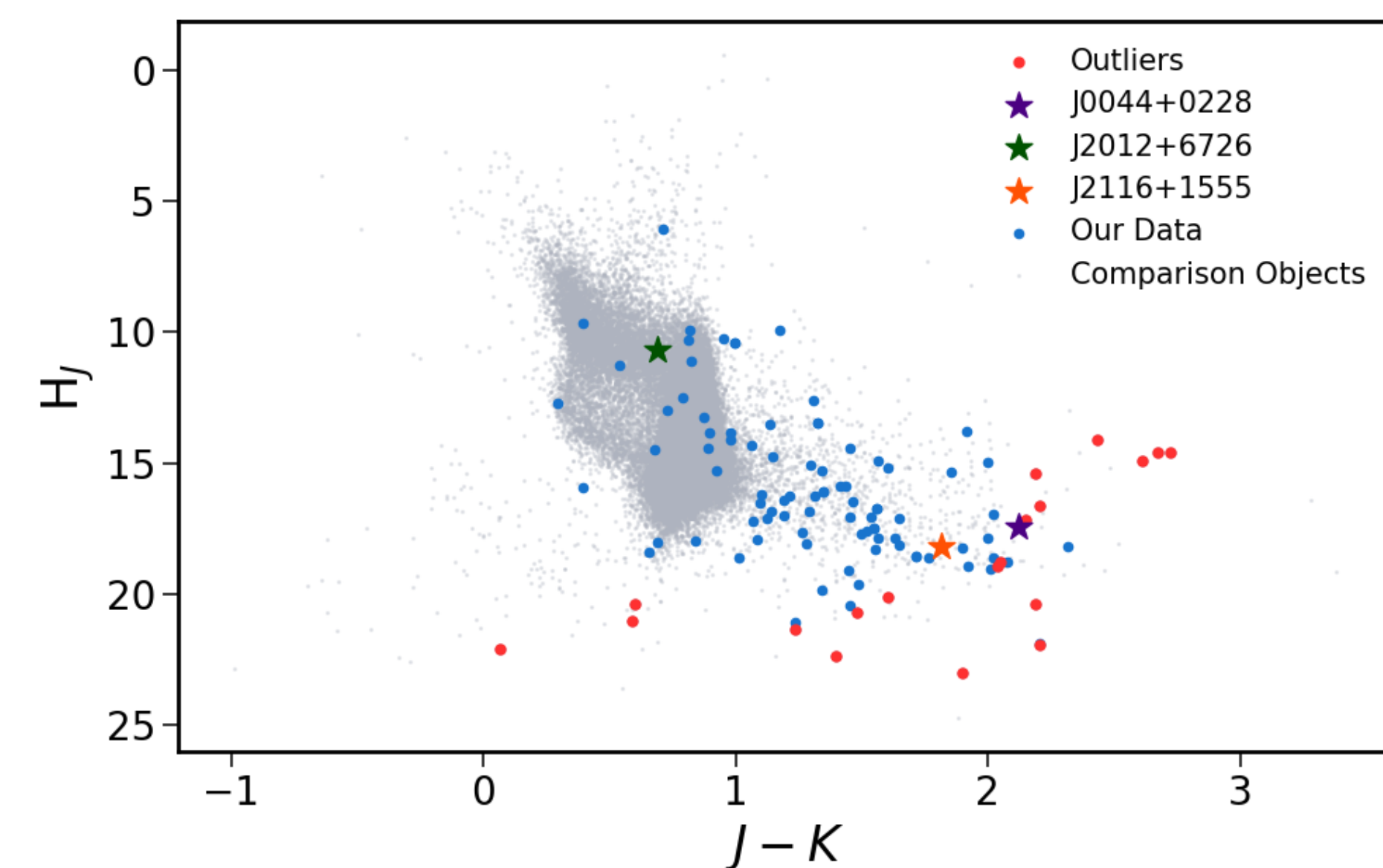
*Proper motion* is the measurement of how fast a astronomical object moves in relation to the sky. It is measured by how much an object moved between two points in time in the sky.



Ohare, B. (2008, December 30). Proper Motion [Digital image].

