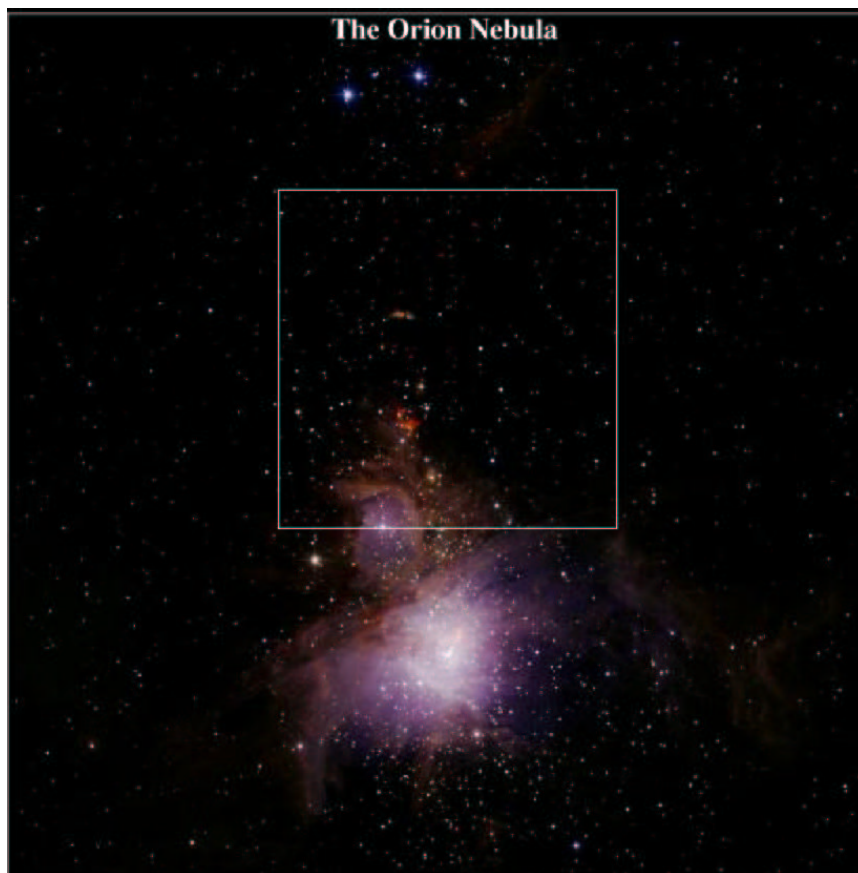


The Pre–Main Sequence and Brown Dwarf Populations of the Orion Molecular Cloud 2/3



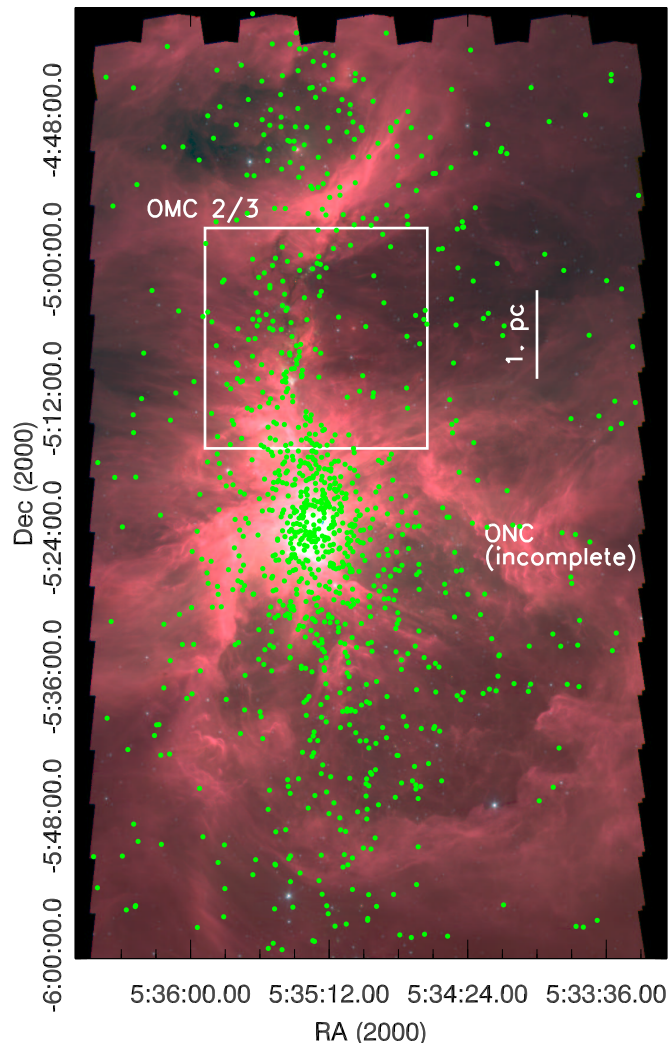
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University of Virginia
with collaborators:
T. Megeath, J. Pipher,
K. Luhman and
J. Stauffer

Motivation

To identify the pre-main sequence (PMS) and sub-stellar populations of the young OMC 2/3 region.

