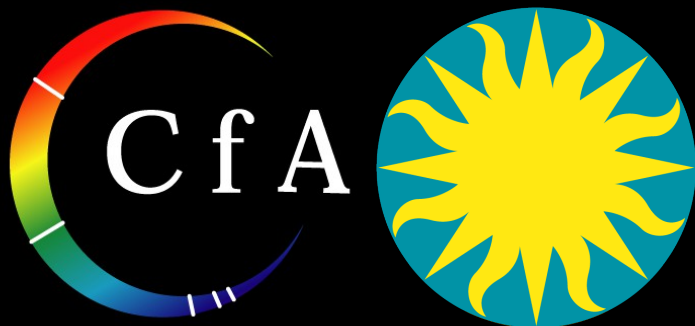
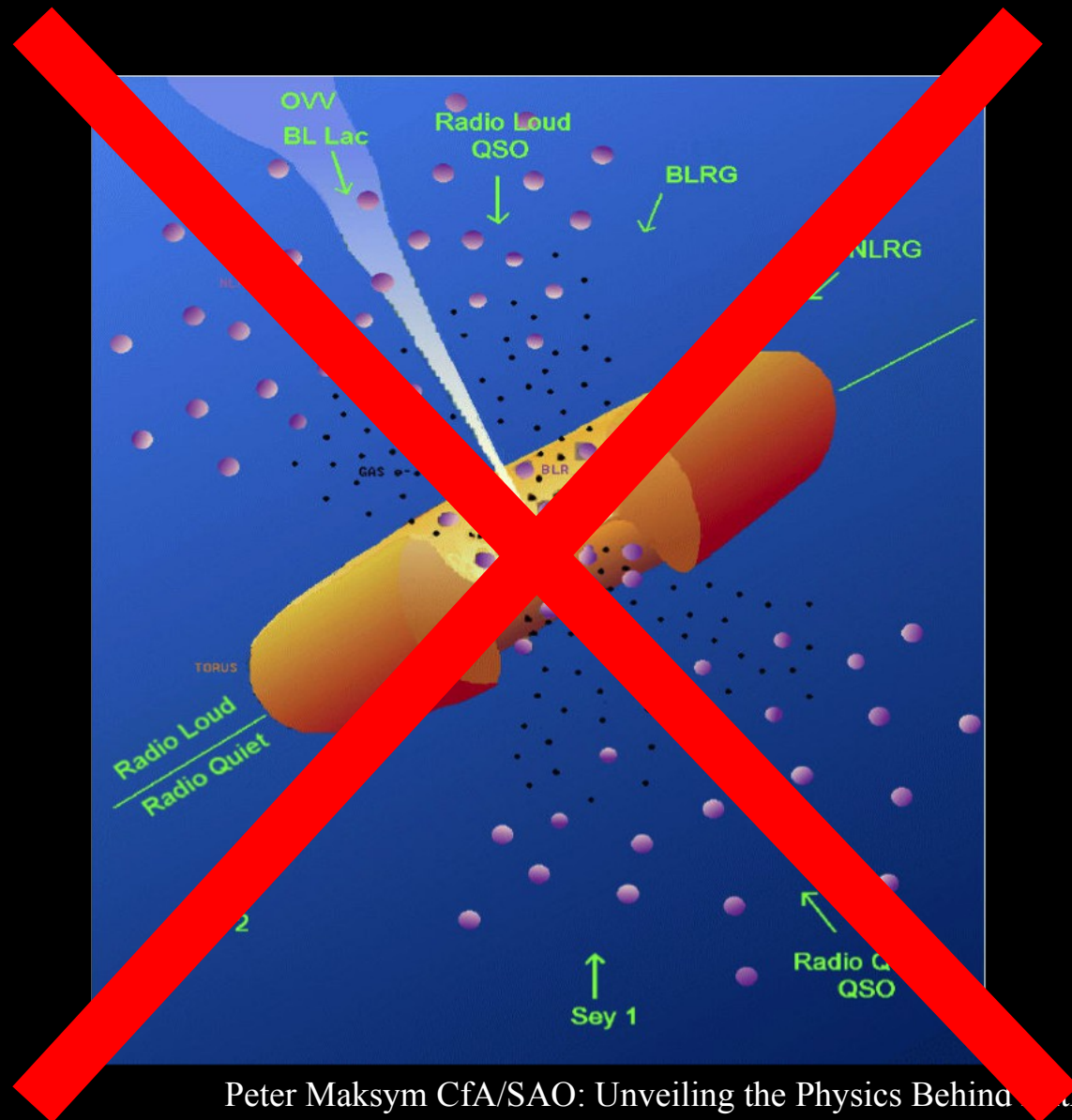


