RECENT GEMINI RESULTS ON X-RAY BINARIES

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GEMINI FOR XRBS

- Key questions:
  Nature of XRB systems (e.g. ULXs)
  Populations of XRBs
  Masses of accreting objects
  -Mass distributions illuminate SN physics

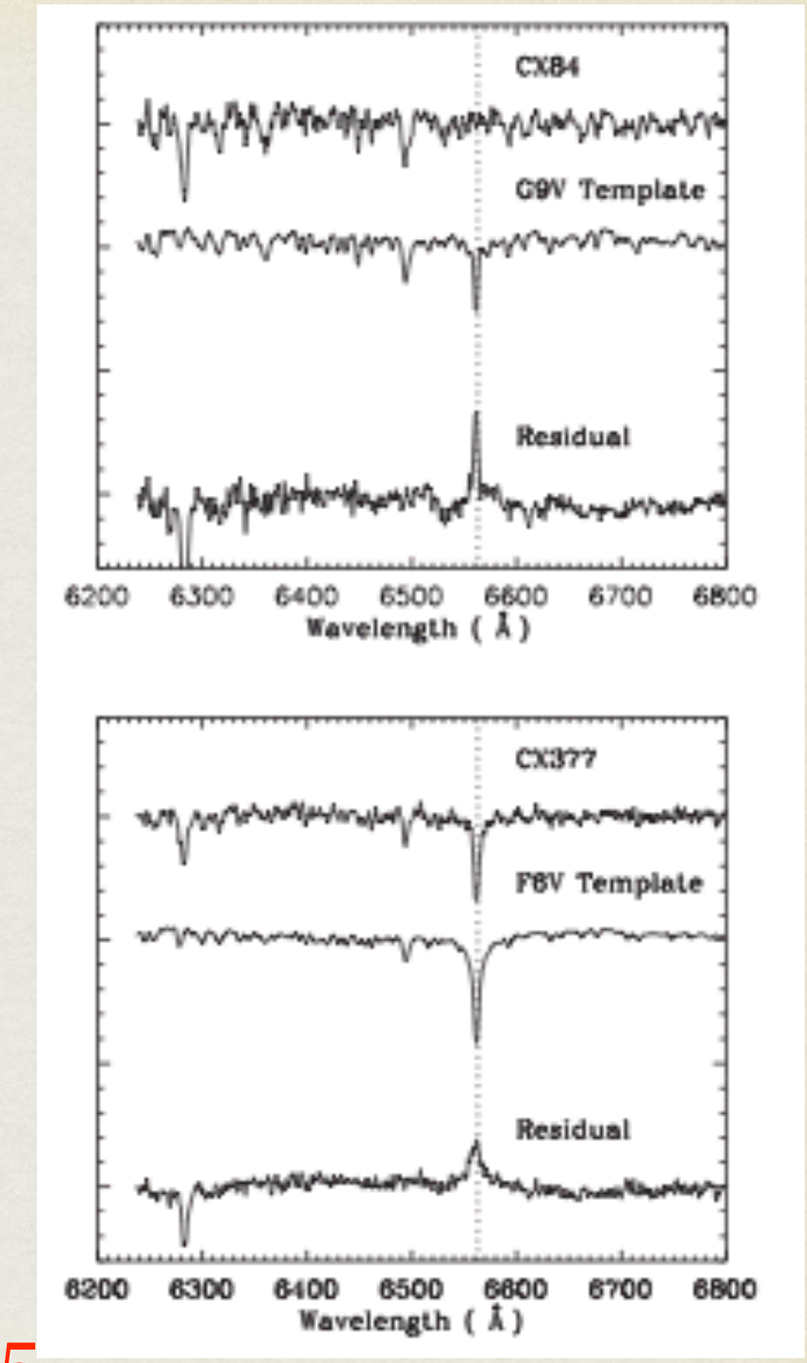
- Photometry, spectroscopy of donor stars
  Use GMOS (imaging, spectra), GNIRS, Flamingos, NIFS

Courtesy ESA

HIDDEN ACCRETING BINARIES

- Chandra Galactic Bulge Survey: 1640 sources (Jonker+11), follow-up opt/IR photometry, spectra to uncover ~300 XRBs

- GMOS data; some absorption-line spectra conceal broad emission lines (Wu+15)