**Objective:** To classify newly discovered brown dwarfs via proper motion and near infrared color.

## Reduced Proper Motion

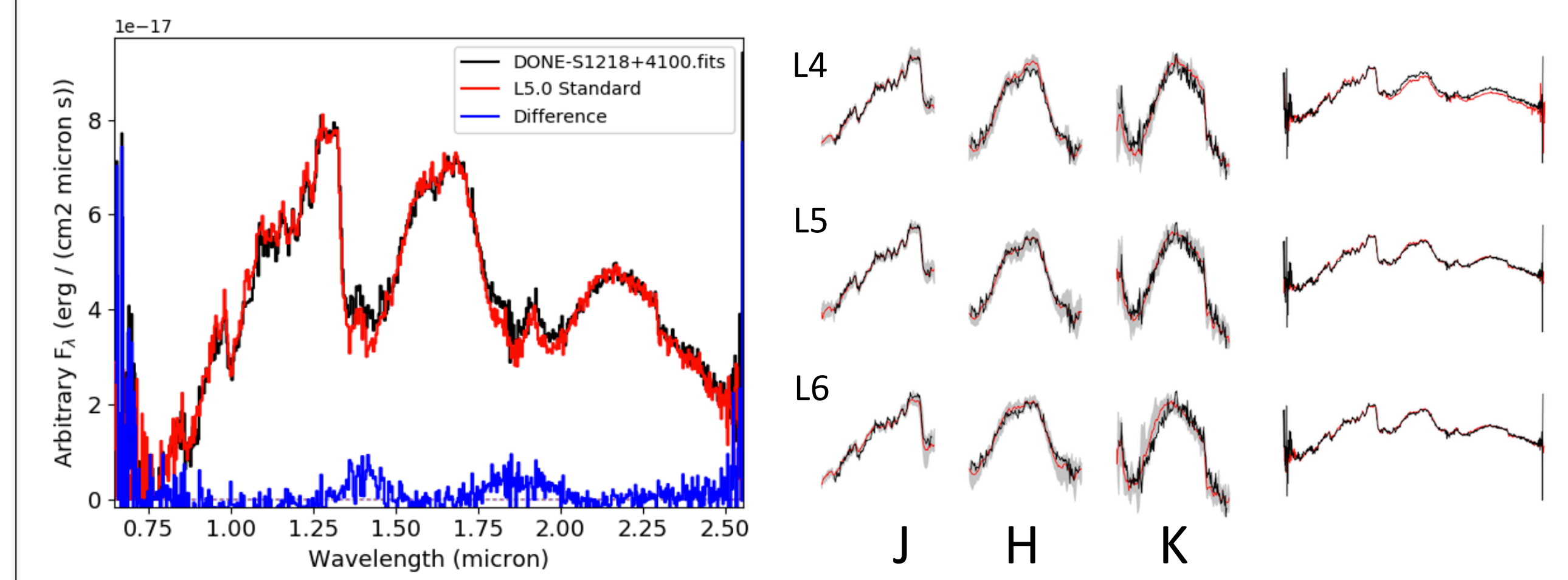


$$H = m + 5 \log(\mu) + 5$$

$H$  = Reduced Proper Motion,  $m$  = Apparent Magnitude,  $\mu$  = Total Proper Motion