Results from Long-Term Monitoring of an X-ray Bright TDE at Only 90 Mpc

Peter Maksym
Harvard-Smithsonian
Center for Astrophysics

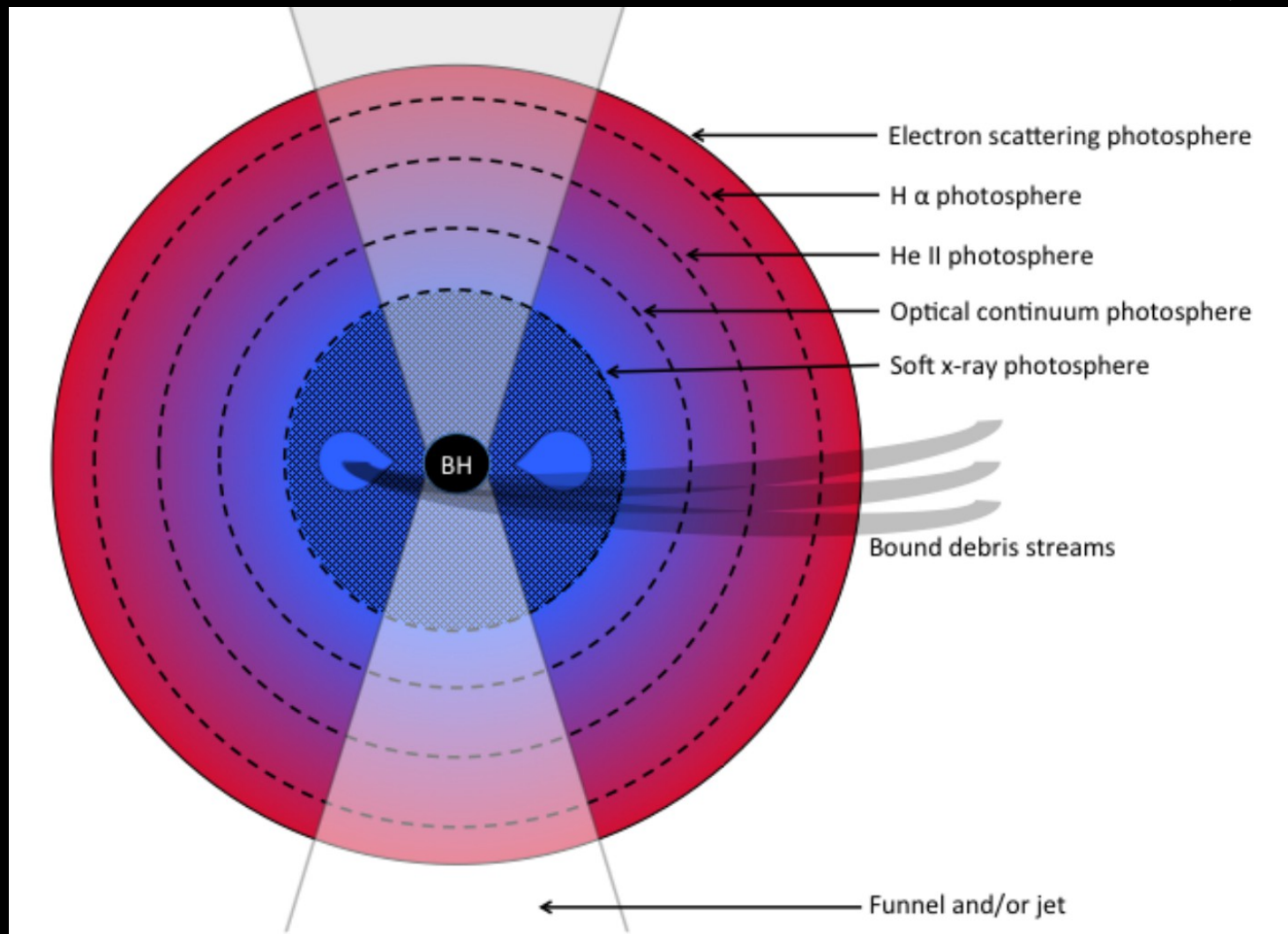
Preliminary!



