A few explorations with Astro-H

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As presented by

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The nature of the low/hard state

- The hard X-ray sensitivity of Astro-H makes it possible to test the predictions of ADAF* models for black holes

- Lowest temperature: 10^9Kelvin.
- Emission mechanism: Bremsstrahlung.

- Astro-H will see that spectrum as different than a power-law, which might be due to e.g. synchrotron (jets).

*Optically thin, geometrically thick, advection-dominated accretion flow (ADAF) in which the ions are extremely hot (up to 10^{12}K near the black hole), the electrons are also hot ($<10^{9}$-$^{10.5}$ K), and thermal Comptonization dominates the X-ray emission The radiative efficiency of an ADAF decreases rapidly with decreasing mass accretion rate, becoming extremely low when a source reaches quiescence. ADAFs are expected to have strong outflows

V404 Cyg, 10^9 K bremsstrahlung, 100 ksec- V404 hovers around 10^{34} erg/s, so 10^{-5} Eddington. F(x)~10^{-12} ergs/cm2/sec- 10x below Suzaku limit

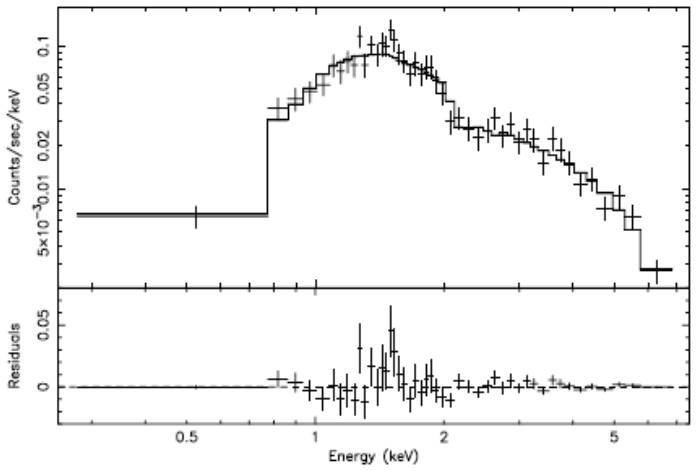
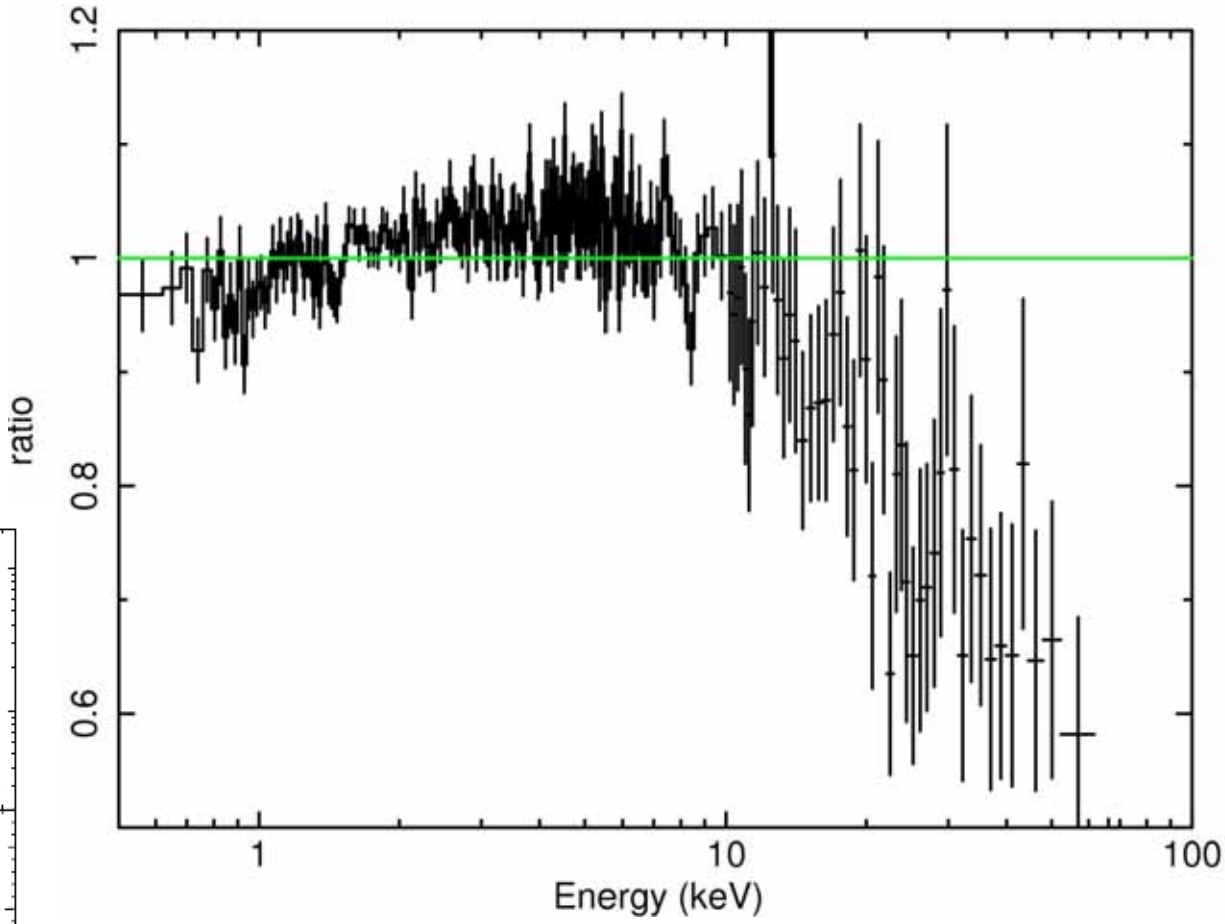


