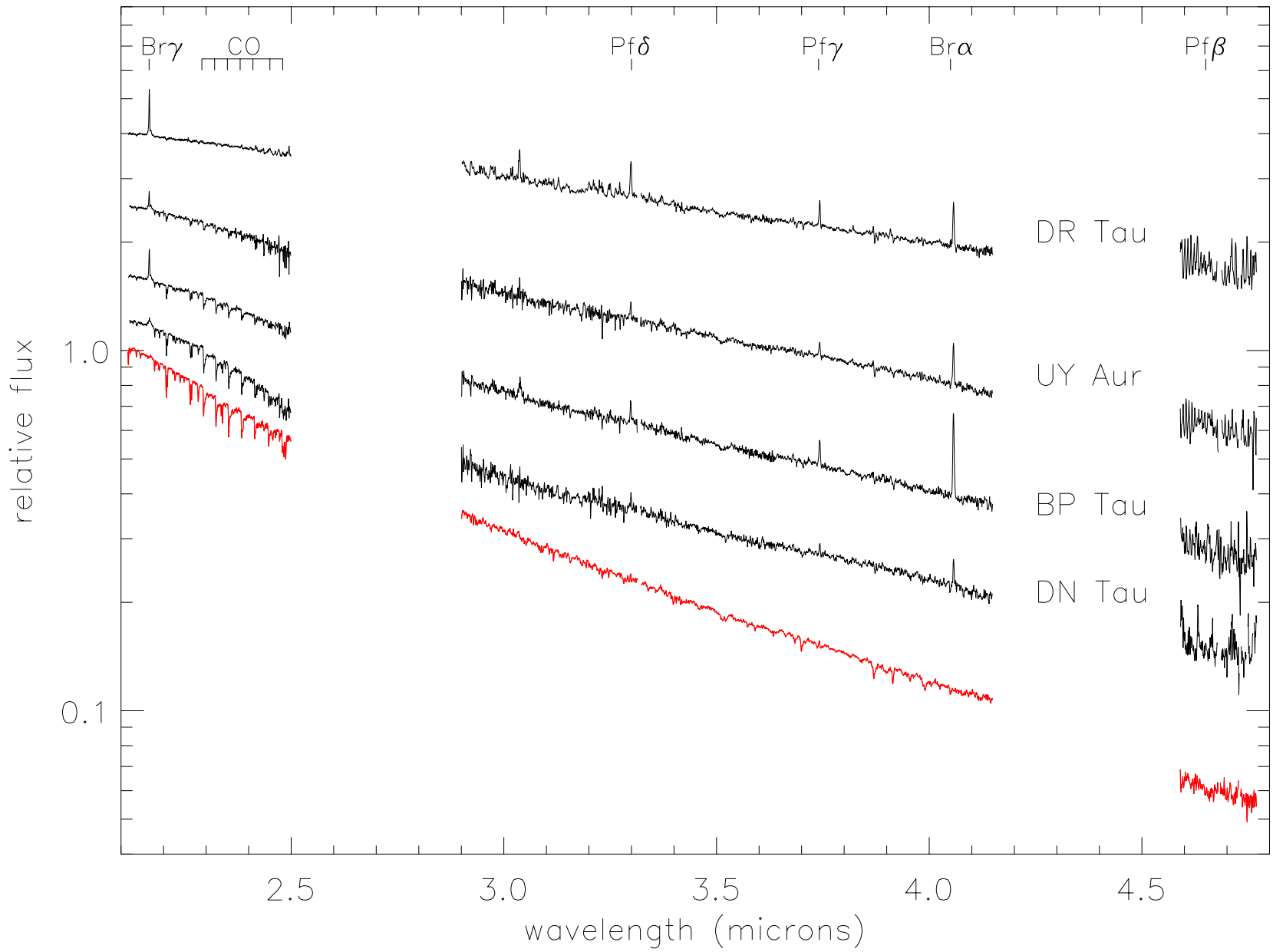
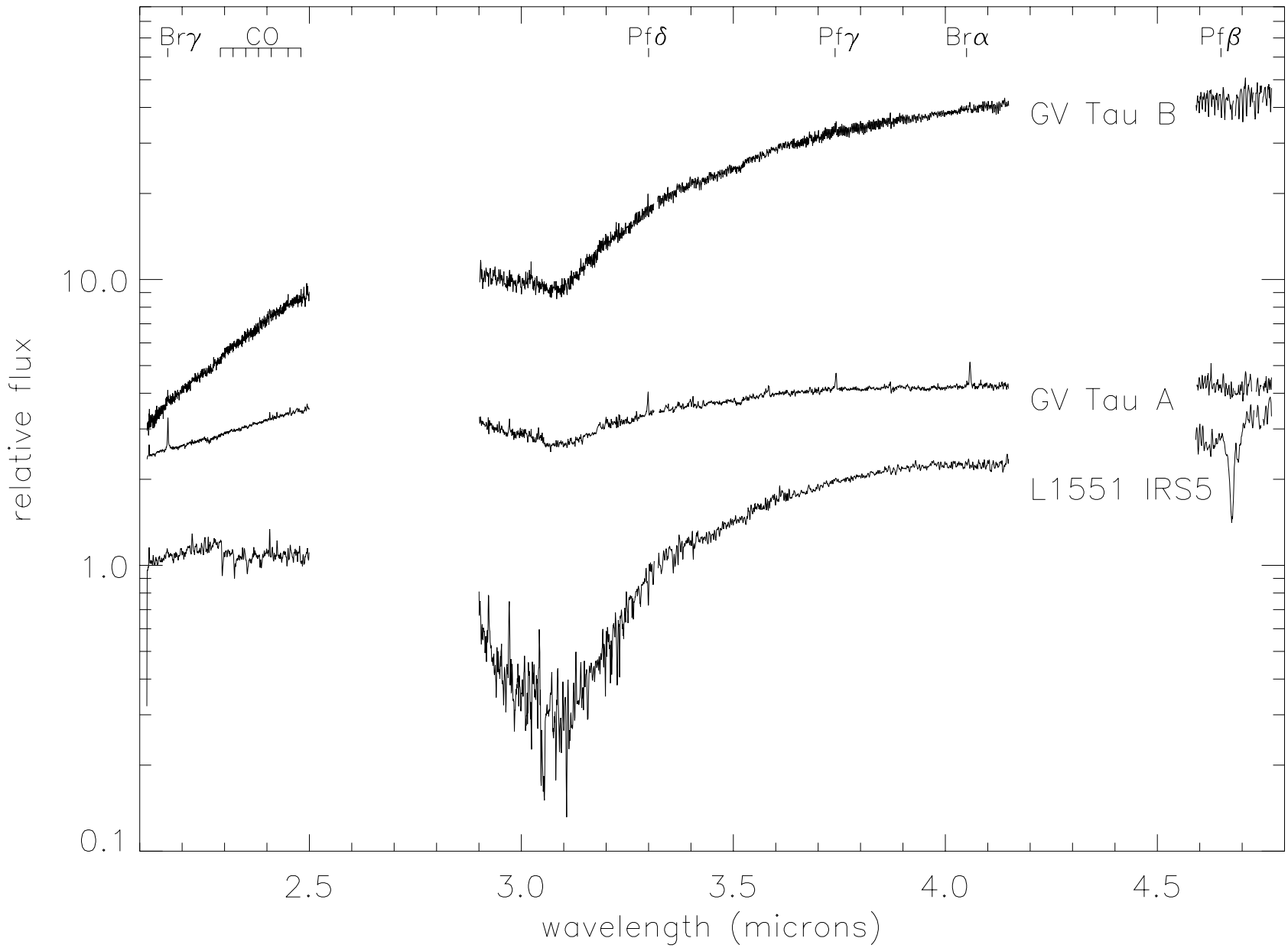
2-5 micron Spectra of Young Stellar Objects