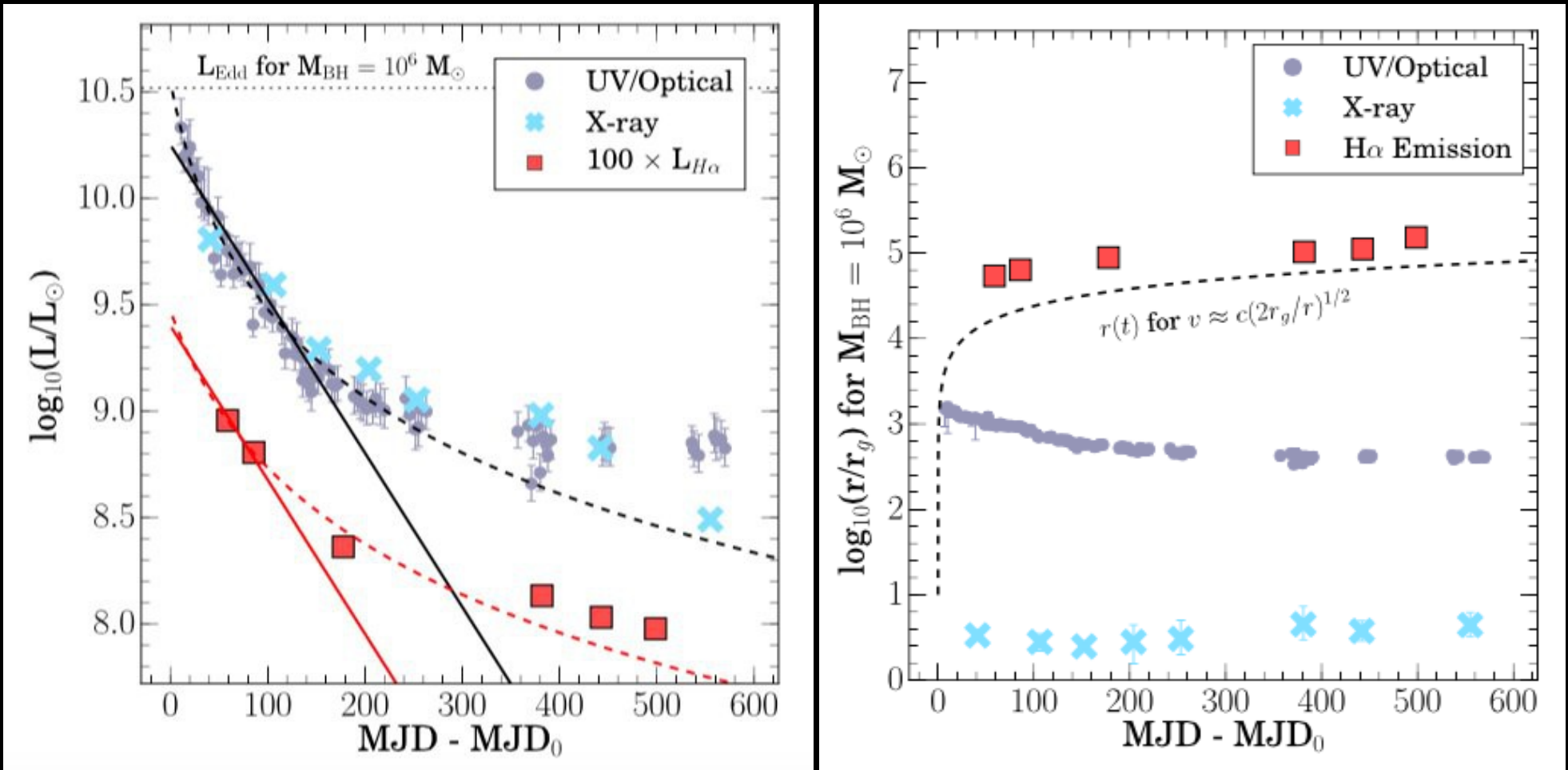


Cartoon Models of TDE Evolution

Roth et al, 2016