- Frequency of **circumstellar disks** detected through IR excesses.
 - ◇ Disk fraction for PMS stars
 - ◇ ...for brown dwarfs
 - ◇ How do they compare?
- Compare the **spatial distribution** of PMS stars and young brown dwarfs in OMC 2/3 with known protostellar cores and dense gas of the ambient molecular cloud.

OMC 2/3 and the ONC: *Spitzer* View

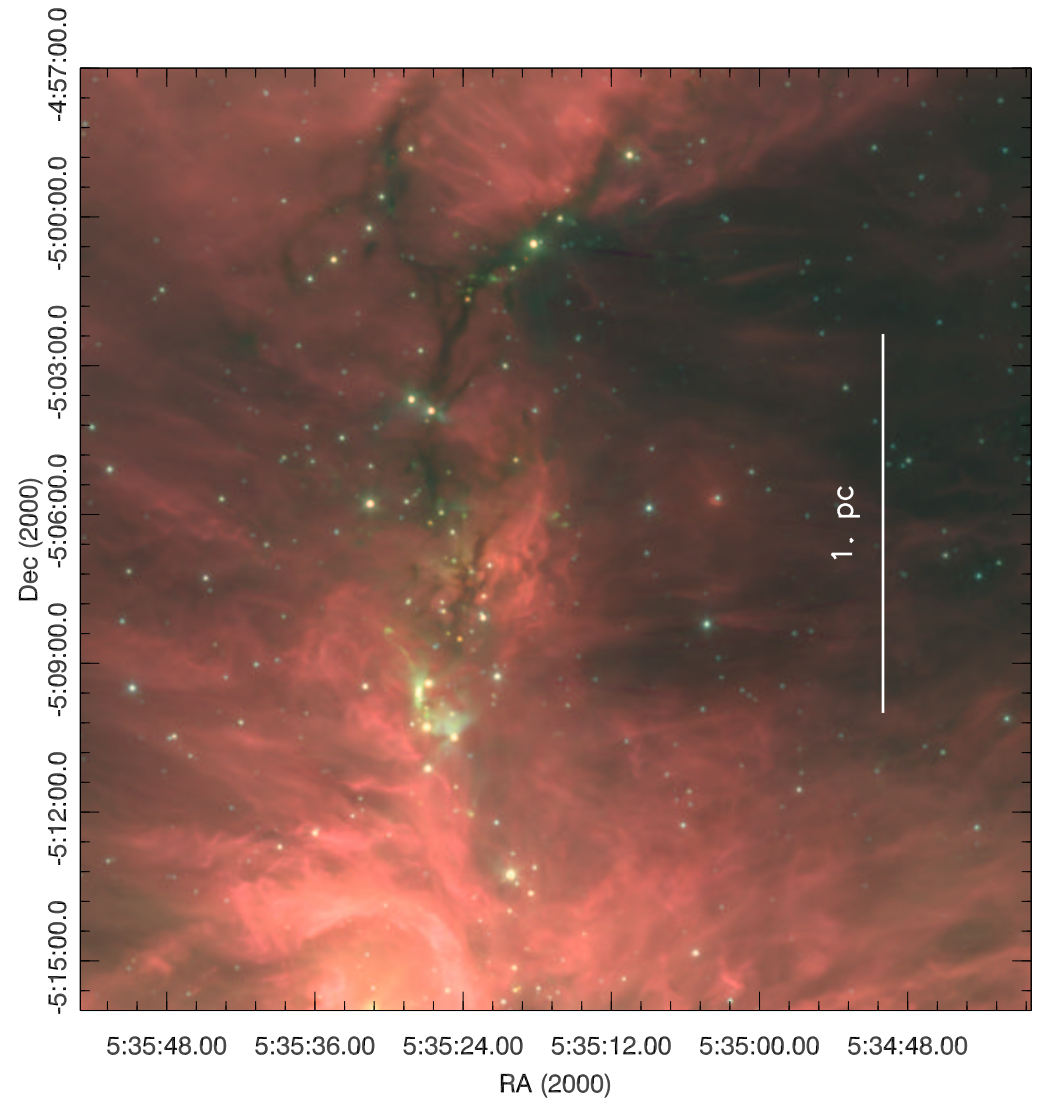


- 21 submillimeter cores (Chini 1997) & 13 far-infrared sources (Lis 1998)
- 80 knots of H₂ emission => jets and outflows (Yu 2000)
- Nearby: 450 pc (Genzel 1989)
- Lower background than ONC
- Spitzer IR excess sources (6)

