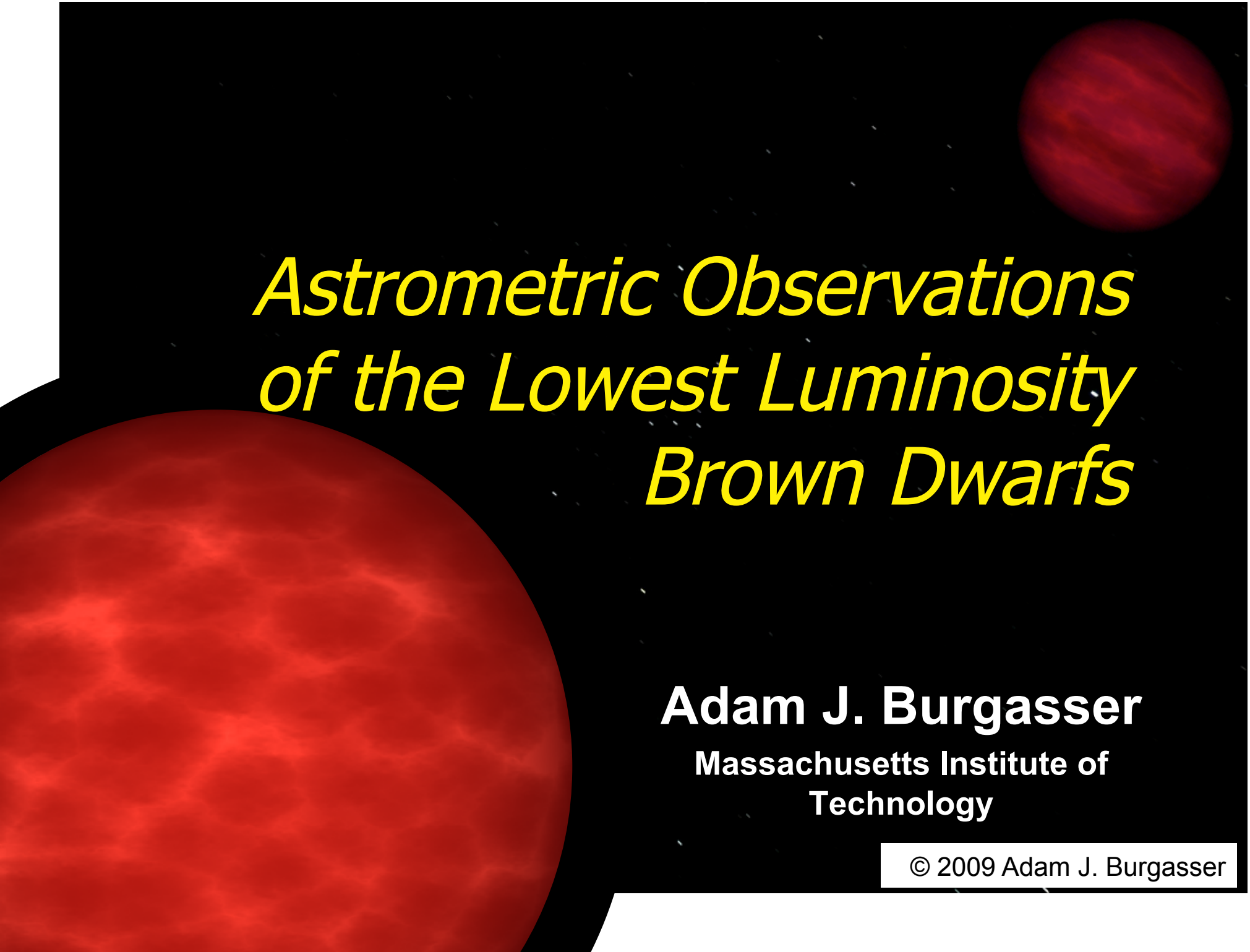

Astrometric Observations of the Lowest Luminosity Brown Dwarfs