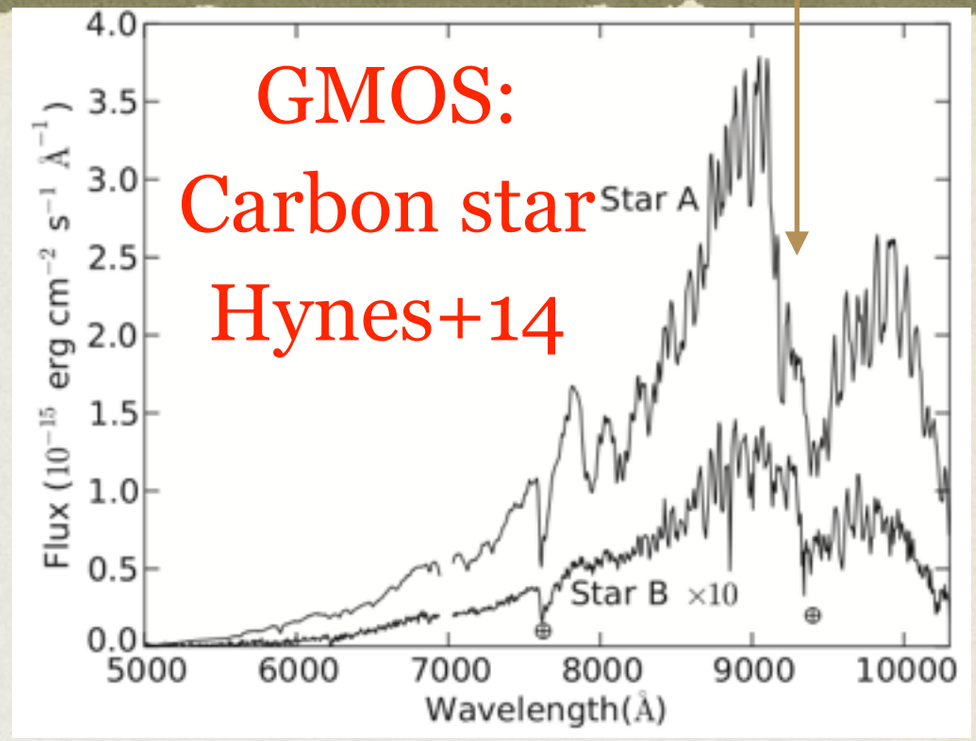
GMOS spectra of
2 hidden XRBs, Wu+15

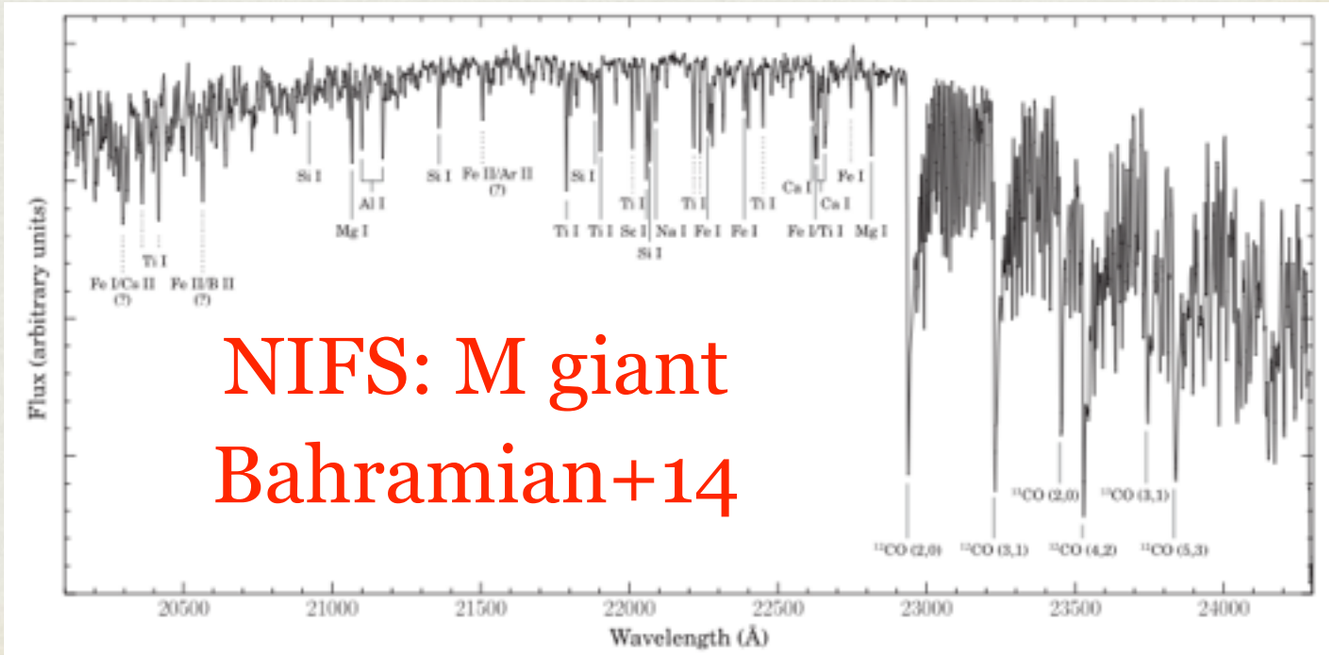
HIDDEN SYMBIOTIC X-RAY BINARIES

- Symbiotics are compact object accreting red giant wind

- 1000s predicted in galaxy, only ~100 known. Most don't show emission lines? (Hynes+14)

- Gemini to type giant, measure distance & infer accretor nature (e.g., L too high for white dwarf)