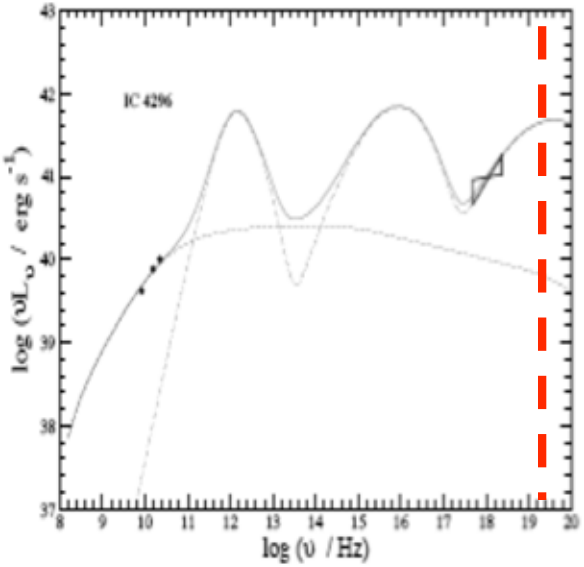
FIG. 1.—*Top*: *Chandra* spectrum of V404 Cyg with an absorbed power-law model ($\alpha = 1.81$ and $N_H = 6.98 \times 10^{21}$ cm^{-2}). *Bottom*: Residuals after subtracting the fit from the data in units of 1 σ.

