The Properties of Young Brown Dwarfs

John D. Shaw

What's a Brown Dwarf?

Artist Rendition by R. Hurt

What is a Brown Dwarf?

- Not enough mass to sustain proton-proton Nuclear Fusion in its core like the sun.
- Gravitational Potential energy from the gas coalescing to form brown dwarf becomes heat.
- Gas pressure supports the brown dwarf.
- As the gas cools it emits light (mostly infrared).
- Much dimmer than the sun or other stars.

What study Brown Dwarfs?

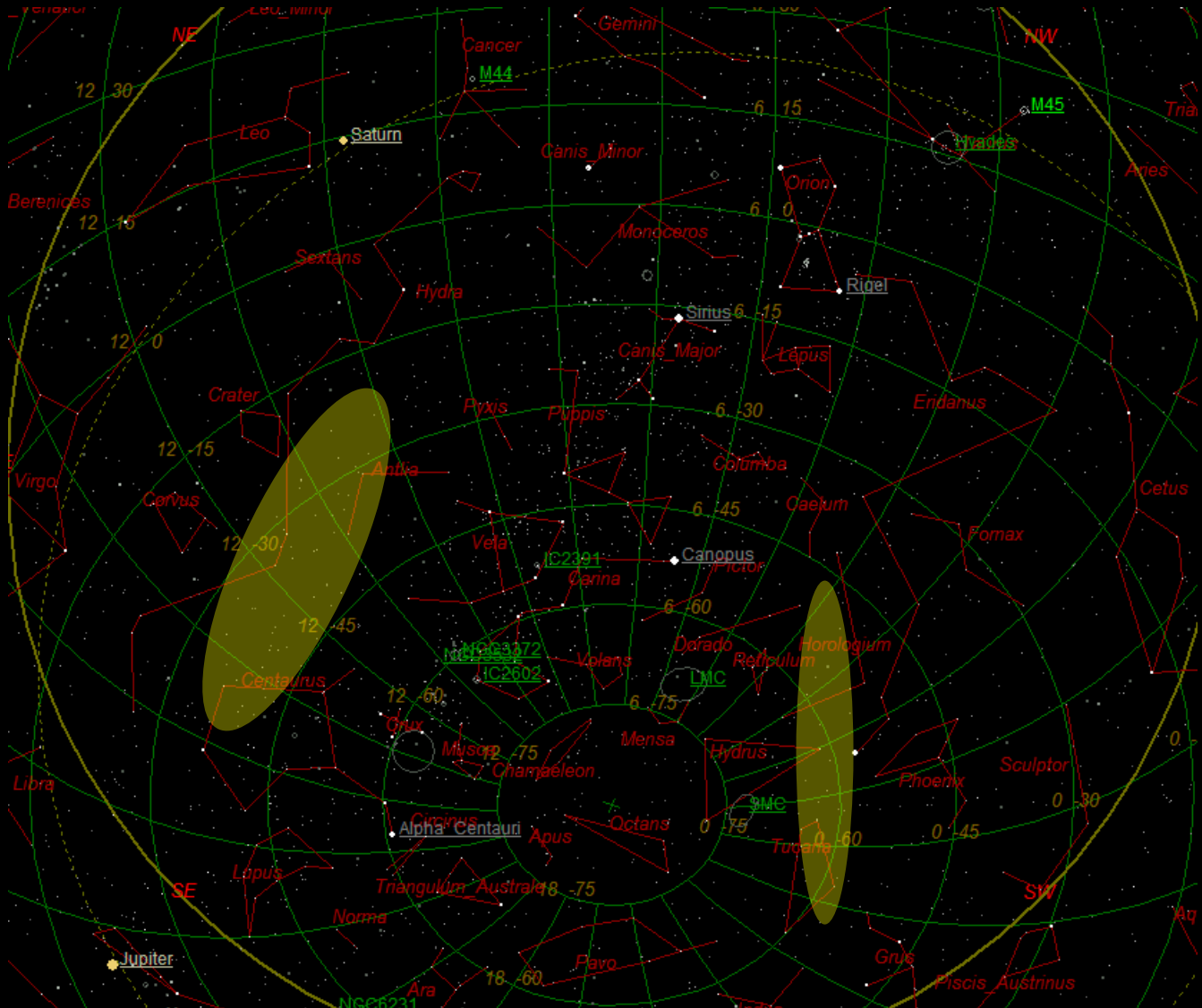
- Limits of conditions for fusion.
- Theory suggest there should be large numbers of the objects – how do we find them?
- Do they develop like stars with planetary systems?
  - How many?
  - What range of sizes?