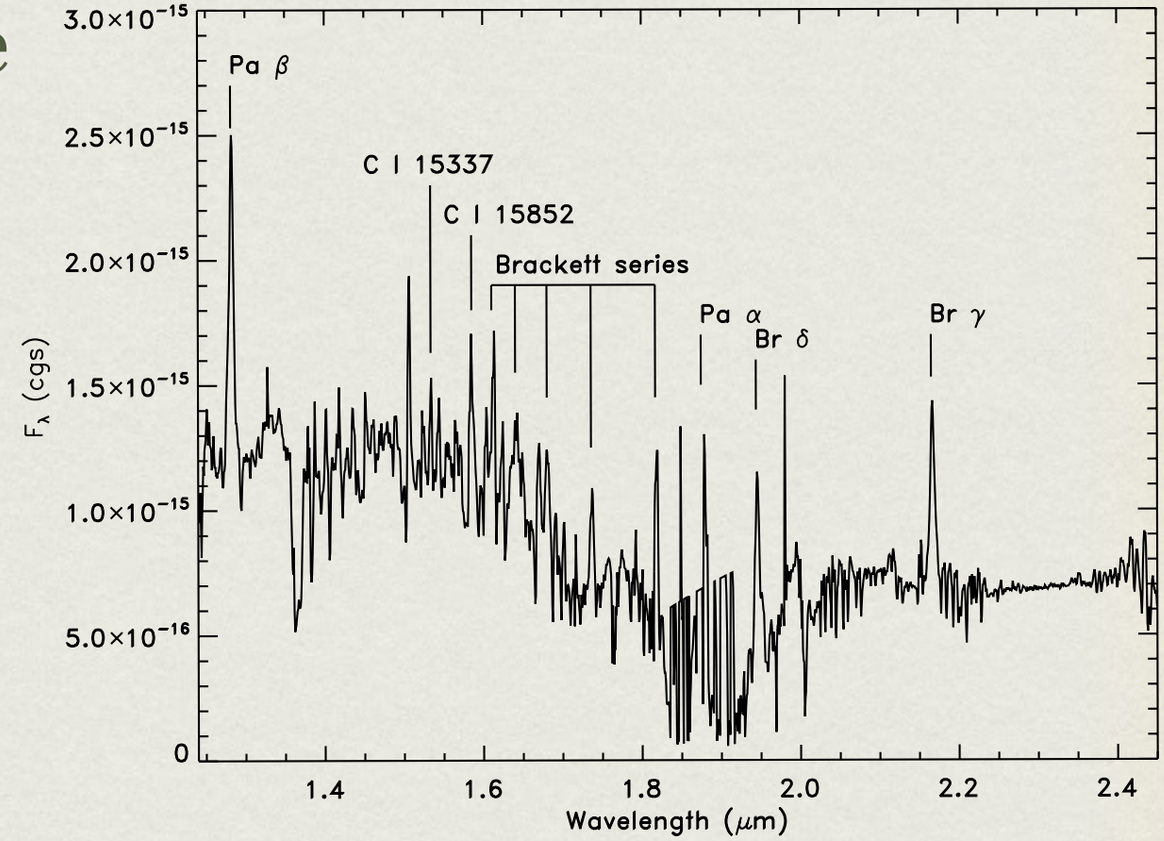




ACCRETING PROTOSTAR?

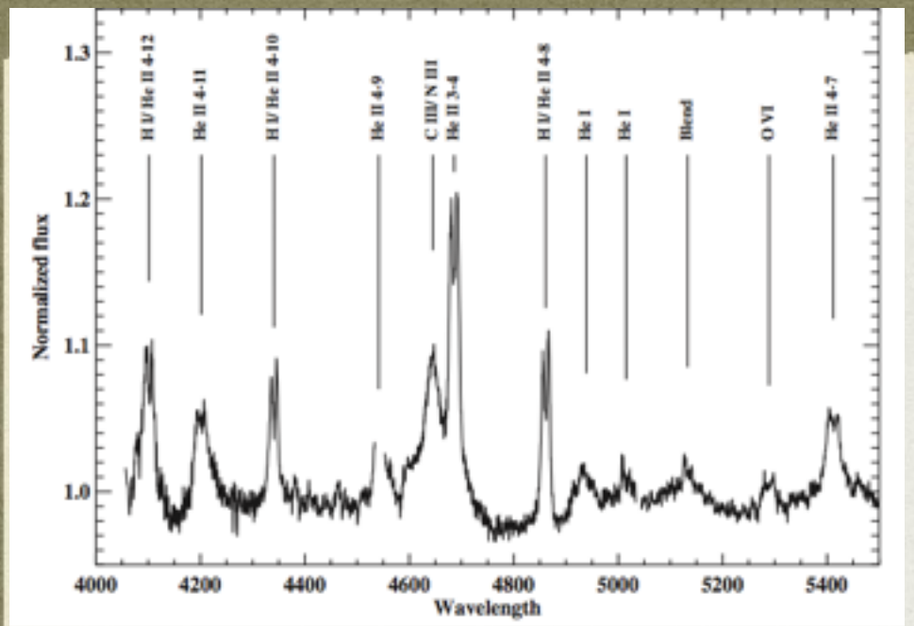
- Faint X-ray source from Bulge survey
  Red SED (peak at 10 μm)
  Mid-IR outburst >6 mag
  Emission lines, including forbidden

- Interpret as young stellar object (FU Ori?).
  3 degrees above plane; isolated star formation?