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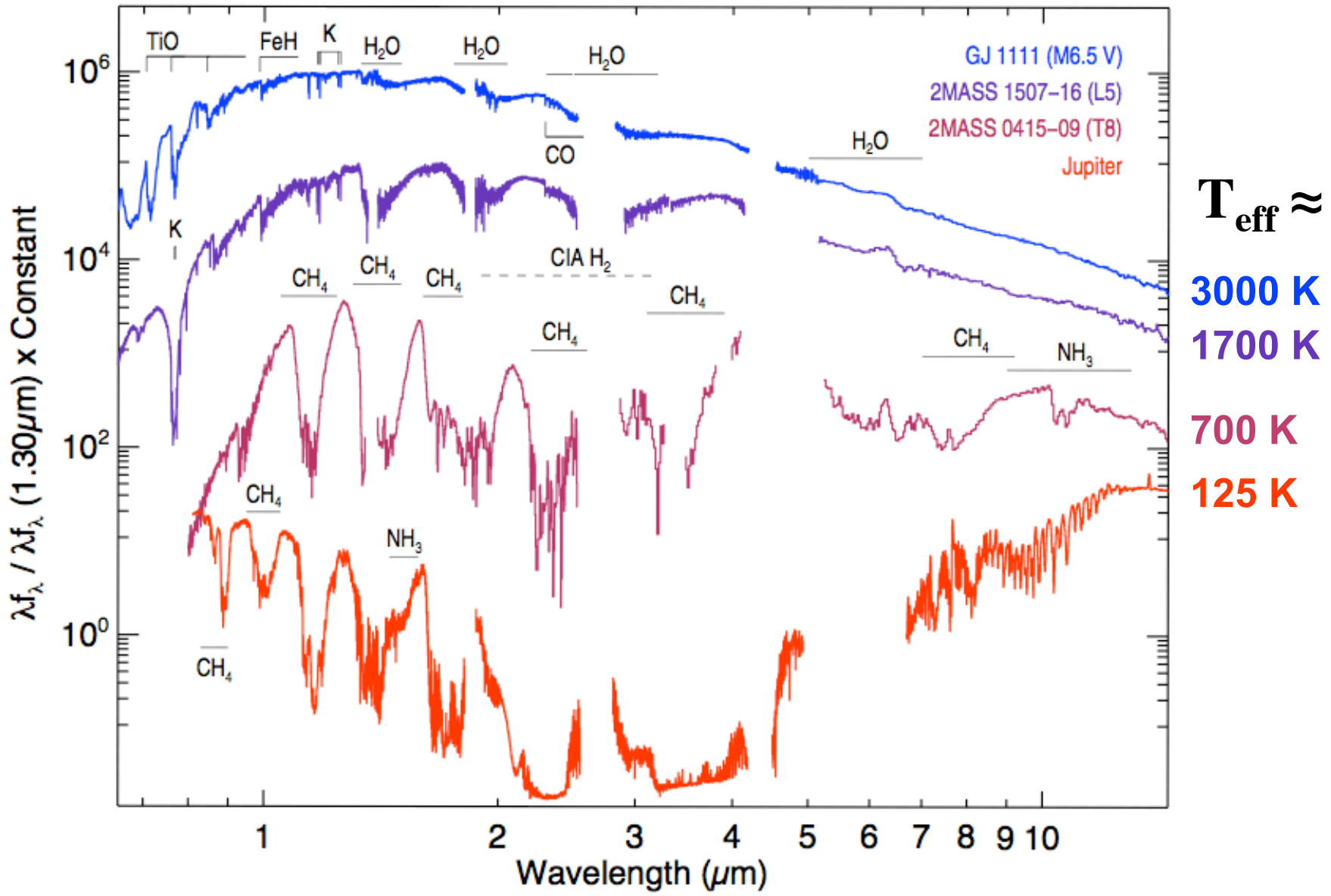