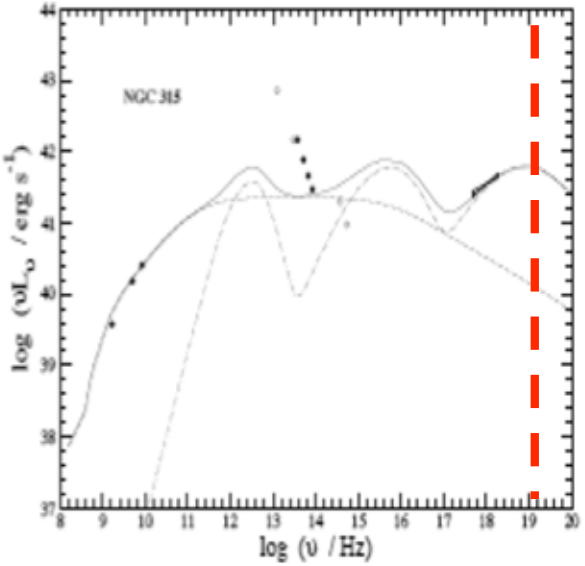


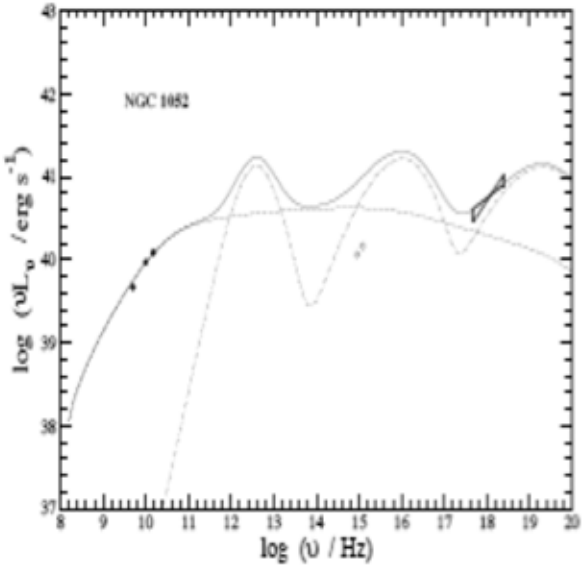
10ks Chandra observation- Power law and bremms indistinguishable

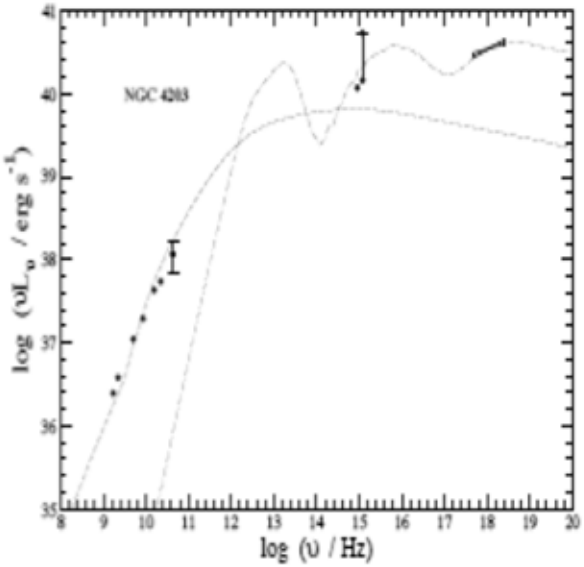
ADAF Models

- Predictions of ADAF models for AGN (Cui and Yuan)
- Expect curvature in the HXI band
- To see blackholes in quiescence need broad band pass and sensitivity
- E.g 10-5 Eddington $10M_{BH}$ at 8 kpc has flux of ~ 10^{-12}
- 10x below Integral/Suzaku limits