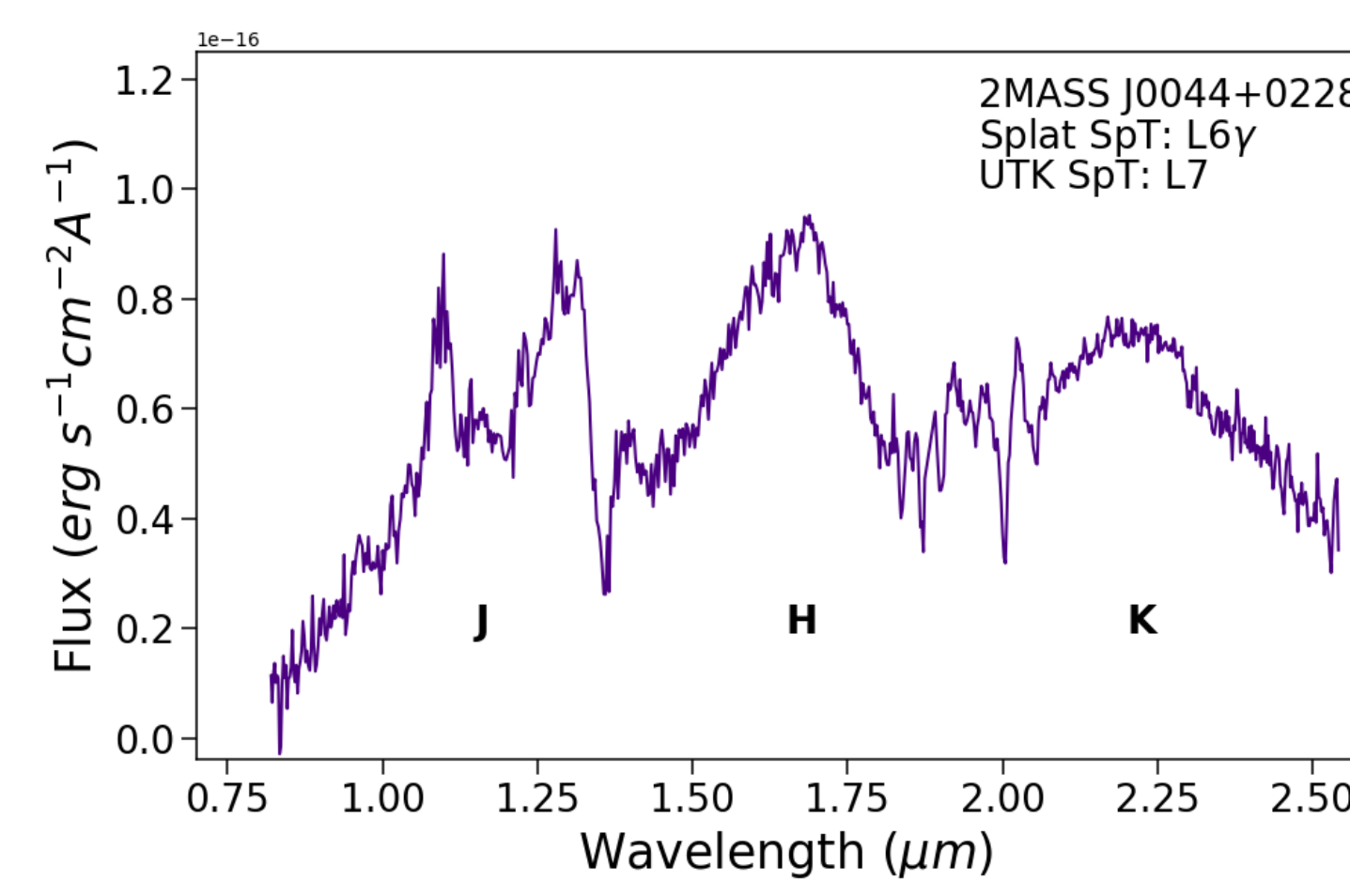
- ★ The grey mass is a comparison sample of brown dwarfs.
- ★ **Outliers** are objects that have a rpm > the rpm of the data standard.
- ★ The stars are objects of interest that were examined in more detail.