$T_{eff} \approx$

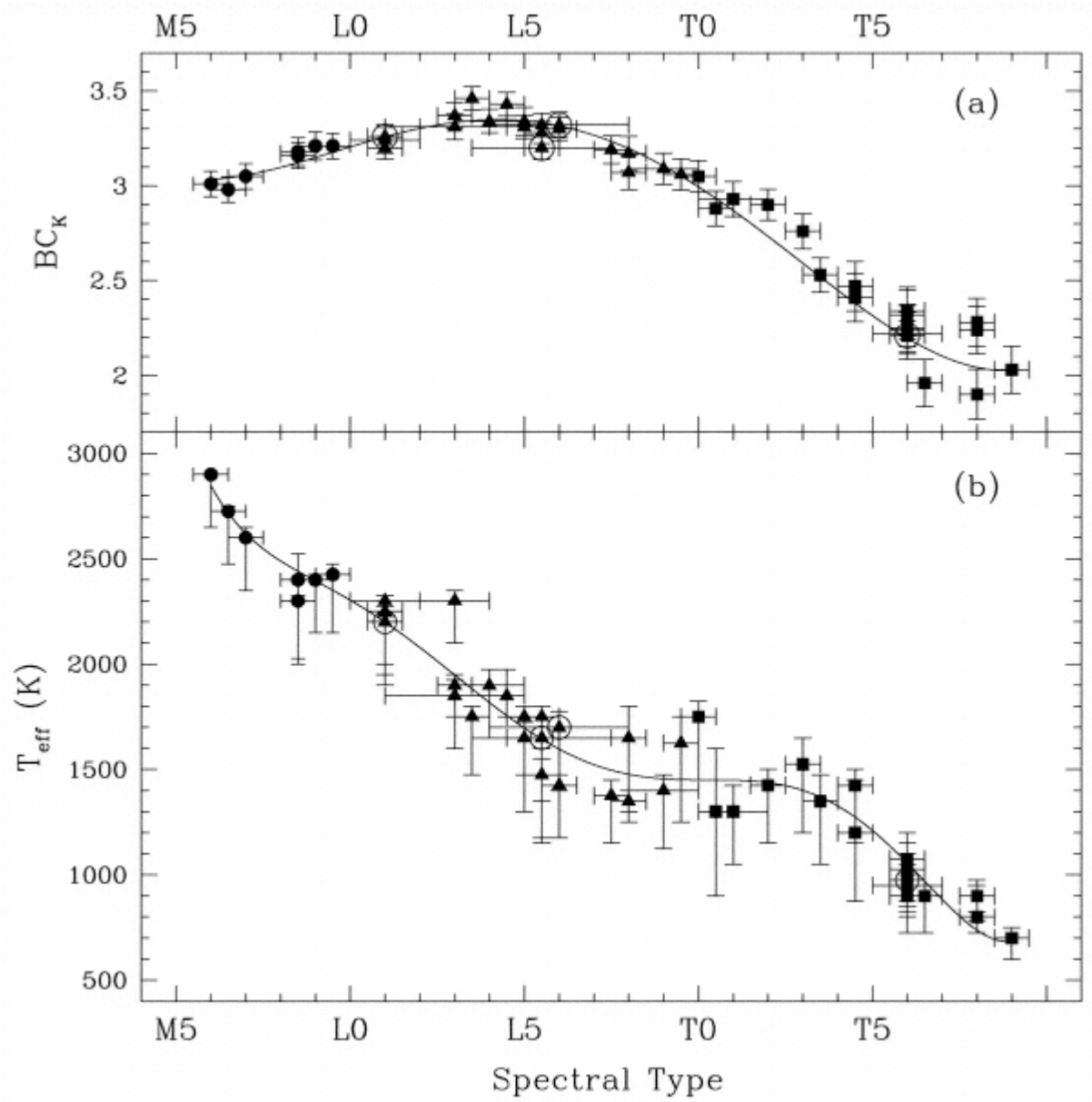
3000 K

1700 K

700 K

125 K

Marley & Leggett (2008)
Data from Cushing et al. (2005,2007)



luminosities & effective temperatures (T_{eff})

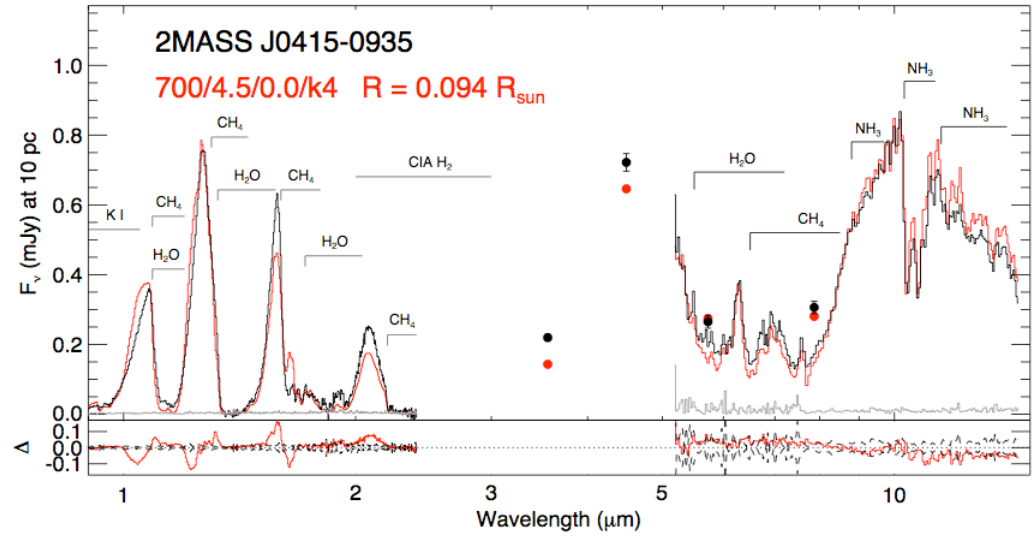
Parallax astrometric observations essential for fundamental characterization of luminosity and temperature scales.