Our primary observatory.

CTIO at night

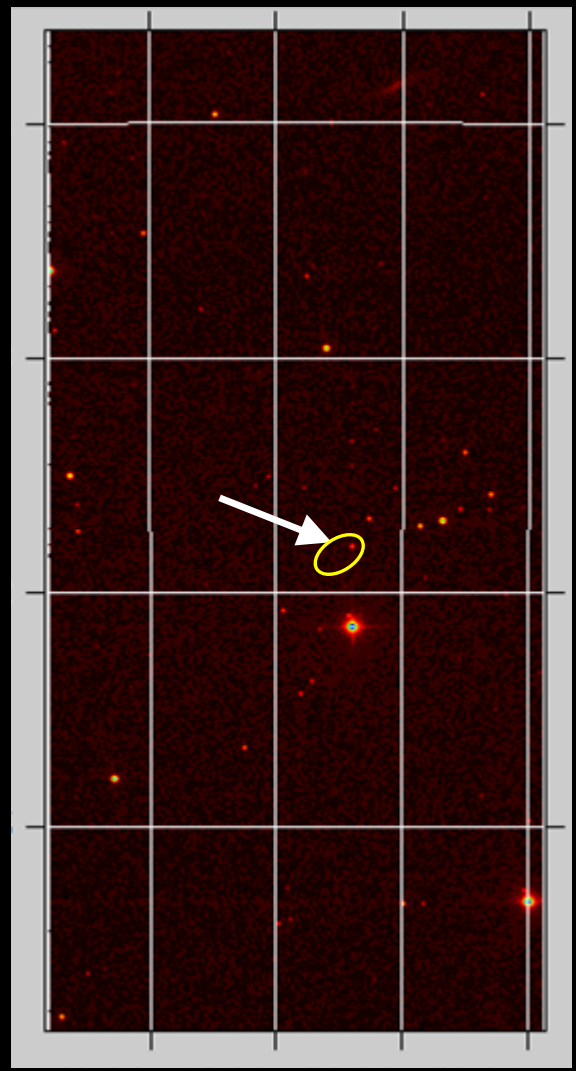
Ñ CTIO

Where to Look?