Flamingos-2 on CX330, Britt+15, submitted (GRACES test target)

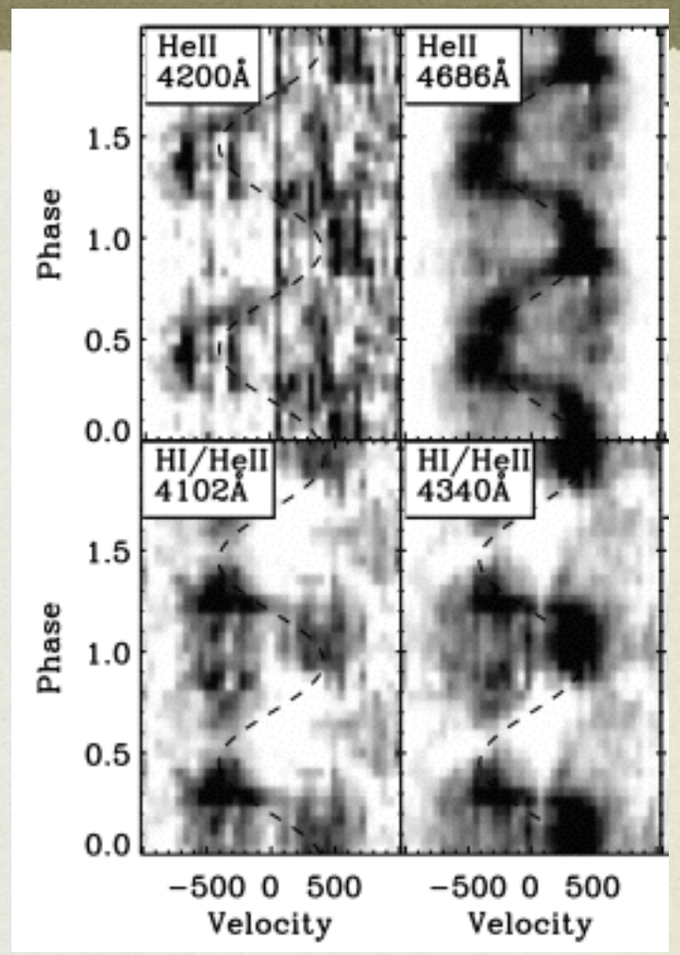
RADIAL VELOCITY STUDIES

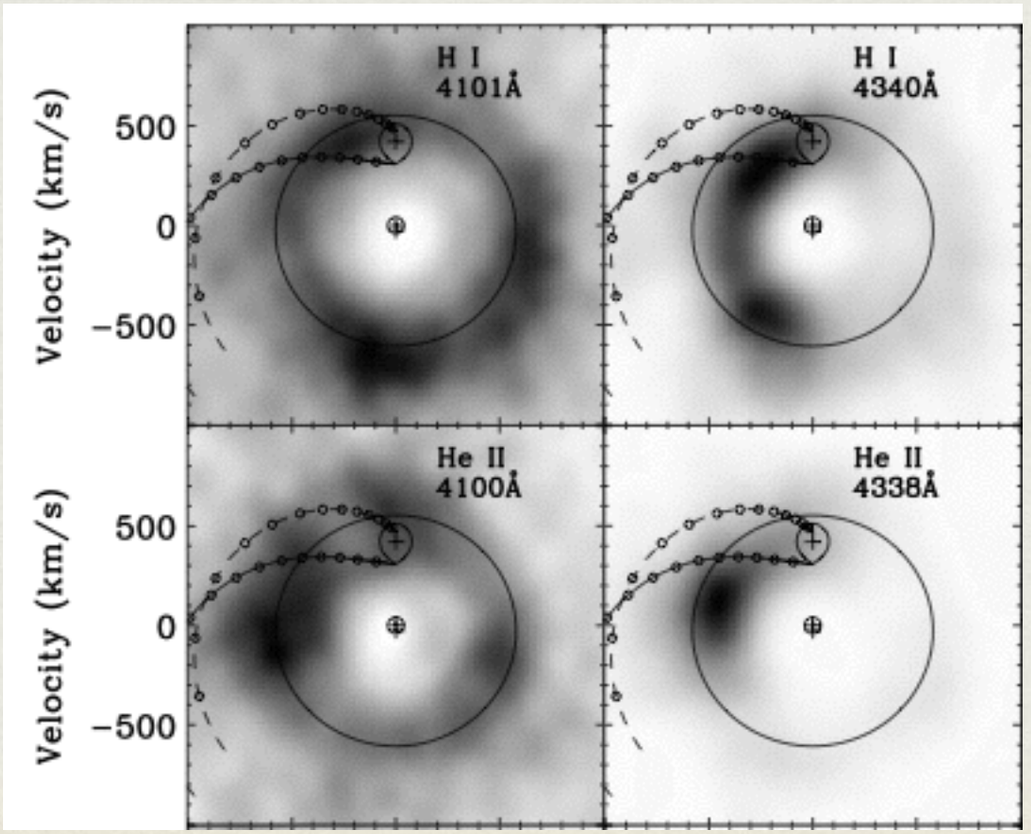