Current brown dwarf population extends down to $T_{eff} \approx 600$ K

Golimowski et al. (2004)

See also Dahn et al. (2002); Tinney et al. (2003); Vrba et al. (2004); Cushing et al. (2006); Burgasser (2007)

new lows in substellar astronomy



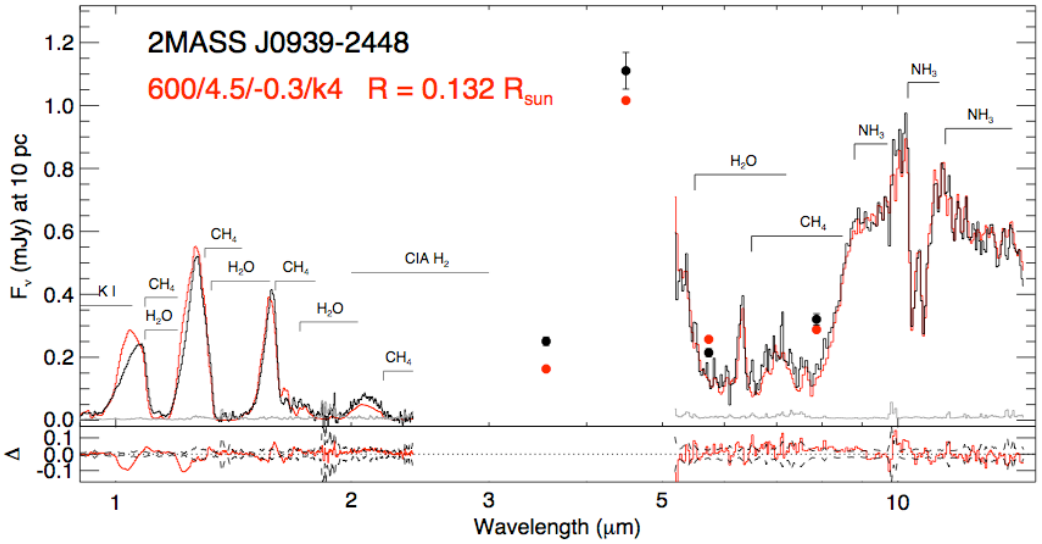
2MASS 0415-0935

d = 5.74 pc

log L_{bol}/L_{sun} = -5.67

T_{eff} ≈ 700 K

(Vrba et al. 2004)