## Spectral Typing

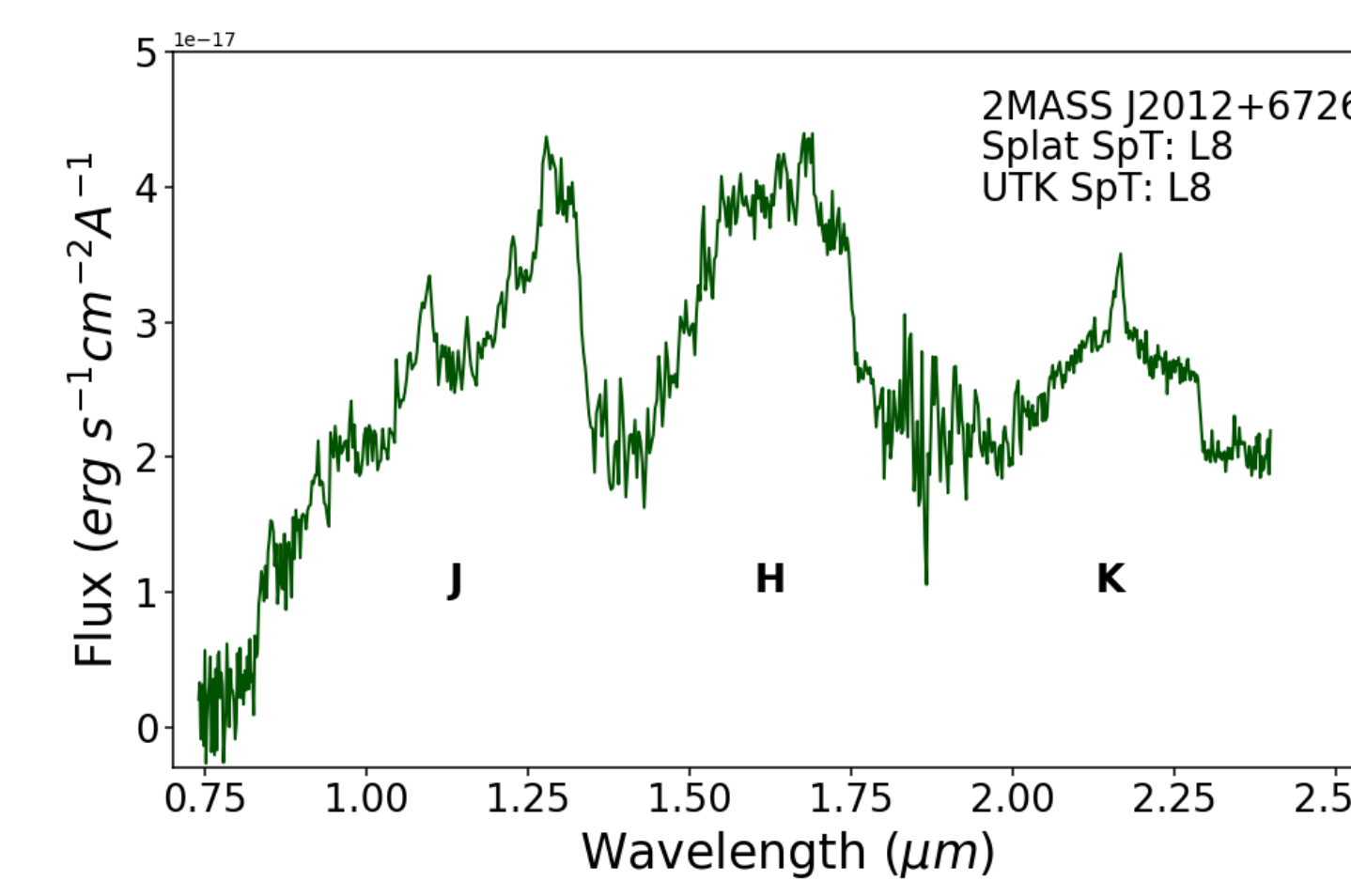


- ★ Spectral typing is a method used to compare the object of interest to a known object.
- ★ Spectral types help determine characteristics of brown dwarfs (i.e. gravity, age)
- ★ Splat compares the overall spectrum of the object to a standard
- ★ UTK compares the near-infrared spectrum band-by-band