Spectrum, with double-peaked emission lines

EXO 0748-676, Mikles+12

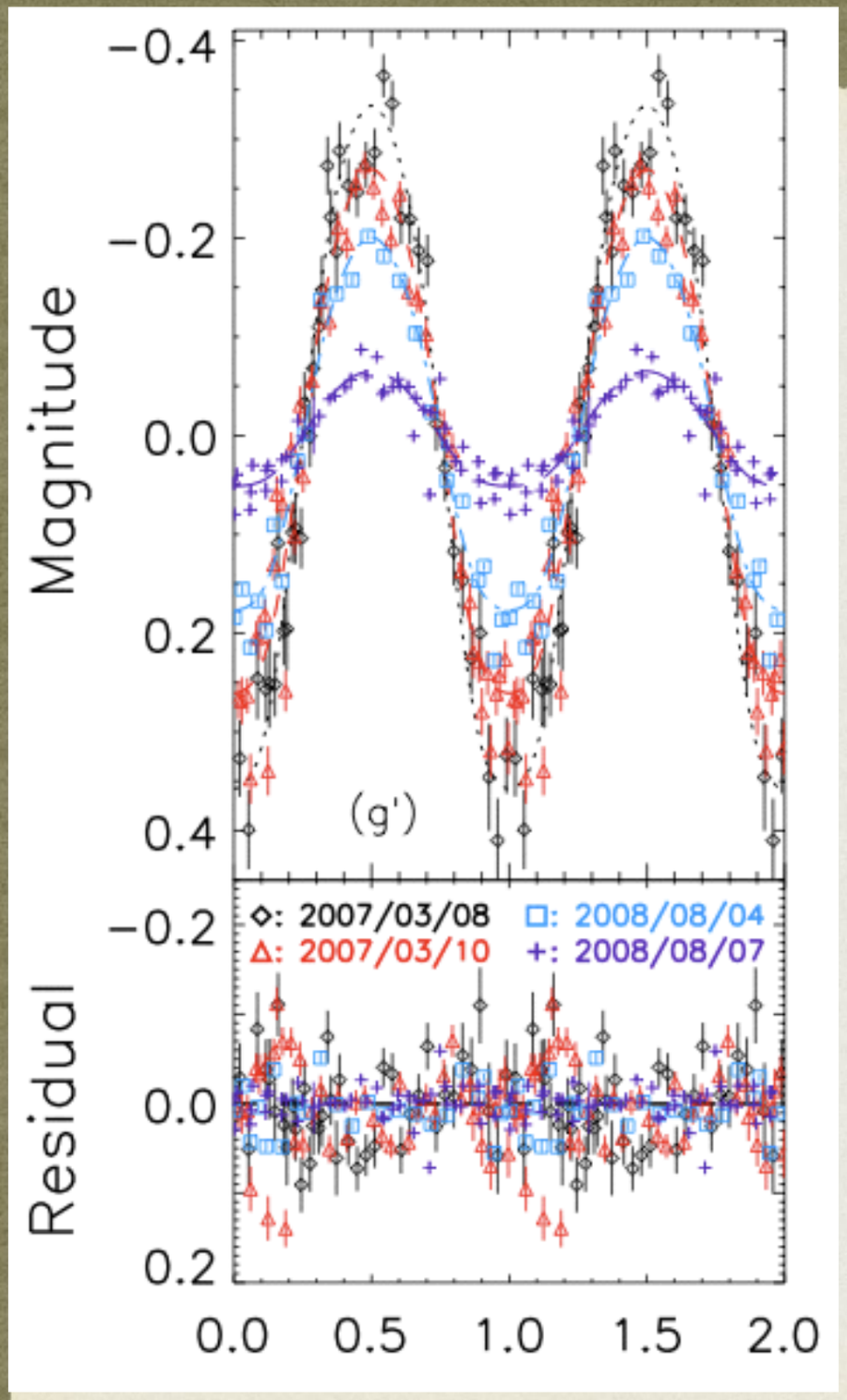
Trailed spectra, change with orbital phase