2MASS 0939-2448

d = 5.34 pc

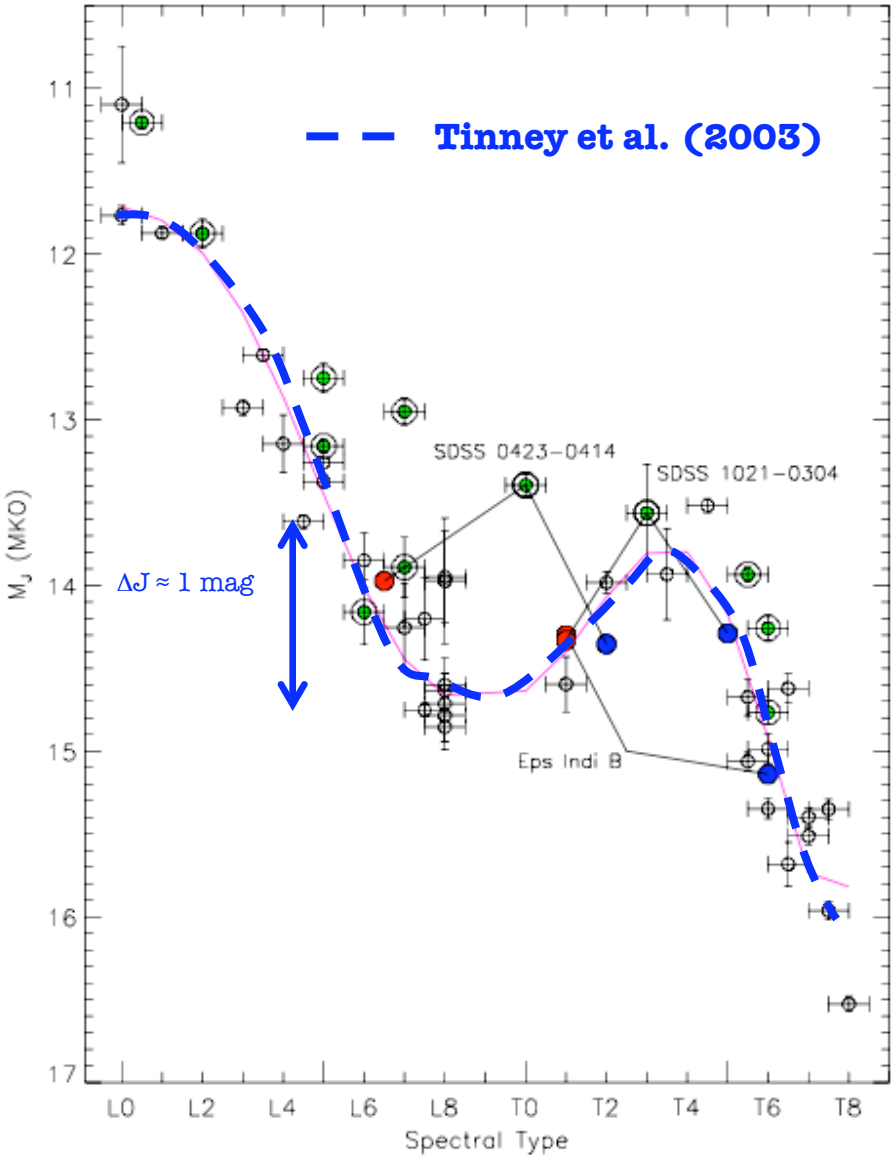
Log L_{bol}/L_{sun} = -5.69

T_{eff} ≈ 600 K

10^{-6} L_{sun} binary pair!

(Burgasser et al. 2008)

“J-band bump”



Burgasser et al. (2006)
see also Dahn et al. (2002); Tinney et al. (2003), Vrba et al. (2004); Liu et al. (2006)

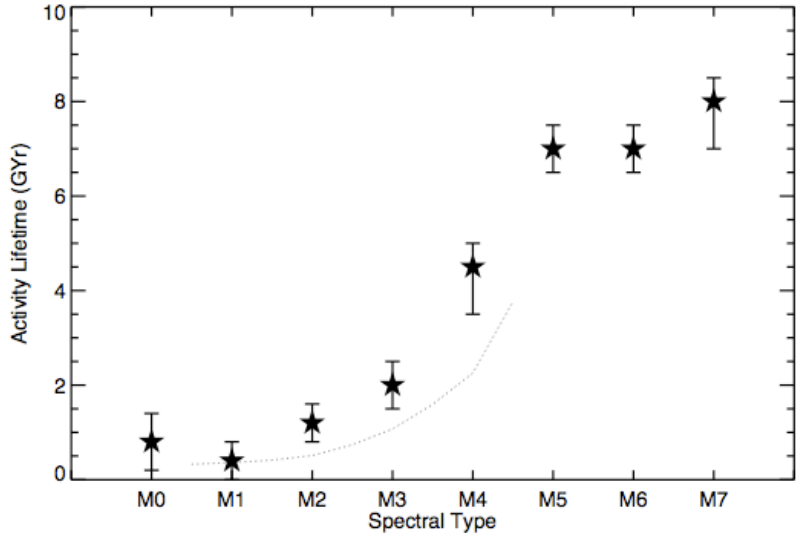
Brightening at 1 μm from late-type L to mid-type T despite declining T_{eff} and L_{bol} ⇒ non-thermal mechanism

Resolved binaries verify brightening, but reduce overall effect (excess of binaries)

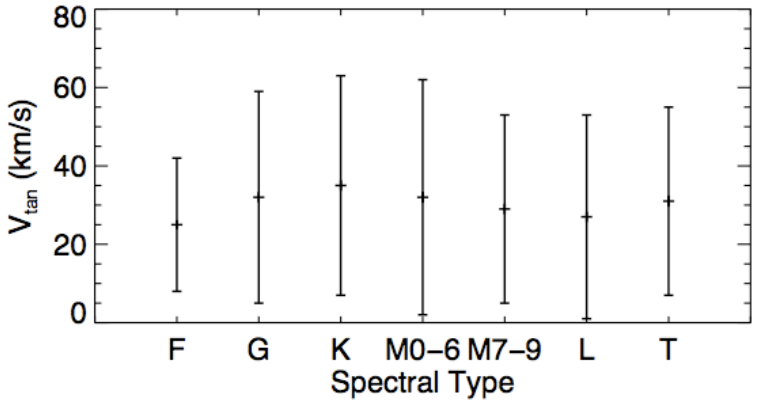
Most likely the dynamic evolution (sinking) of clouds in brown dwarf photospheres on a short timescale.