The following figures show 2.1-4.8 μm spectra of young stellar objects obtained by James Muzerolle. SpeX has enabled remarkable signal-to-noise data of these relatively bright objects (K~7-9), revealing weak photospheric features in the K and L bands. The photospheric features allow measurements of veiling from excess infrared continuum emission arising from circumstellar disks or envelopes. Many hydrogen emission lines are also seen, allowing measurements of gas infall from the disks to their central stars. Together, this information provides powerful probes of accretion disk structure and evolution in young stellar objects.

Figure 1 shows spectra of 4 classical T Tauri stars, compared to a standard star of similar spectral type (K7, red line). Telluric cancellation in the L-band is excellent, though some residuals remain in the M-band. Hydrogen emission lines are labeled, as are the CO overtone bands. The objects are normalized to the standard spectrum, then scaled upwards according to the veiling of their K-band photospheric features. There is clear continuum excess emission in all 4 objects, arising from their circumstellar accretion disks.

Figure 2 shows spectra of 2 Class I objects (embedded protostars), including the resolved binary components of GV Tau. The objects are scaled arbitrarily for clarity (veiling cannot be measured, since it is large enough to completely fill in photospheric absorption features - the CO absorption in L1551 is probably produced in a disk rather than the stellar photosphere). Broad water ice absorption can be seen around 3 microns in all 3 spectra, and a CO ice feature appears at about 4.7 microns in L1551. These are likely due to ice-covered grains in circumstellar envelopes.


Brγ
CO
Pfδ
Pfγ
Brα
Pfβ
DR Tau
UY Aur
BP Tau
DN Tau
relative flux
1.0
0.1
2.5
3.0
3.5
4.0
4.5
wavelength (microns)


Brγ
CO
Pfδ
Pfγ
Brα
Pfβ
GV Tau B
GV Tau A
L1551 IRS5
10.0
1.0
0.1
relative flux
2.5
3.0
3.5
4.0
4.5
wavelength (microns)