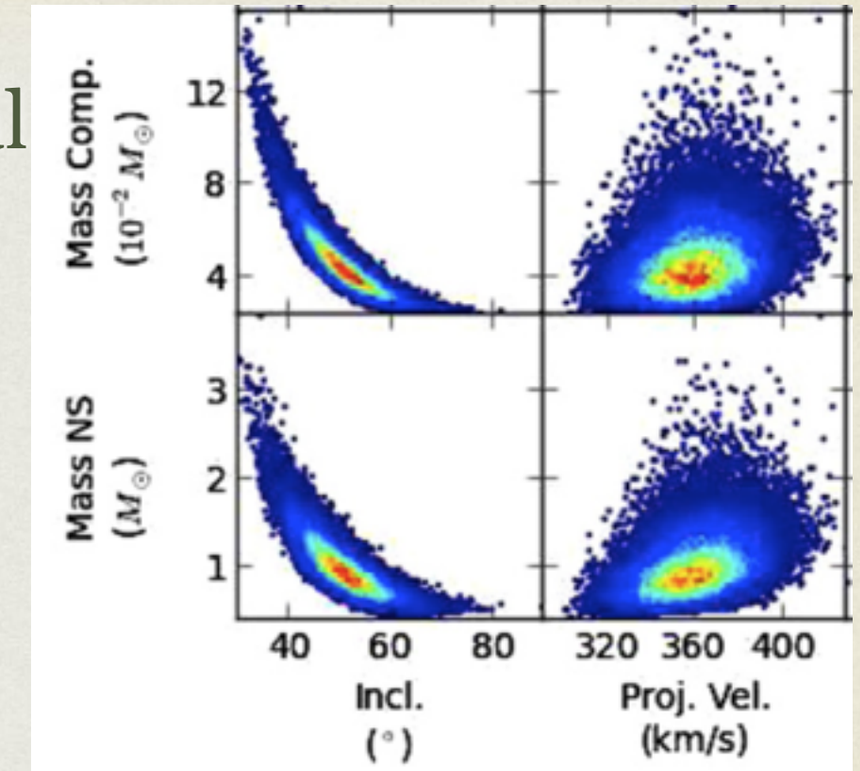


Tomograms, show locations of emission

SPECTRA + PHOTOMETRY



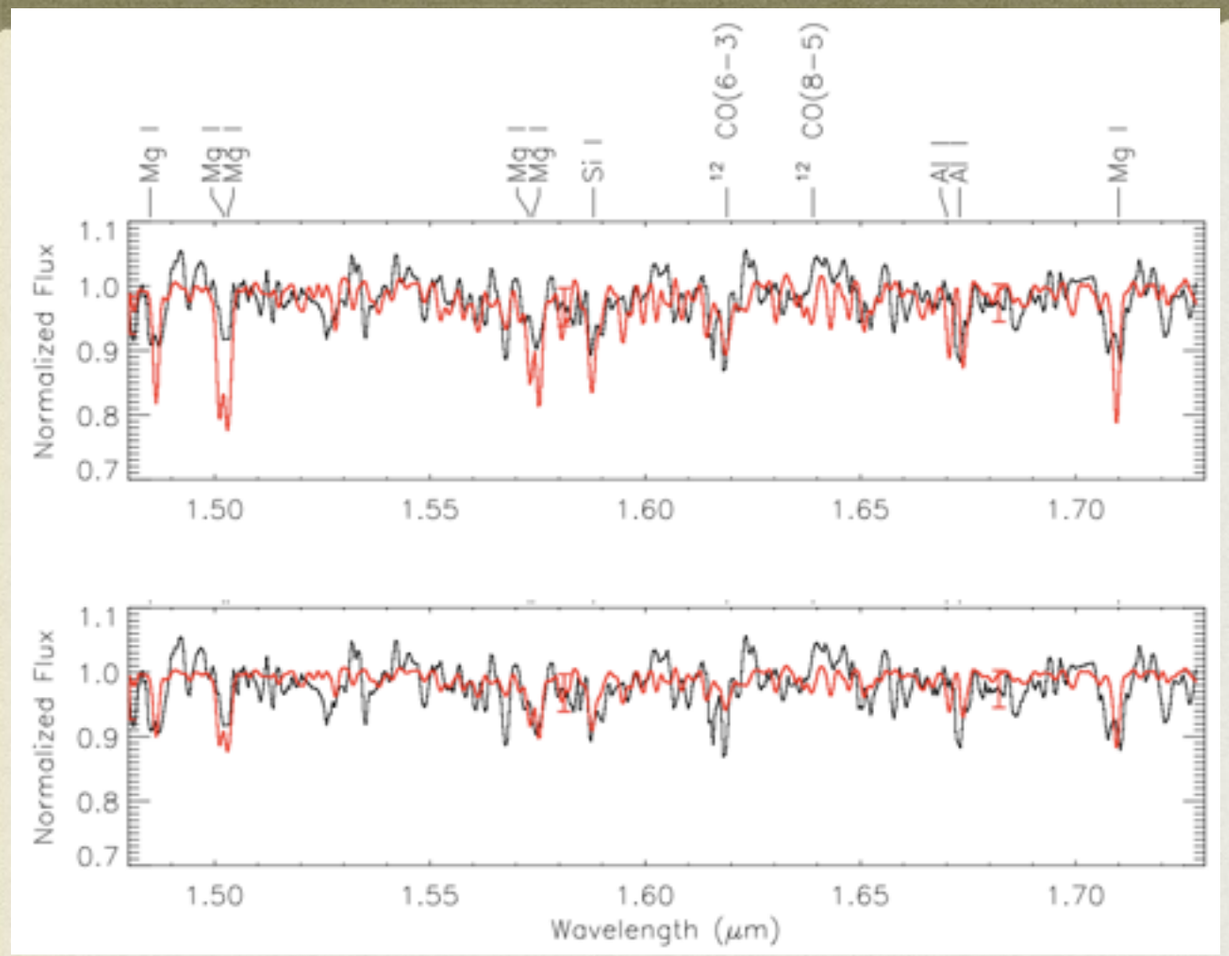
Degeneracy between radial velocities & inclination