see also Dahn et al. (2002); Burgasser et al. (2002); Tinney et al. (2003); Vrba et al. (2004); Tsuji (2004); Burrows et al. (2005); Burgasser et al. (2006); Liu et al. (2006); Looper et al. (2008)

brown dwarfs in motion



Activity lifetimes of M dwarfs
(West et al. 2007,2008)



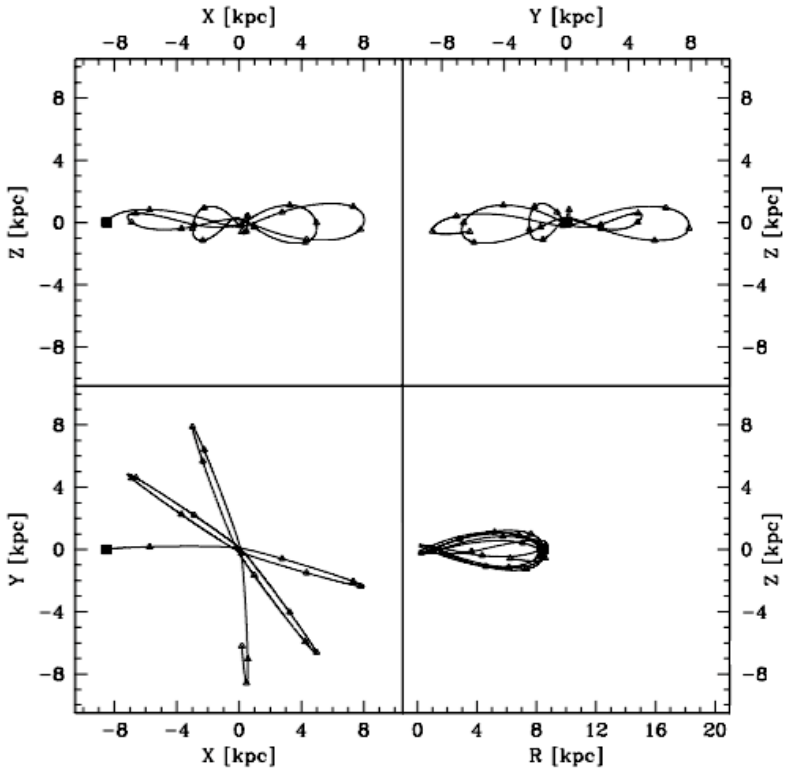
Population ages
(Faherty et al. 2008)

Astrometry + radial velocity = UVW velocities

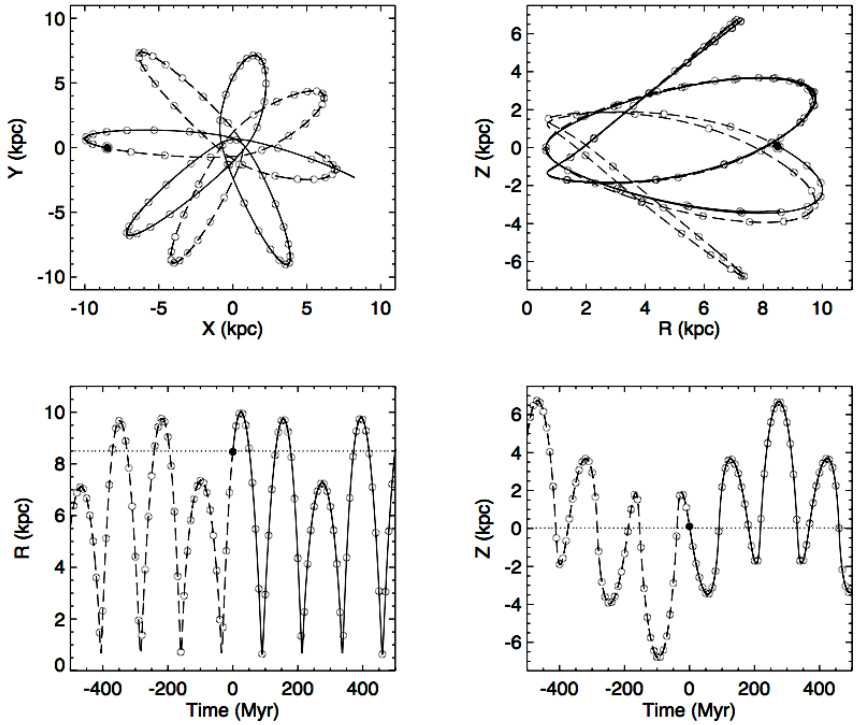
Age/activity/metallicity relationships (Mohanty et al. 2003; Schmidt et al. 2007; West et al. 2007, 2008)