OMC 2/3: *Spitzer* View

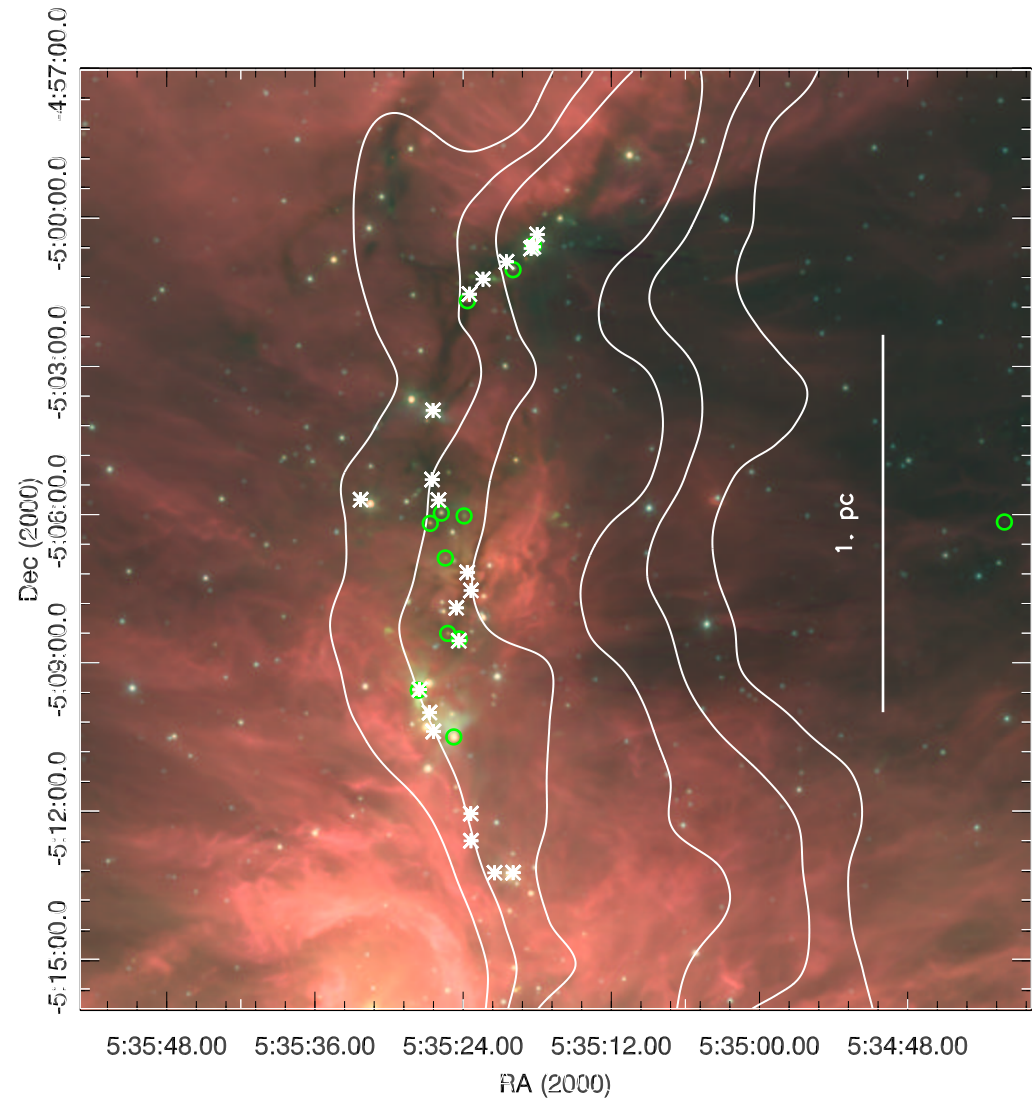
4 IRAC bands:

- Red:
8.0 μm
- Green:
4.5 μm
- Blue:
3.6 μm
- (not shown):
5.8 μm



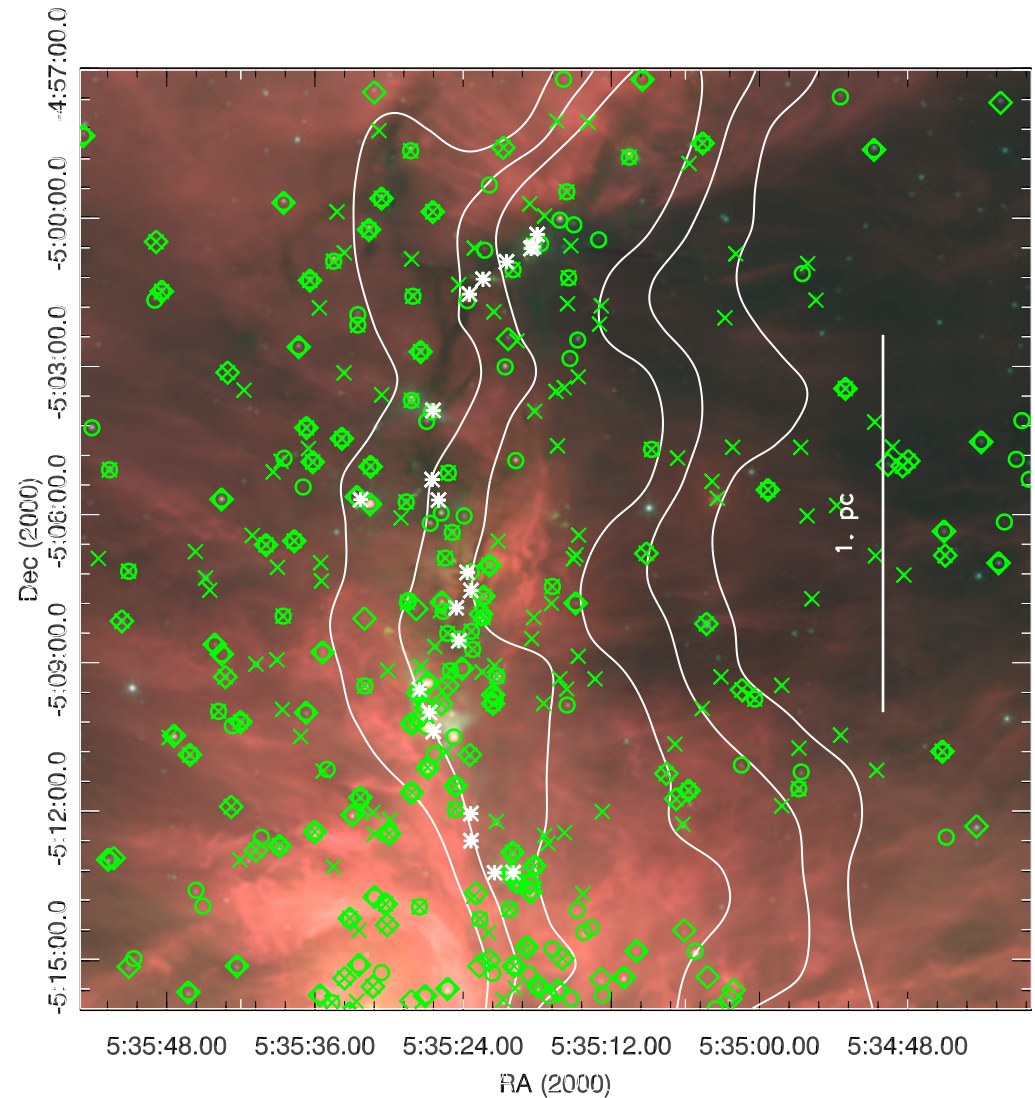
OMC 2/3: *Spitzer* View

- ^{13}CO ($1 \rightarrow 0$) emission (Bally 1987) (contours)
- Submillimeter cores (Chini 1997) (*)
- IRAC identified candidate protostars (\circ)