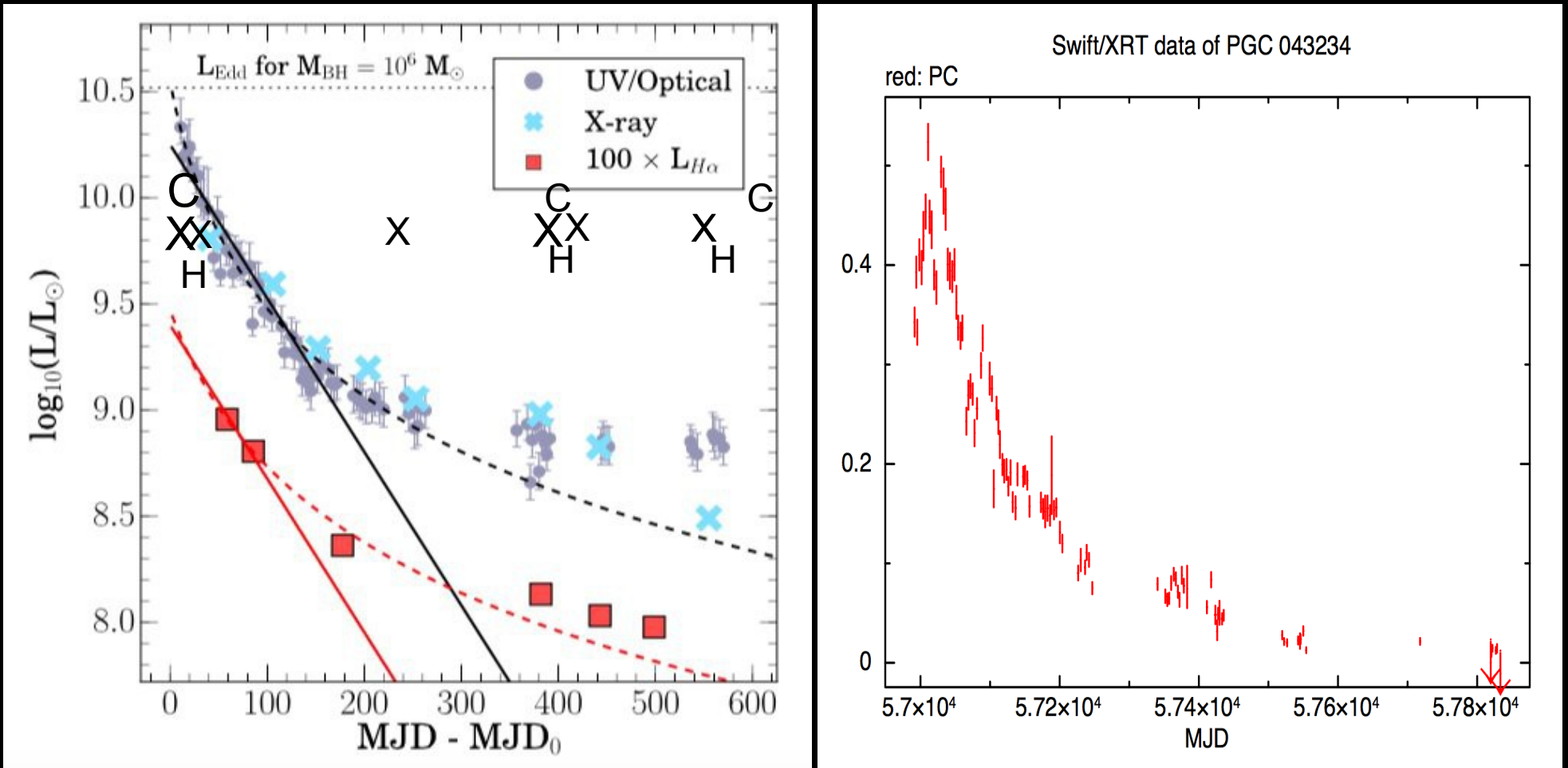
Following the long-term evolution of ASASSN-14li