Search Method

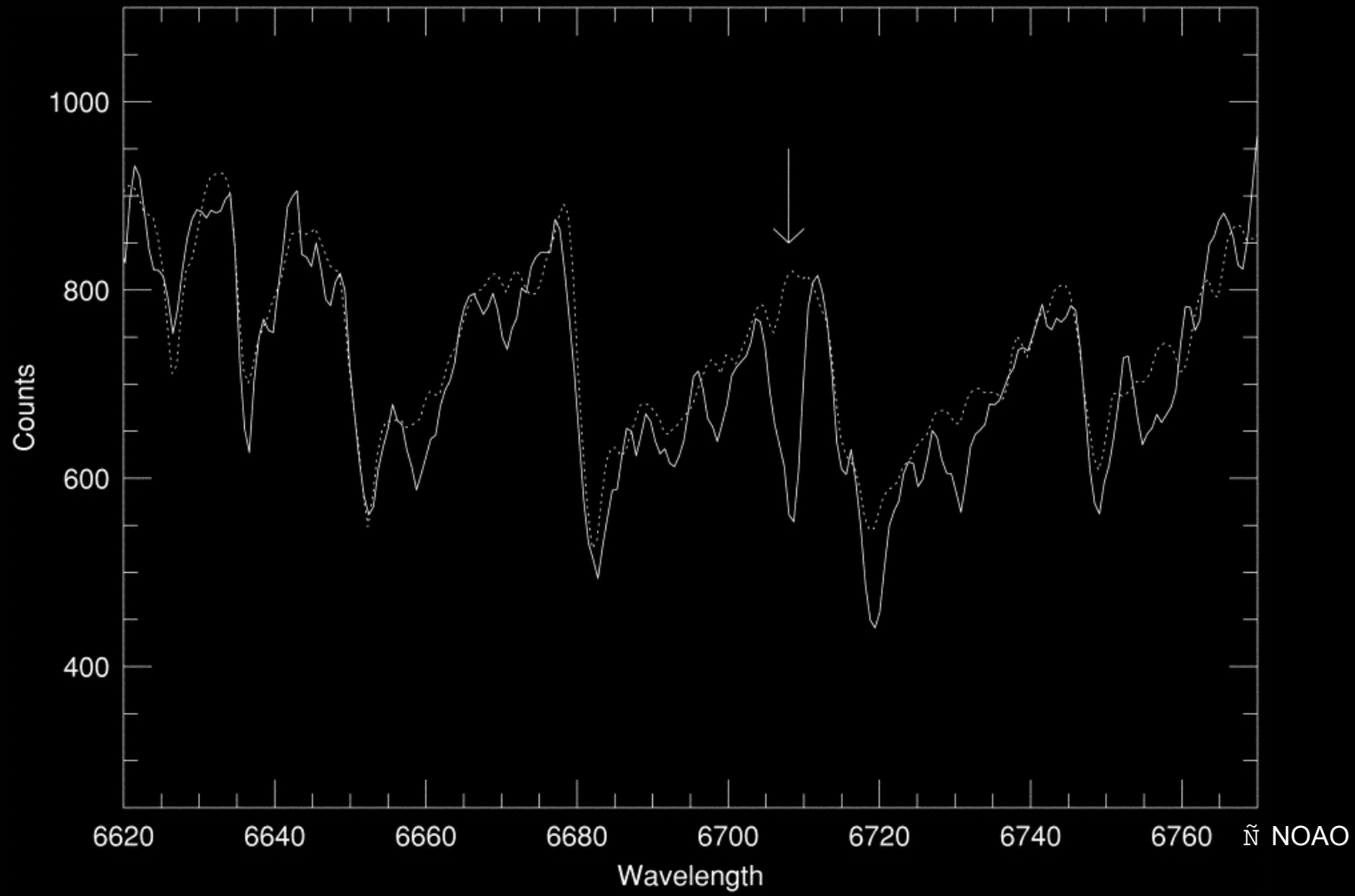
- Observe same area of sky 5 – 10 years apart with wide surveys.
- Look for movement!
- Process includes writing software to resize and align images.
- Then scan the images (automatically and manually) for noticeable differences.
- This process is partially complete.



Follow Up

- Use other telescopes to observe the candidate objects at different wavelengths to determine their temperatures
- If the objects are cool enough follow up with spectroscopic observations (from ground and space based telescopes)

Spectra – Confirmed Brown Dwarf!



Dashed line is M-dwarf of same spectral type. Arrow indicates presence of lithium

Goals

- Find young brown dwarfs based on photometric temperature.
- Look for excess in Infrared (5 -10 μm) spectrum to indicate dust in a disk surrounding the brown dwarf.
- Determine composition, size and dynamics of disk.
- Hope to find system(s) with planet formation in disk.

DANGER! – CAUTION!
DO NOT FEED THE ASTRONOMER!