Multi-band light curves constrain ellipsoidal variations, inclination

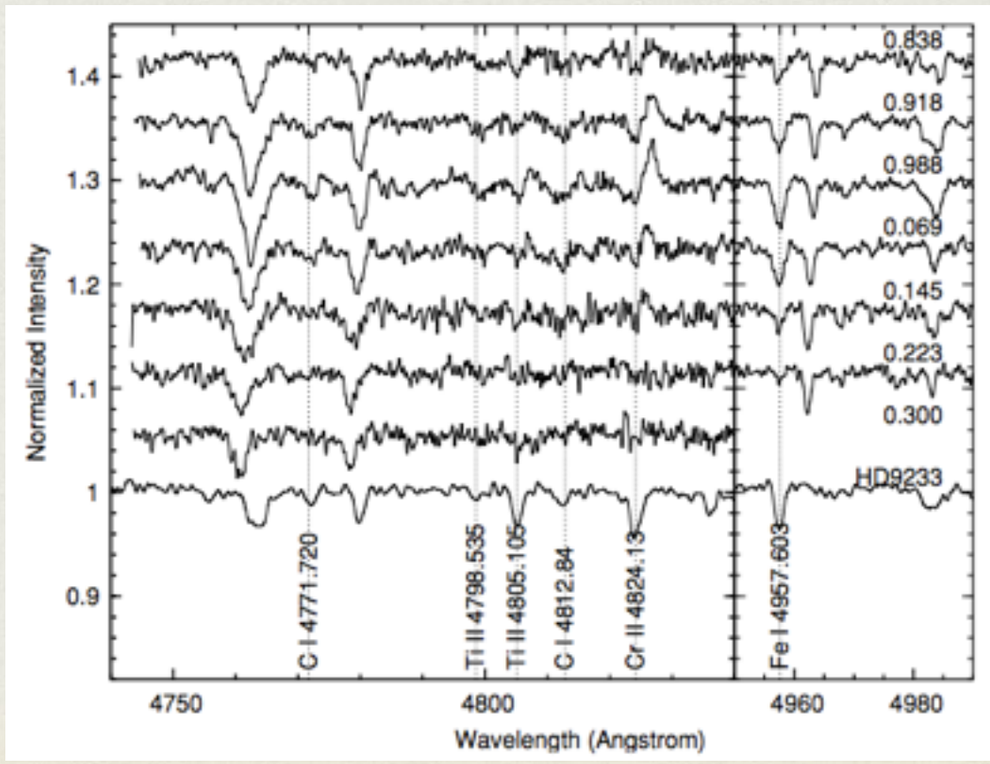
SAX J1808-37; Wang+13

MEASURE BLACK HOLE MASSES



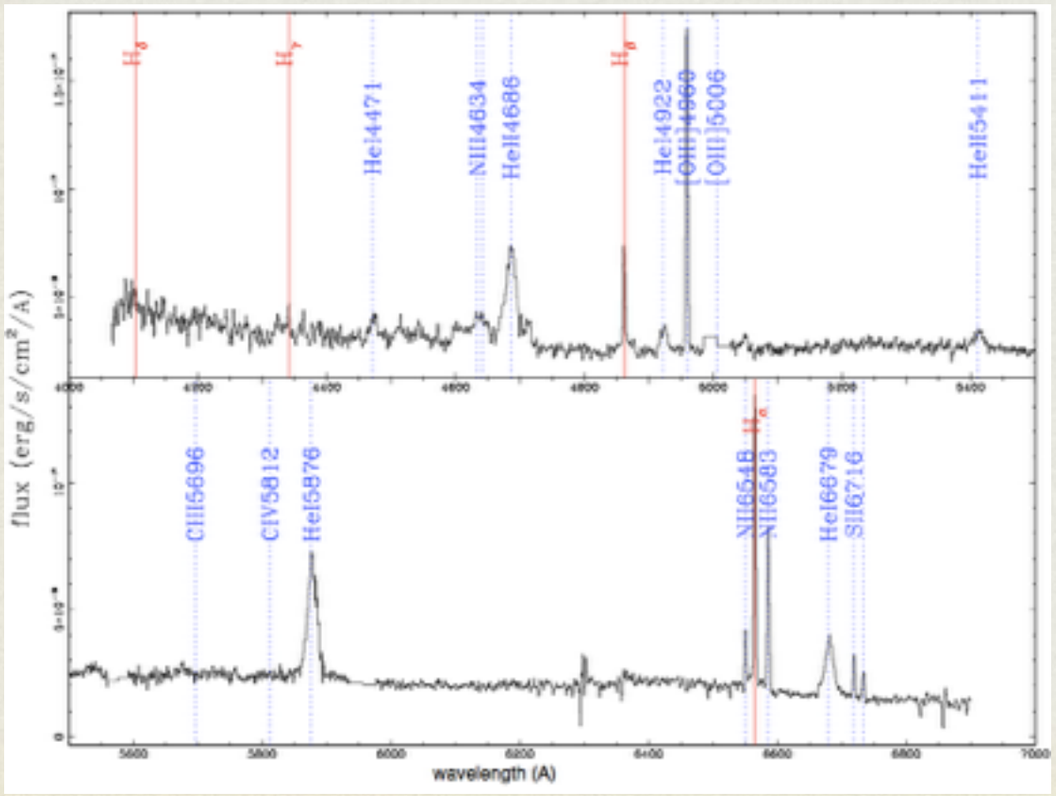
GNIRS H-band spectrum, half of IR light from disk in XTE J1118+480. With photometry, allows $6.9<M_{BH}<8.2$ Msun. Khargharia+13