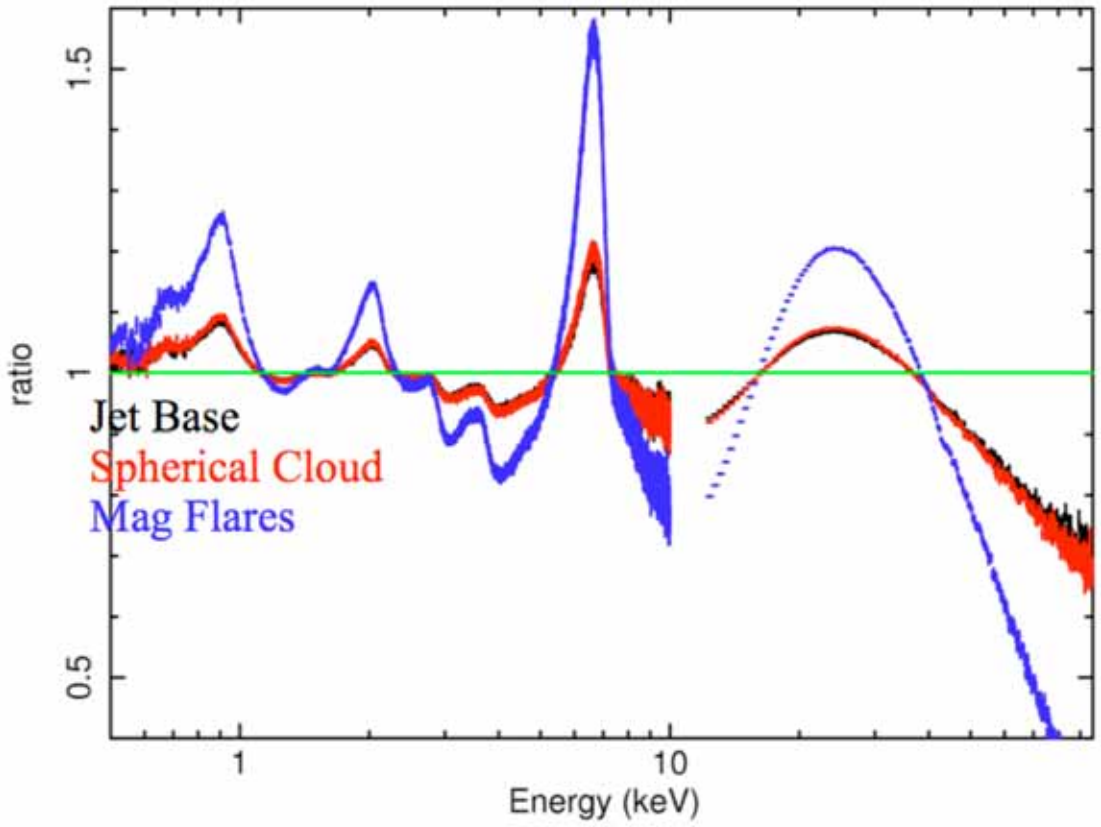


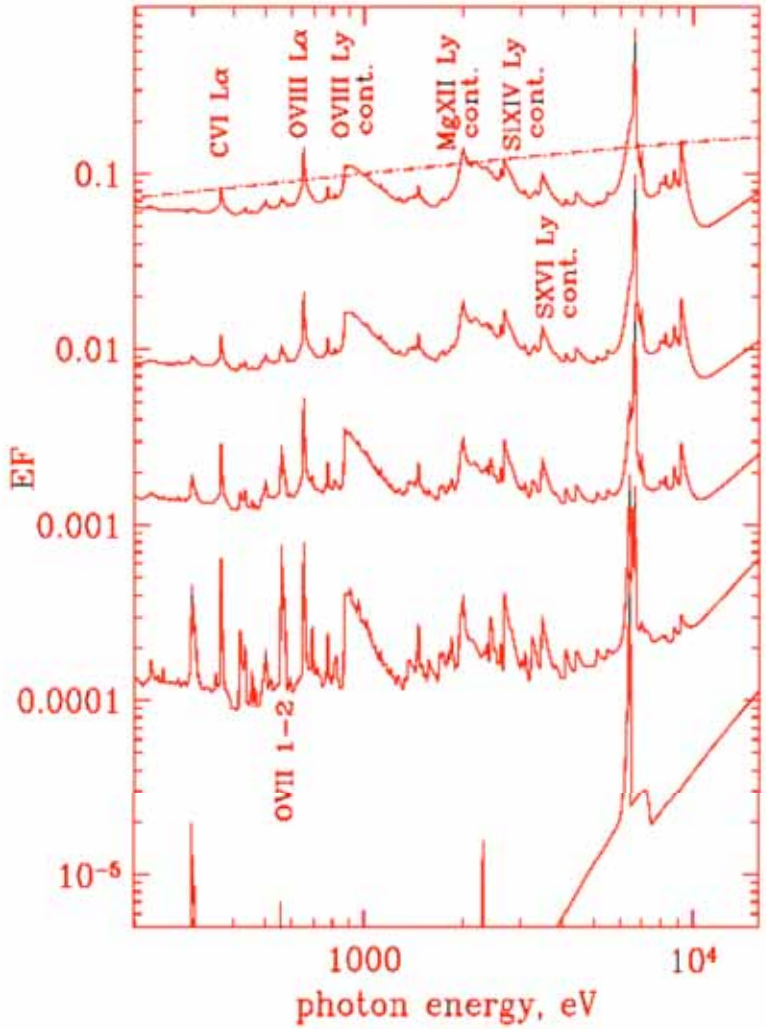


Disk Reflection / The Corona

- We still don’t understand the nature and geometry of the hard X-ray corona.
- Some disk reflection models (e.g. Nayakshin & Kallman) predict different spectra for different coronae geometries.
- Astro-H will be able to tell them apart.