Discovery: Holoen et al, 2015

Above: Brown et al, 2017

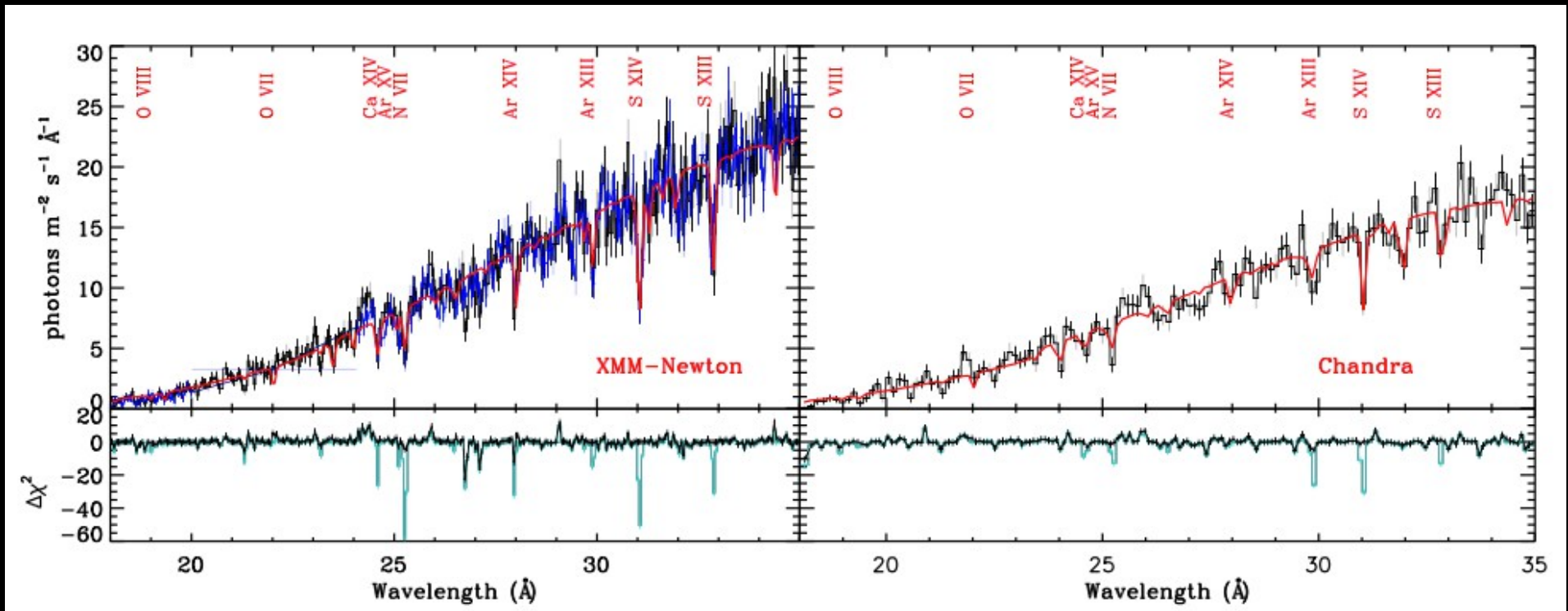
Following the long-term evolution of ASASSN-14li