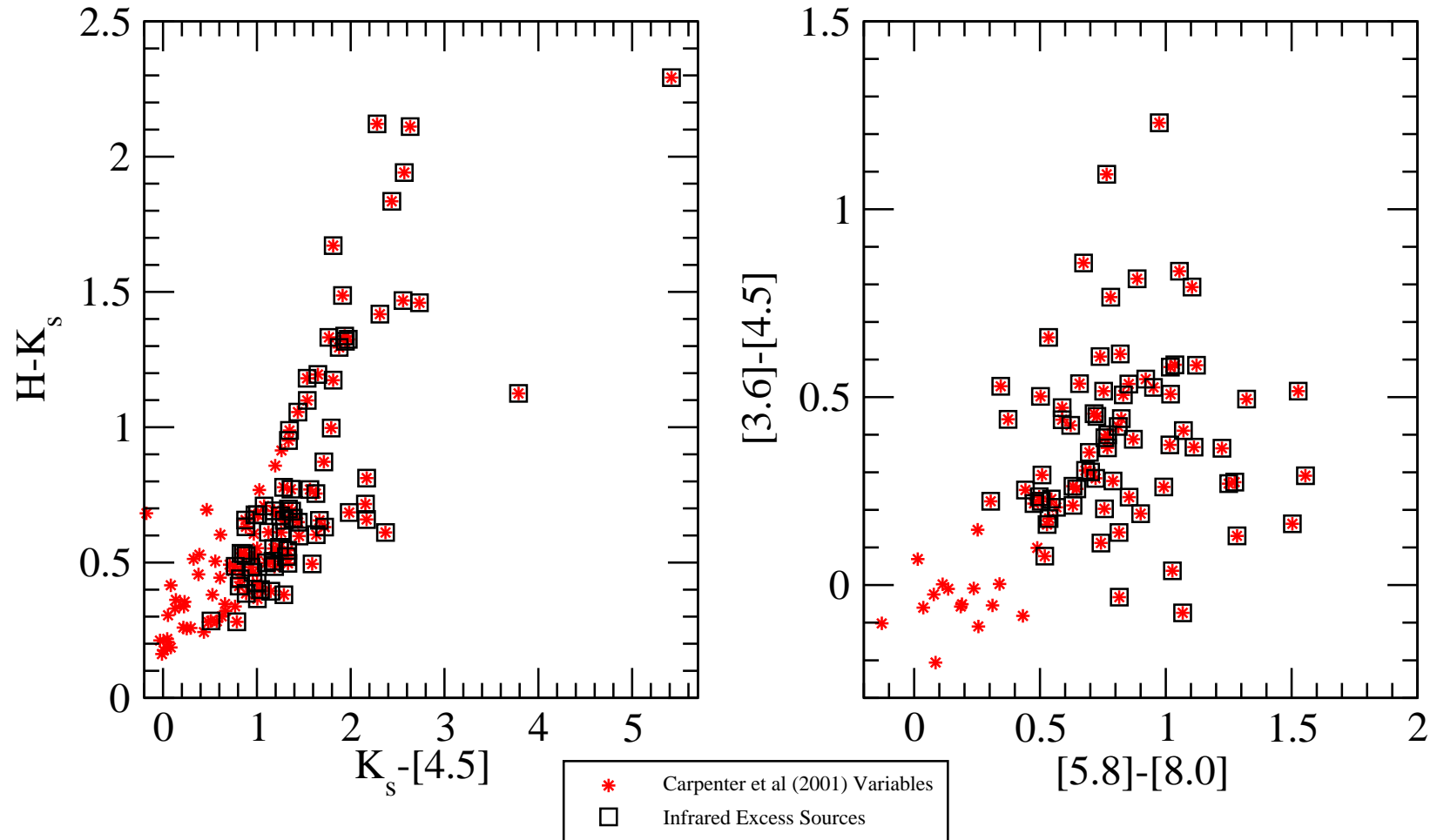


OMC 2/3: *Spitzer* View

- Spitzer IR excess sources (○)
- Chandra X-ray (Tsujiimoto 2002) sources (×)
- 2MASS variables (Carpenter 2001) (◇)



Spitzer IR Excesses

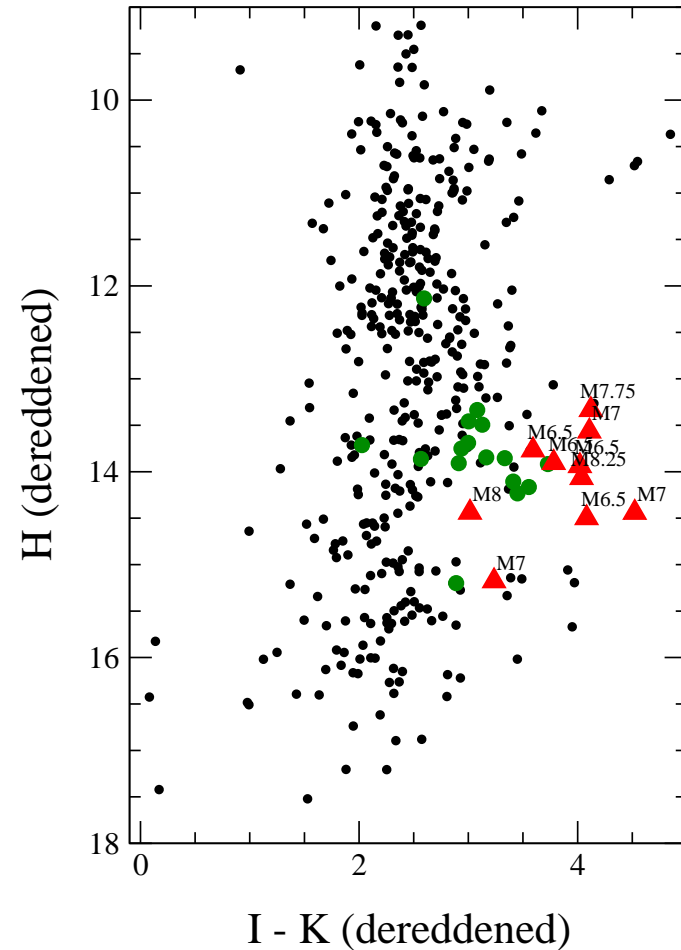
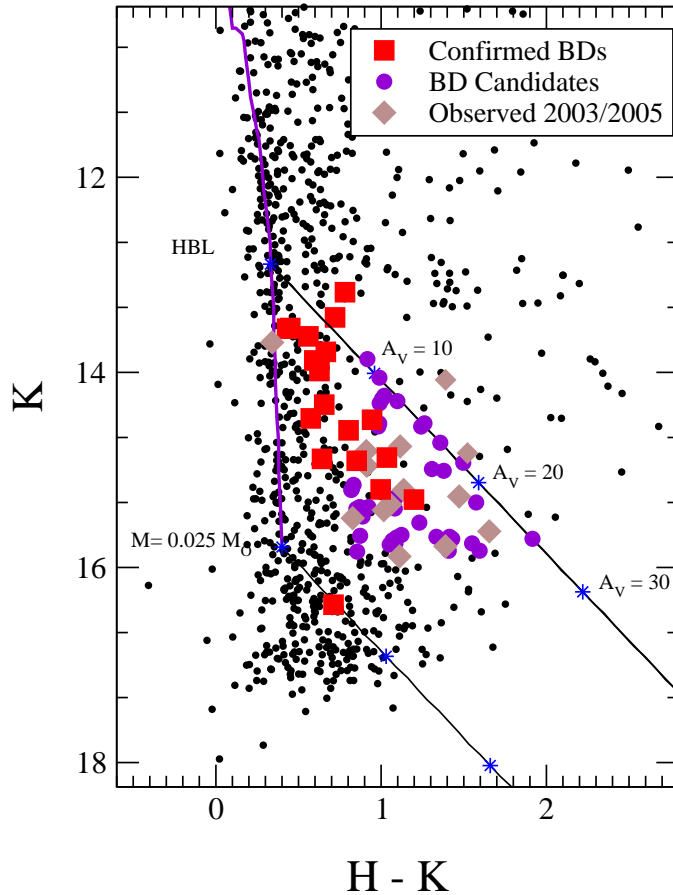