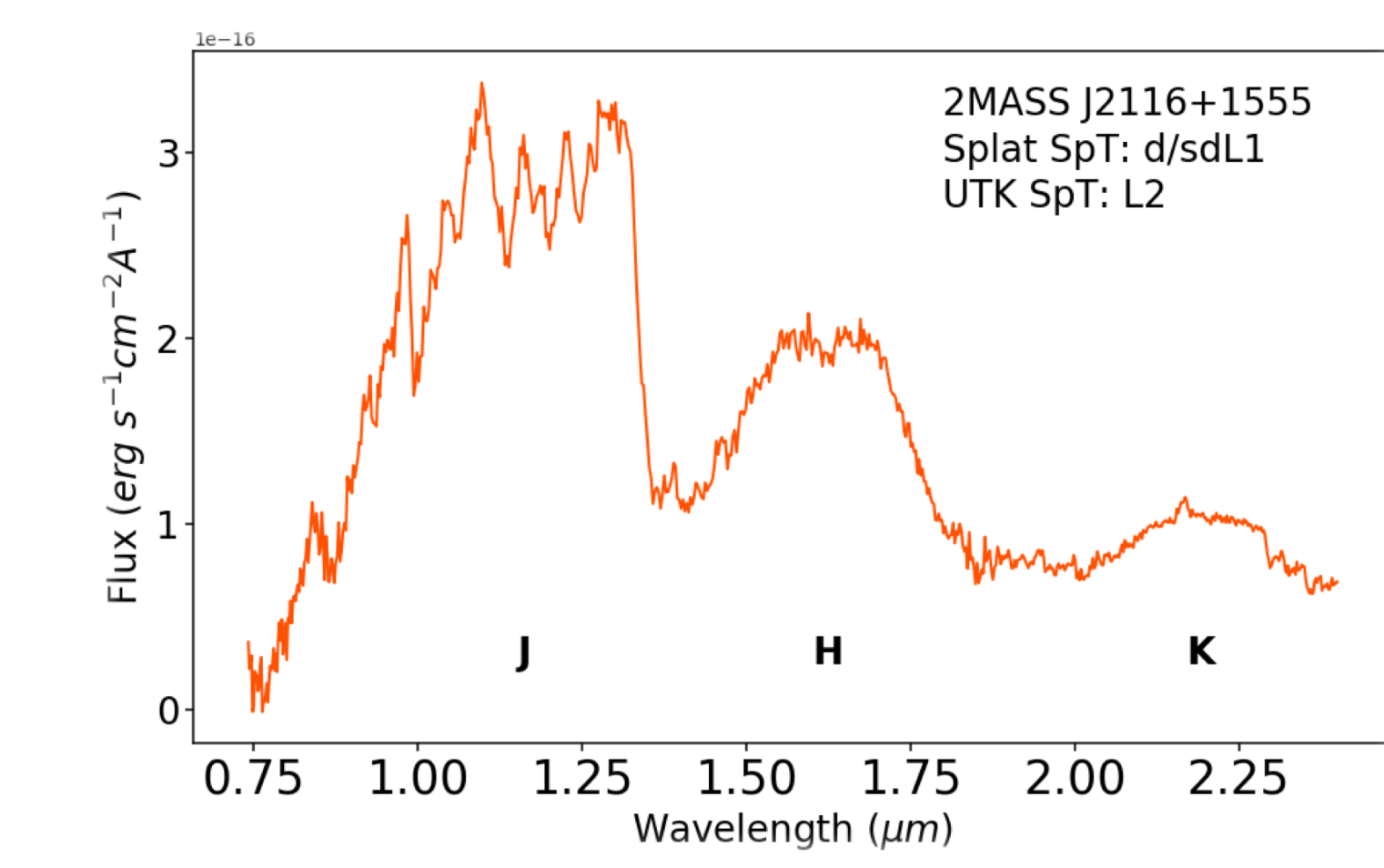
## A Discussion on Three Interesting Brown Dwarfs



- ★ Also discovered by Schneider et al. 2017 and Kellogg et al. 2017 and typed as a L7
- ★ Member of the nearby young moving group  $\beta$  Pictoris, with an age of 21–27 Myr.
- ★ Low gravity: visible from the triangular H band, has a fairly red NIR color.



- ★ This is a standard L8 Brown Dwarf
- ★ L8 objects have methane absorption in their K band
- ★ Methane absorption is usually found in T spectral type objects, making L8 objects unique and interesting



- ★ This object is a d/sd L1, which is a very rare spectral type; there are only 33 known L subdwarfs.
- ★ This object has a redder  $J-K$  color and a relatively slow proper motion for a dwarf/subdwarf.

## Acknowledgments

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