Are local brown dwarfs very young (Zapatero Osorio et al. 2006; Jameson et al. 2007) **or "normal"-aged?** (Reid et al. 2002; Faherty et al. 2008)

Galactic orbits

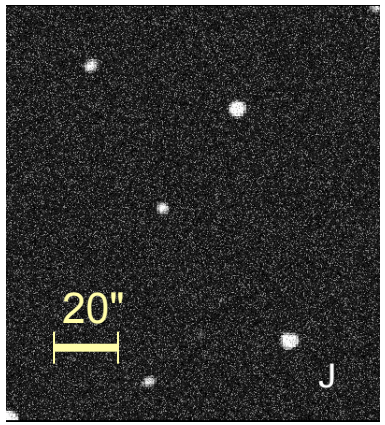


Dahn et al. (2008)
d/sd?M6pec LSR 1610



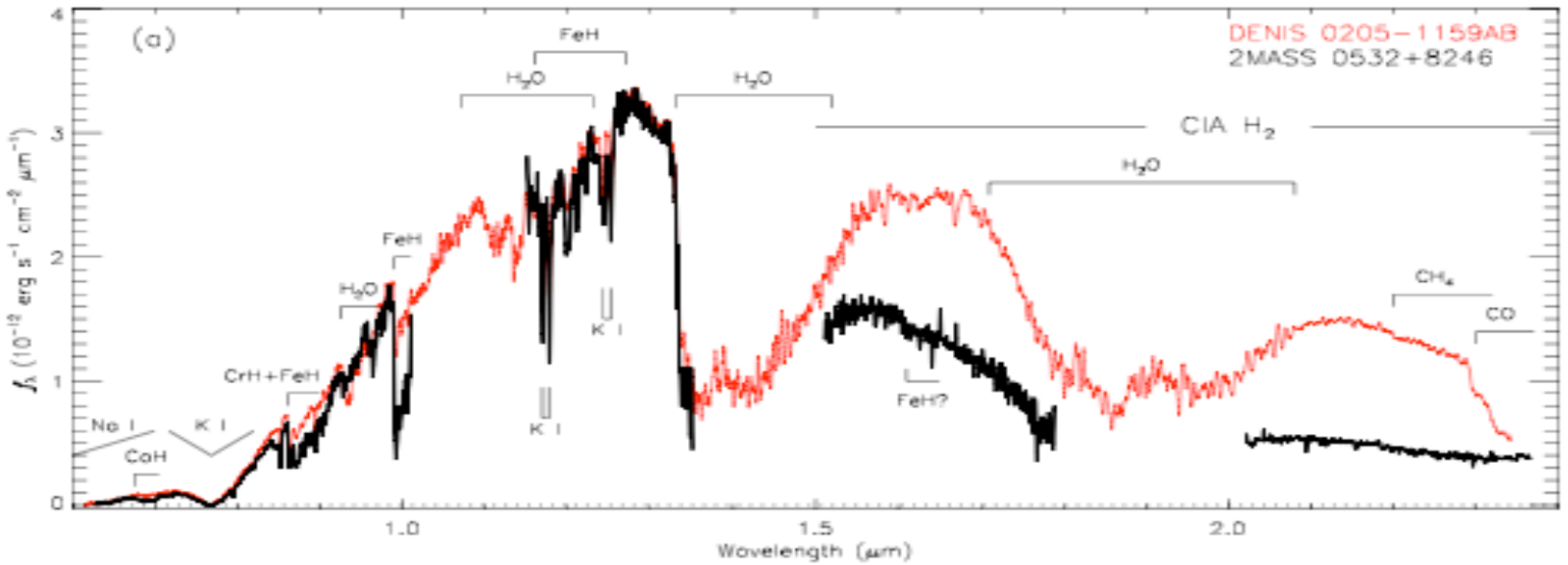
Burgasser et al. (in prep.)
sdL3.5 SDSS 1256

red/NIR proper motion surveys: nearby ultracool dwarfs & subwarfs



Δt = 3.2 yr

e.g. LSPM (Lepine et al. 2004,2008), SSSPM (Scholz et al. 2004), SCR (Hambly et al. 2004; Henry et al. 2004), SIMP (Artigau et al. 2006), 2MASS (Kirkpatrick et al. 2008), SDSS (Lang et al. 2008), etc…