65-72% circumstellar disk fraction for PMS stars
in OMC 2/3

Young Brown Dwarfs (BDs)

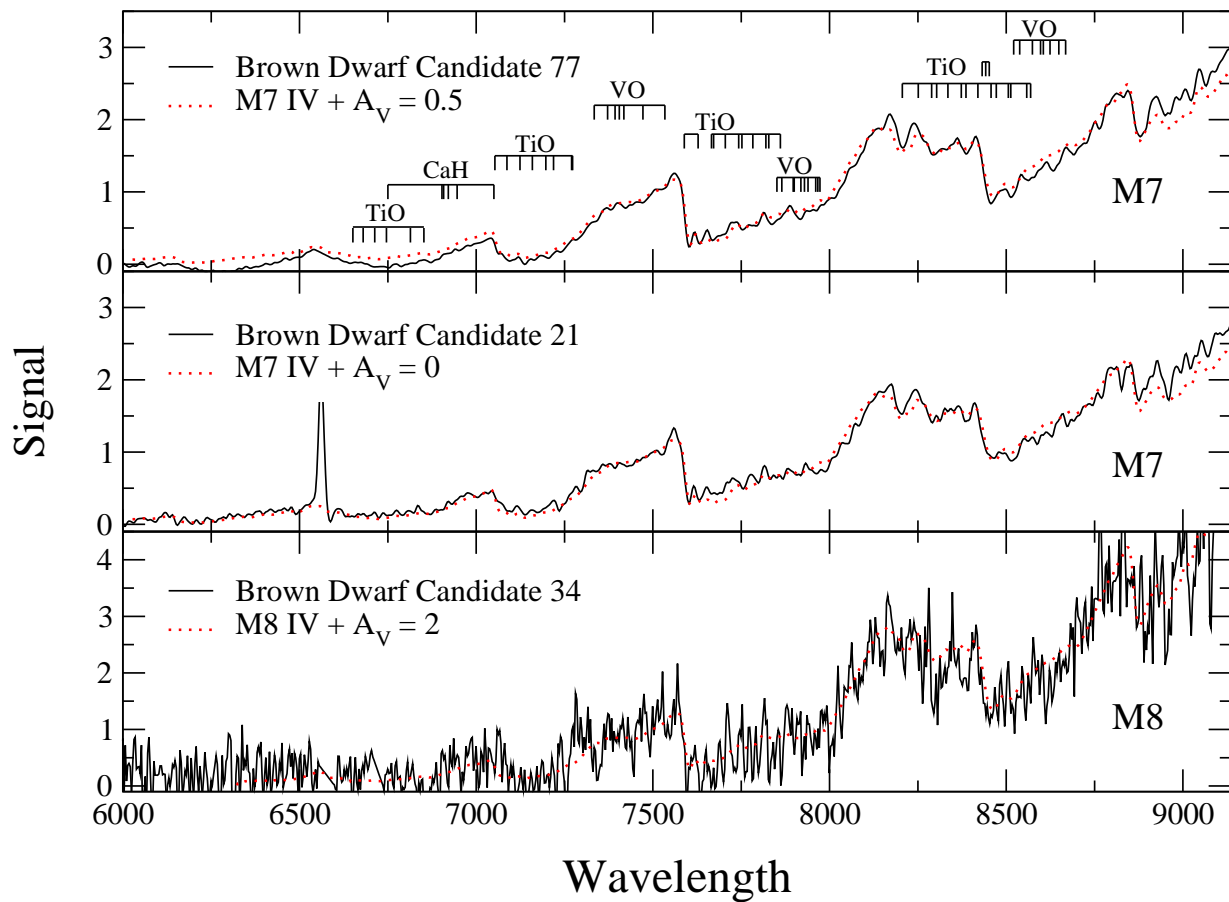
- Typically have masses:
 - ◇ $M < 75 M_{\text{Jupiter}}$ (lower than H-burning limit)
 - ◇ $M > 13 M_{\text{Jupiter}}$ (deuterium burning threshold)
- Possible formation mechanisms:
 - ◇ similar to stars: fragmentation and collapse of cloud cores
 - ▷ brown dwarfs with IR excesses: indicative of circumstellar disks
 - ◇ “ejection scenario” (Reipurth & Clarke 2001)
 - ◇ premature termination of accretion by photoevaporation of the envelope in young clusters containing O stars (Kroupa & Bouvier 2003)