Discovery: Holoen et al, 2015

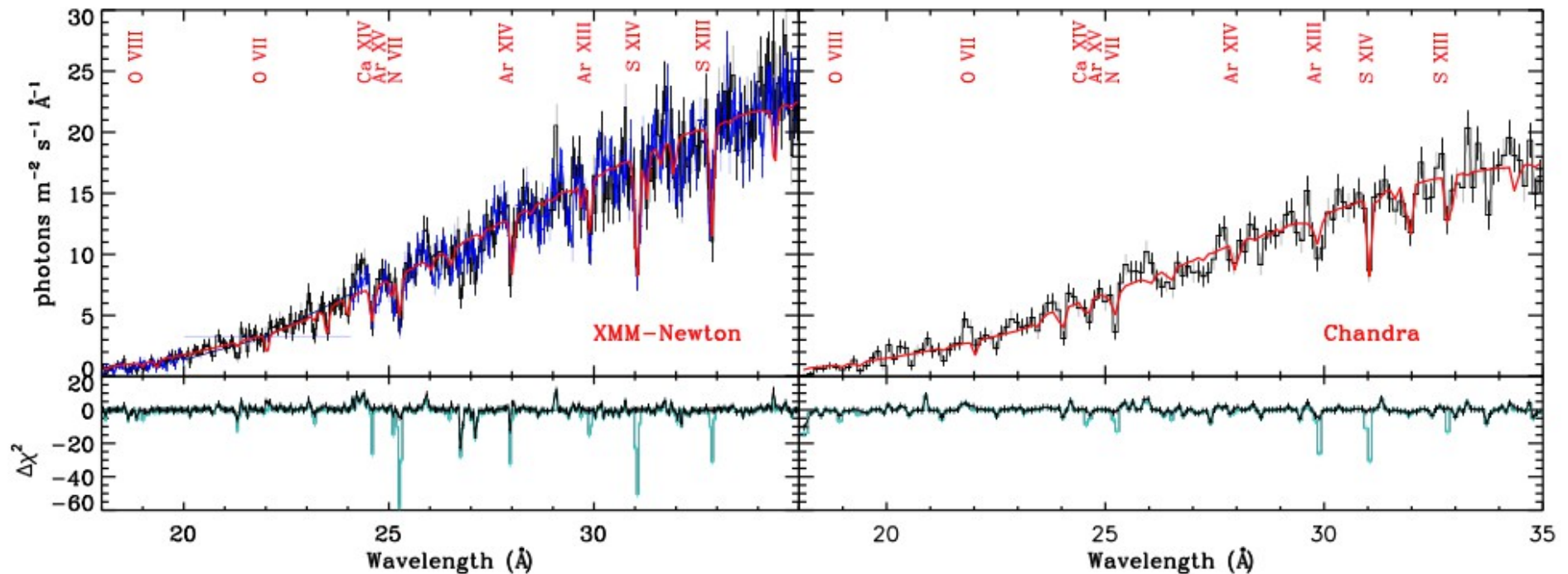
Above, left: Brown et al, 2017

ASASSN-14li: (initially) as luminous as Mkn 231 but unobscured and half as far!



Discovery: Jose et al (ATel #6777), Holoien et al (2015)

Above: Miller et al, incl. WPM, SBC, SG, JG (2015)



O VI: 138.1 eV
 O VII: 739.3 eV (He-like)
 O VIII: 871.4 eV (H-like)

N VI: 552.1 eV (He-like)
 N VII: 667.0 eV (H-like)

S XII: 564.4 eV
 S XIII: 652.2 eV
 S XIV: 707.0 eV
 S XV: 3223.8 eV (He-like)

Ar XII: 618.3 eV
 Ar XIII: 686.1 eV
 Ar XIV: 755.7 eV
 Ar XV: 854.8 eV (Be-like)

Ca XIII: 726.6 eV
 Ca XIV: 817.6 eV (N-like)