Distinguishing different models of geometry of accretion disks
1 Crab Source. 100 ksec

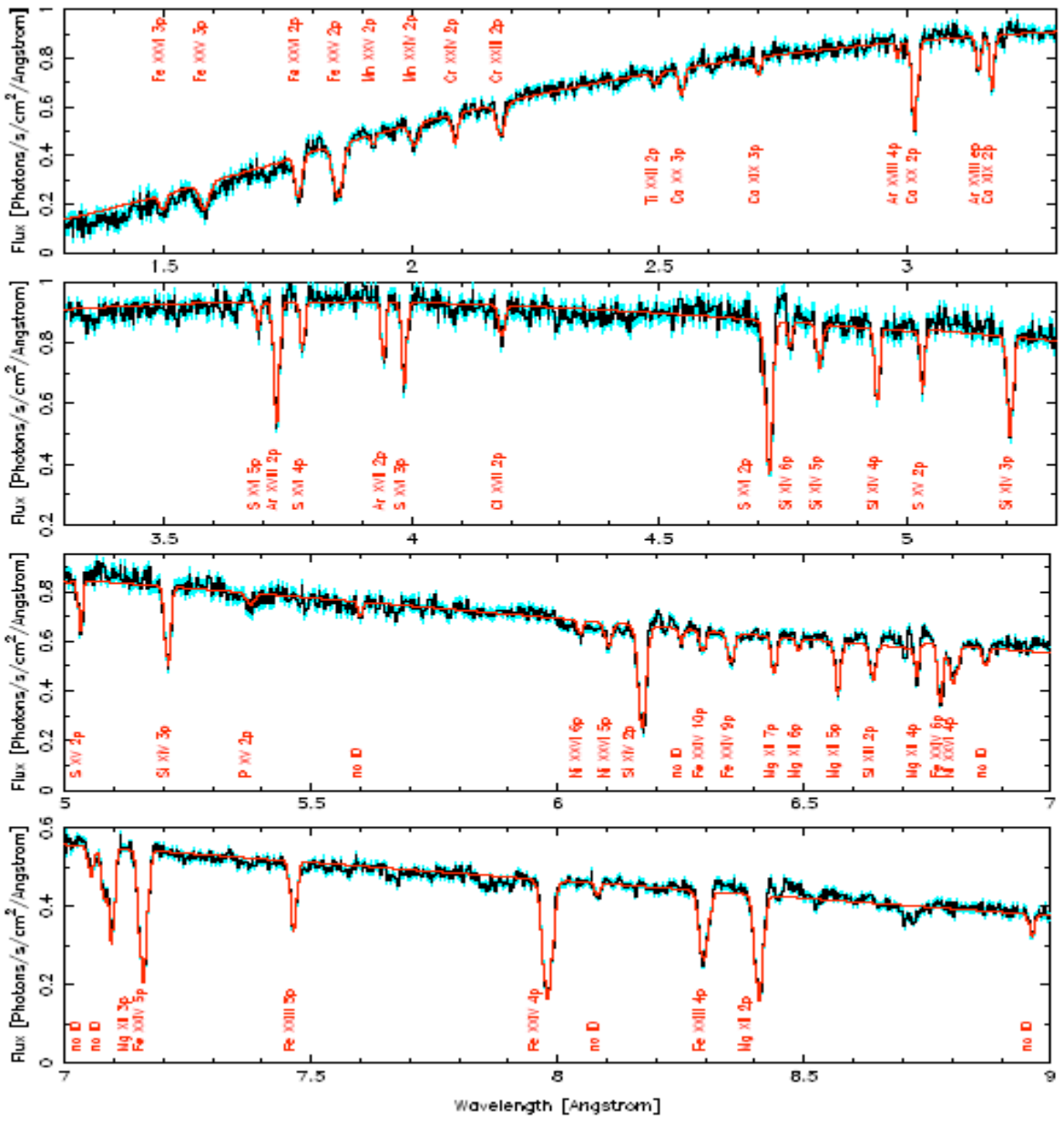




Both broad band pass of Astro-H and high Resolution are crucial

Black Hole Disk Winds

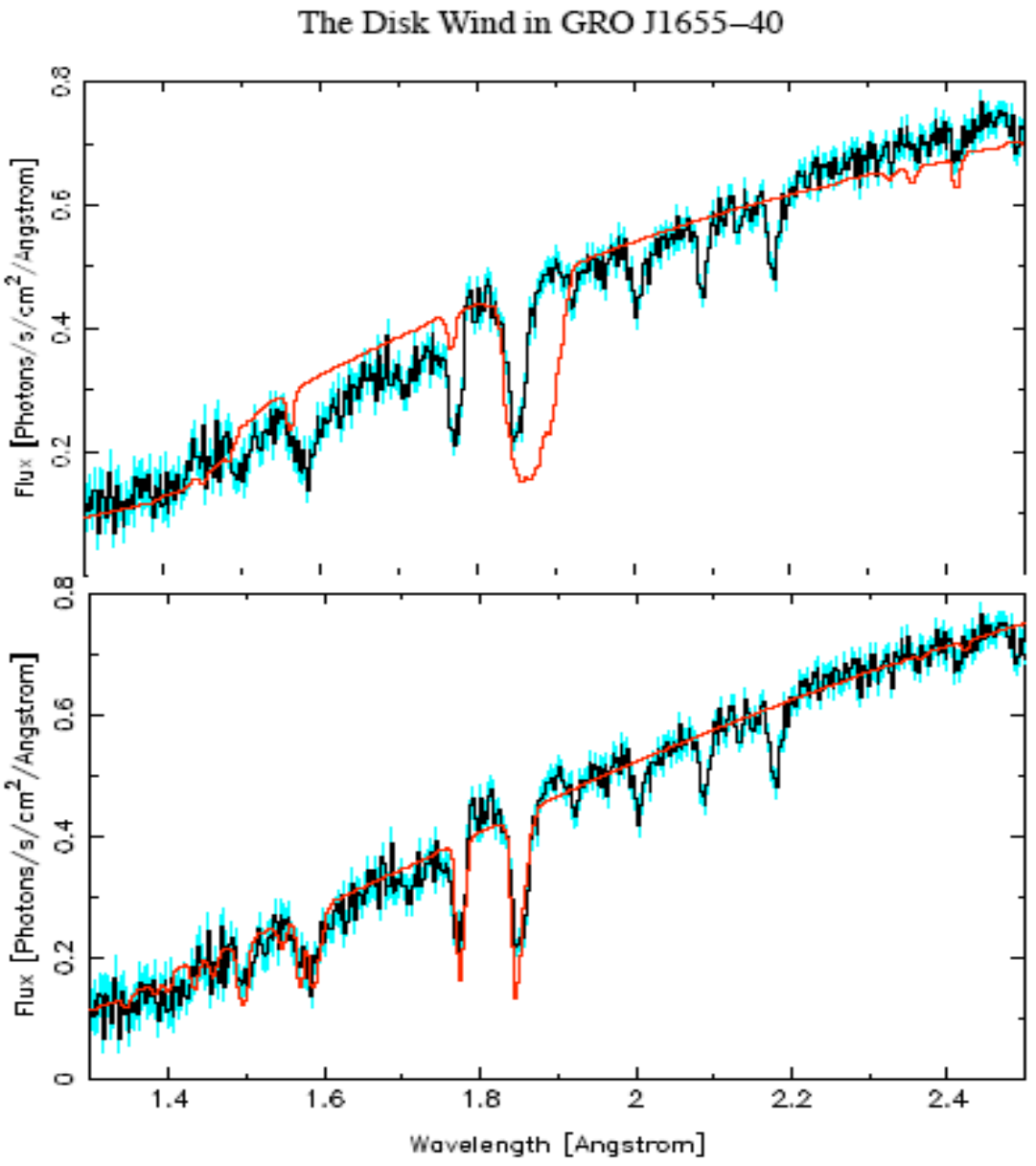
- Disk winds appear to be strongly state-dependent.
- Winds are only seen in soft states, *when jets are quenched.*
- Changes in the B field geometry could account for state transitions and jet production. Winds when B is toroidal close to the disk, jets when B is poloidal.
- Wind studies with the calorimeter should be a high priority; real progress is possible.



Chandra grating GRO1655- line widths 300-1100 km/sec (7-20 eV at 6.4 keV)

Magnetically vs thermally driven winds

- In GRO1655 magnetic driven wind model is much better fit than thermal driven wind
- Fe K line region is critical- best measure of the innermost part of wind



Quiescent neutron stars

- Some quiescent neutron stars may exhibit thermal and non-thermal emission.
- In a few cases, e.g. Cen X-4, Astro-H may be able to detect the power-law out to 20-30 keV.
- This will help to refine radius measurements made in quiescence.