Selection of BDs with Photometry



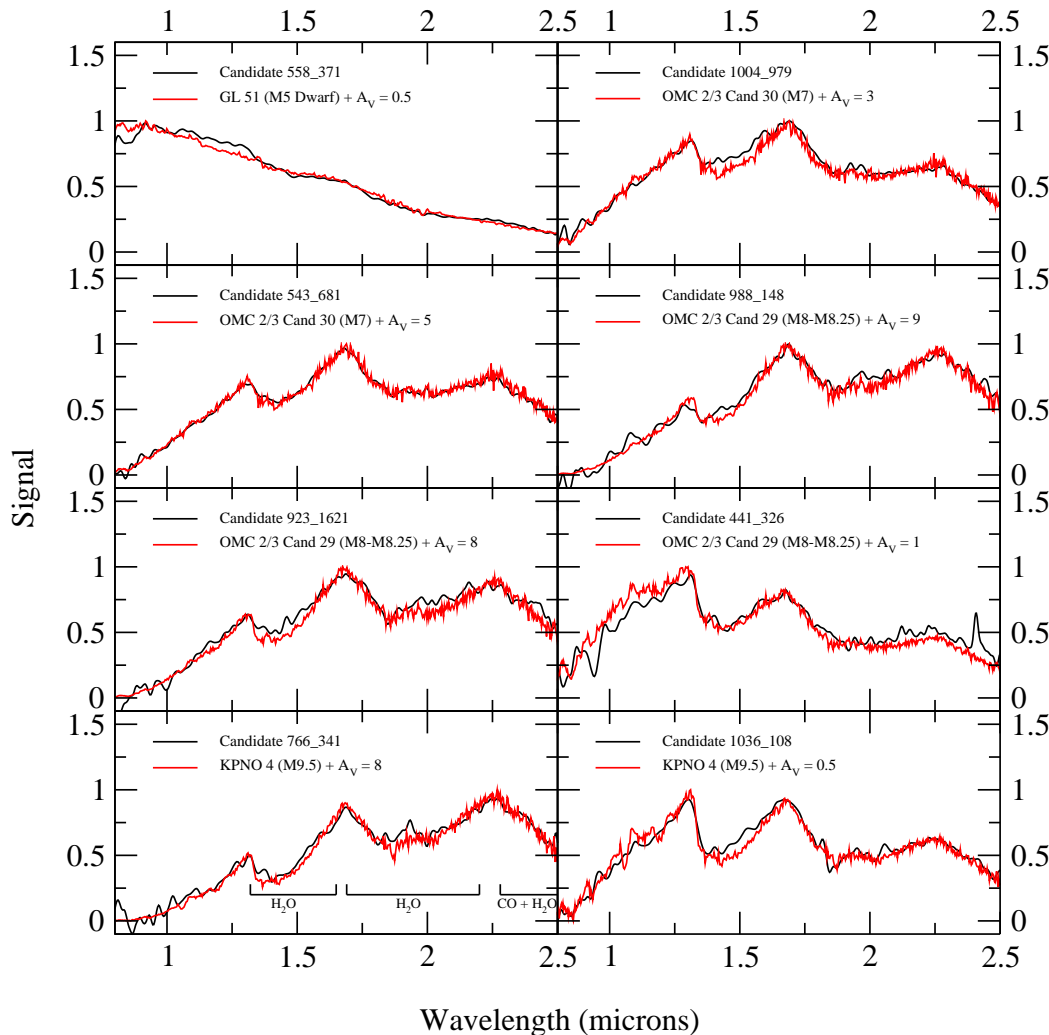
17 confirmed brown dwarfs in OMC 2/3

Far-Red Spectra of BD Candidates



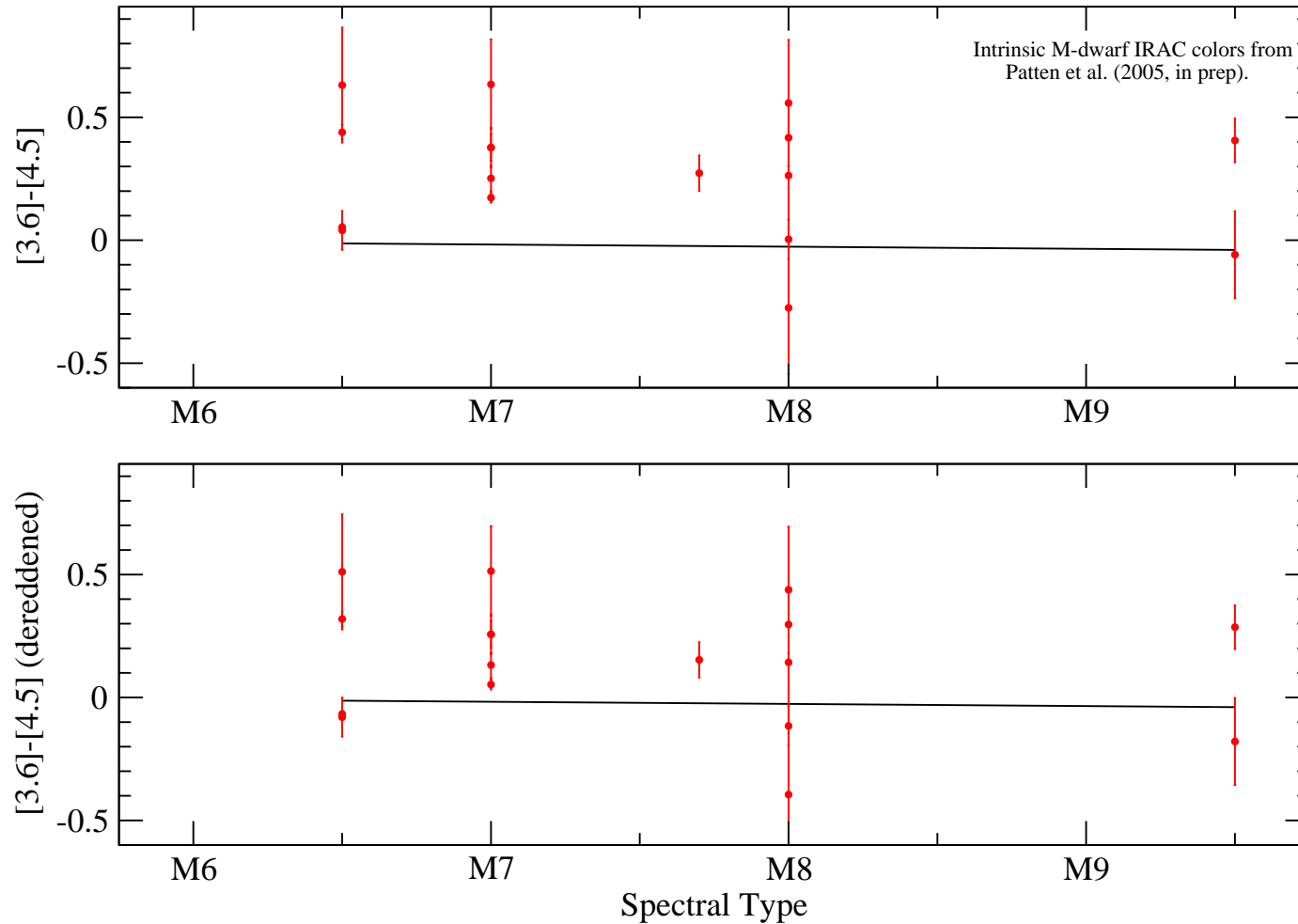
- Spectra obtained at the MMT
- Spectral type based on strength of TiO and VO absorption
- $H\alpha$ emission (6563Å)?

Near-Infrared Spectra of BD Candidates



- Obtained using SpeX at the IRTF
- 1–2.5 μm prism mode; $R = 250$
- Spectral type based on the depth and shape of the water bands

Brown Dwarfs with Disks



71% circumstellar disk fraction for bds in OMC 2/3

Results and Conclusions

- Identified a large population of PMS stars in OMC 2/3
- Population extended along filament, with no central condensation
- 65-72% circumstellar disk fraction for PMS stars
- 17 brown dwarfs confirmed in OMC 2/3
- 71% circumstellar disk fraction for the confirmed bds out to the IRAC 4.5 μm band
 - ◇ Supports the hypothesis that bds have a similar formation mechanism as stars; however the presence of bds with disks does not rule out the ejection scenario as a means for premature termination of accretion (which would imply the disk is stripped) since only the inner disk region is probed here.