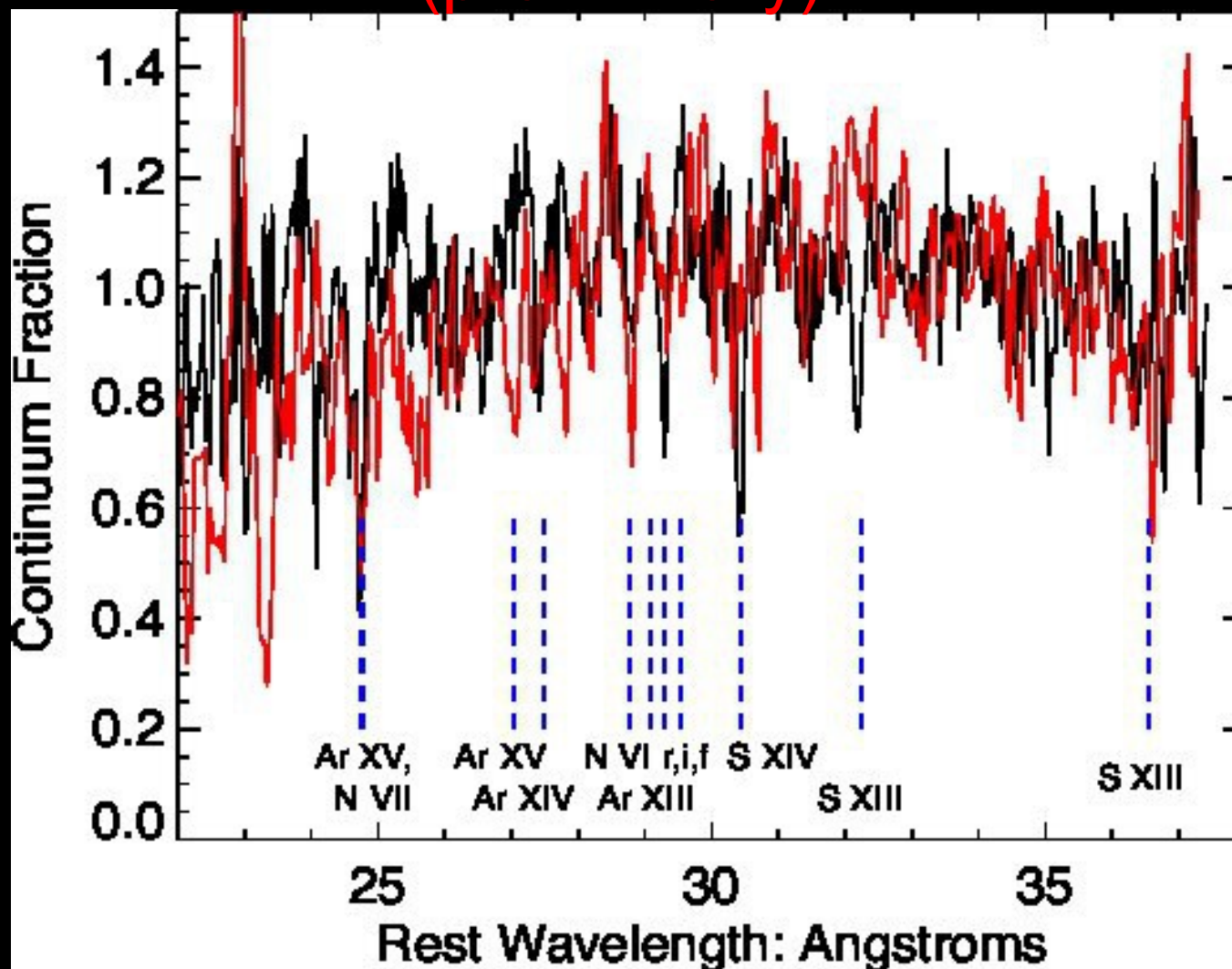
Above: Miller et al, incl. WPM, SBC, SG, JG (2015)