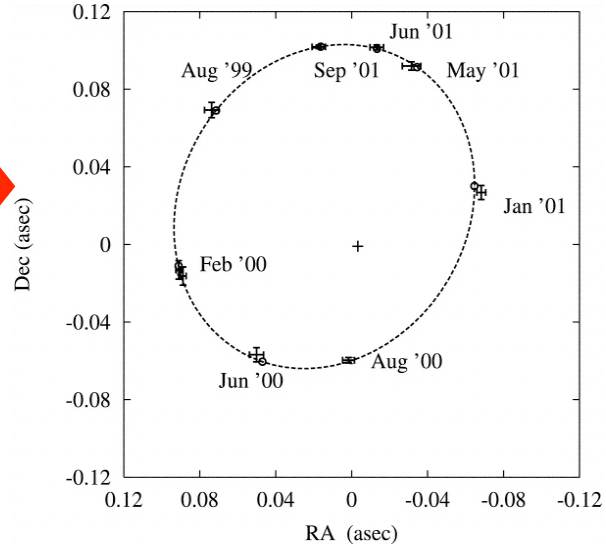


Burgasser et al. (2003, 2008)

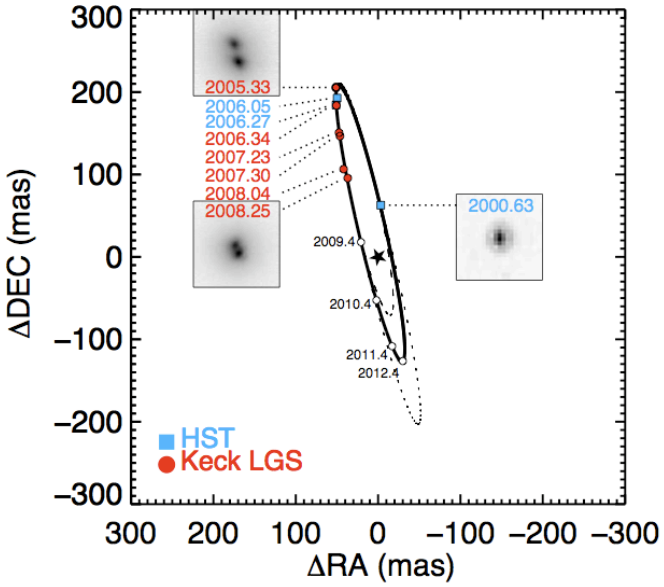
L subdwarf 2MASS 0532+8246

halo kinematics (V = -350 km/s), T_{eff} = 1730±90 K

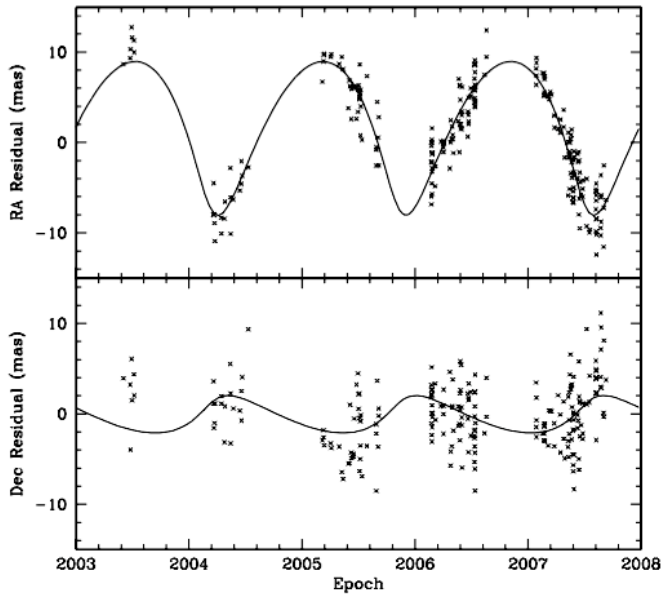
binaries: astrometric measures of mass



GJ 569Bab (e.g., Lane et al. 2001)
Resolved M dwarf binary and companion to nearby young star



2MASS 1534-29AB (e.g., Liu et al. 2008)
Resolved T dwarf binary



LSR 1610-00AB (e.g., Dahn et al.2008)
Astrometric M/L subdwarf binary