Complex GMOS spectra of SS433 give RVs, giving $1.9<M_{BH}<4.9$ Msun. Kubota+10

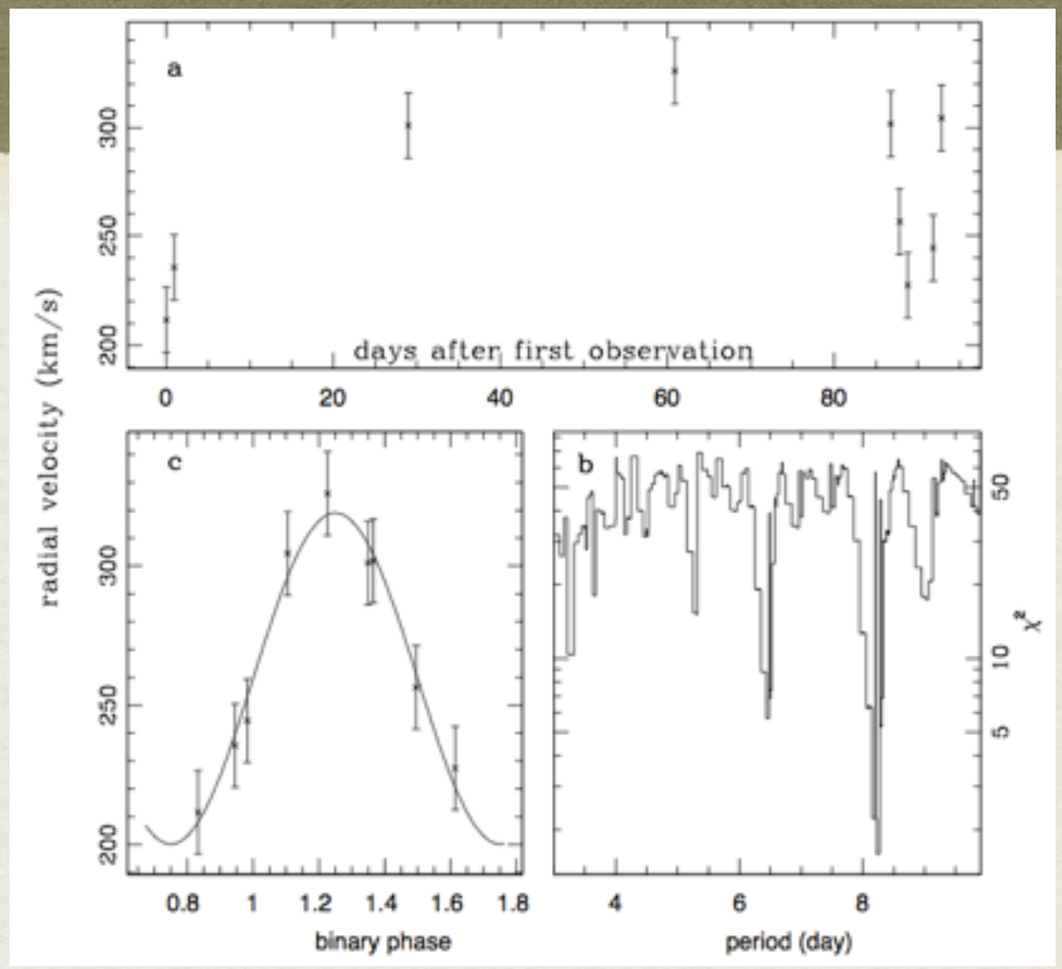


MASS OF BH IN A ULX

GMOS identified bright XRB (ULX) in M101 with WR star, gave mass estimate for star, 19 Msun (Liu+13).



Liu +13



GMOS radial velocities gave orbit, BH mass 20-30 Msun.

Proves some of brightest XRBs are *not* ~1000-Msun BHs.

GALACTIC BULGE SURVEY LLP

- Approved LLP (PI R. Hynes);
  GMOS dynamical mass estimates of ten quiescent XRBs in Galactic Bulge.
  Known systems selected in outburst—selection effects?
  Measure mass distributions of NSs & BHs, constrain SN explosion mechanisms.