Slicing and Dicing

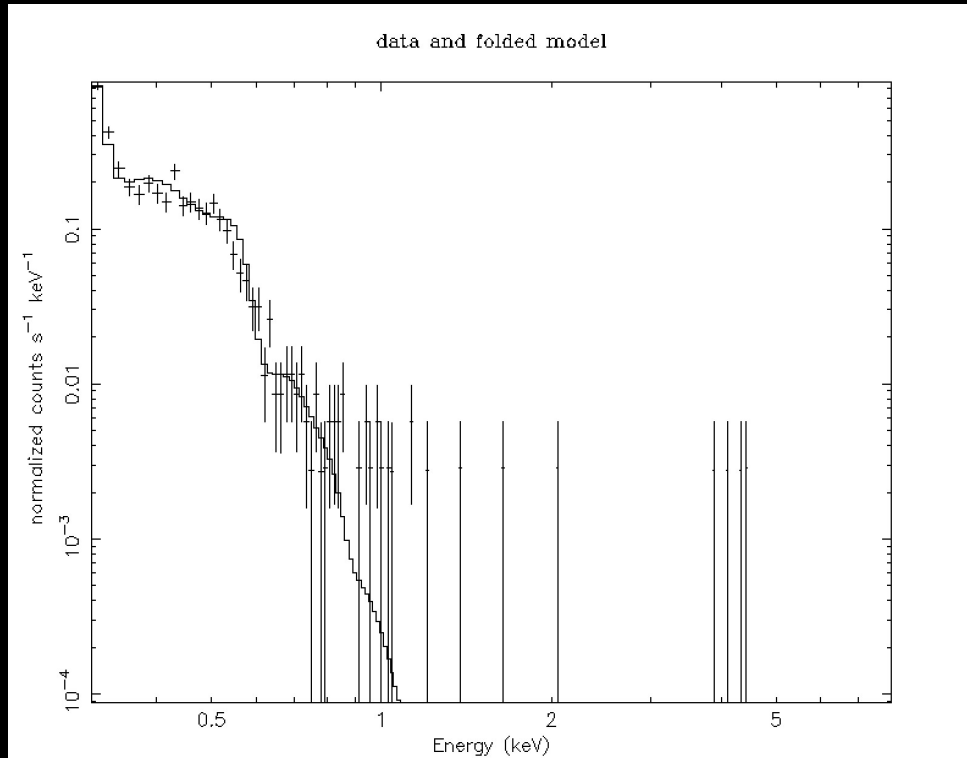
Mission	<i>XMM-Newton</i>	<i>XMM-Newton</i>	<i>XMM-Newton</i>	<i>XMM-Newton</i>	<i>Chandra</i>	<i>XMM-Newton</i>
ObsId	0694651201	0722480201	0722480201	0722480201	17566, 17567	0694651401
comment	monitoring	long stare	stare (low)	stare (high)	–	monitoring
Start (MJD)	56997.98	56999.54	56999.94	57000.0	56999.97, 57002.98	57023.52
Duration (ks)	22	94	36	58	35, 45	23.6
$F_{X,b}$ (10^{-11} erg cm $^{-2}$ s $^{-1}$)	2.7 ± 0.7	3.2 ± 0.4	3.4 ± 0.3	3.4 ± 0.2	$2.5^{+0.2}_{-0.3}$	2.68 ± 0.08
$L_{X,b}$ (10^{44} erg s $^{-1}$)	2.9 ± 0.7	2.2 ± 0.3	2.2 ± 0.2	2.0 ± 0.1	$1.7^{+0.1}_{-0.2}$	3.2 ± 0.1
$F_{X,f}$ (10^{-11} erg cm $^{-2}$ s $^{-1}$)	1.2 ± 0.3	1.2 ± 0.2	1.07 ± 0.08	1.24 ± 0.08	$1.0^{+0.1}_{-0.2}$	1.19 ± 0.04
$L_{X,f}$ (10^{44} erg s $^{-1}$)	0.25 ± 0.06	0.21 ± 0.03	0.19 ± 0.01	0.21 ± 0.01	$0.17^{+0.01}_{-0.02}$	0.27 ± 0.01
$N_{H,MW}$ (10^{20} cm $^{-2}$)	2.6*	2.6 ± 0.6	2.6*	2.6*	2.6*	2.6*
$N_{H,HG}$ (10^{20} cm $^{-2}$)	1.4*	1.4 ± 0.5	1.4*	1.4*	1.4*	1.4*
$N_{H,TDE}$ (10^{22} cm $^{-2}$)	0.7 ± 0.2	$1.3^{+0.9}_{-0.4}$	$0.1^{+0.3}_{-0.2}$	$0.9^{+0.3}_{-0.3}$	$0.5^{+0.4}_{-0.1}$	0.5 ± 0.1
$\log(\xi)$ (erg cm s $^{-1}$)	3.6 ± 0.1	4.1 ± 0.2	4.1 ± 0.1	$3.9^{+0.3}_{-0.1}$	$3.9^{+0.1}_{-0.2}$	3.7 ± 0.1
v_{rms} (km s $^{-1}$)	130 ± 30	110^{+30}_{-20}	60^{+60}_{-50}	120 ± 20	120^{+40}_{-30}	230^{+60}_{-50}
v_{shift} (km s $^{-1}$)	-180 ± 60	-210 ± 40	-360 ± 50	-130^{+50}_{-70}	-500^{+60}_{-70}	-490 ± 70
kT (eV)	50.0 ± 0.09	51.4 ± 0.1	50.0 ± 0.4	52.6 ± 0.4	52.6 ± 0.3	49.7 ± 0.9
Norm (10^{25} cm 2)	5.7 ± 1.4	3.7 ± 0.5	4.0 ± 0.3	3.0 ± 0.2	$2.5^{+0.1}_{-0.2}$	6.1 ± 0.2
χ^2/ν	704.8/567	870.5/563	687.8/564	726.8/565	266.5/178	626.5/566

Above: Miller et al, incl. WPM, SBC, SG, JG (2015)

Late-time X-ray Spectroscopy (preliminary)

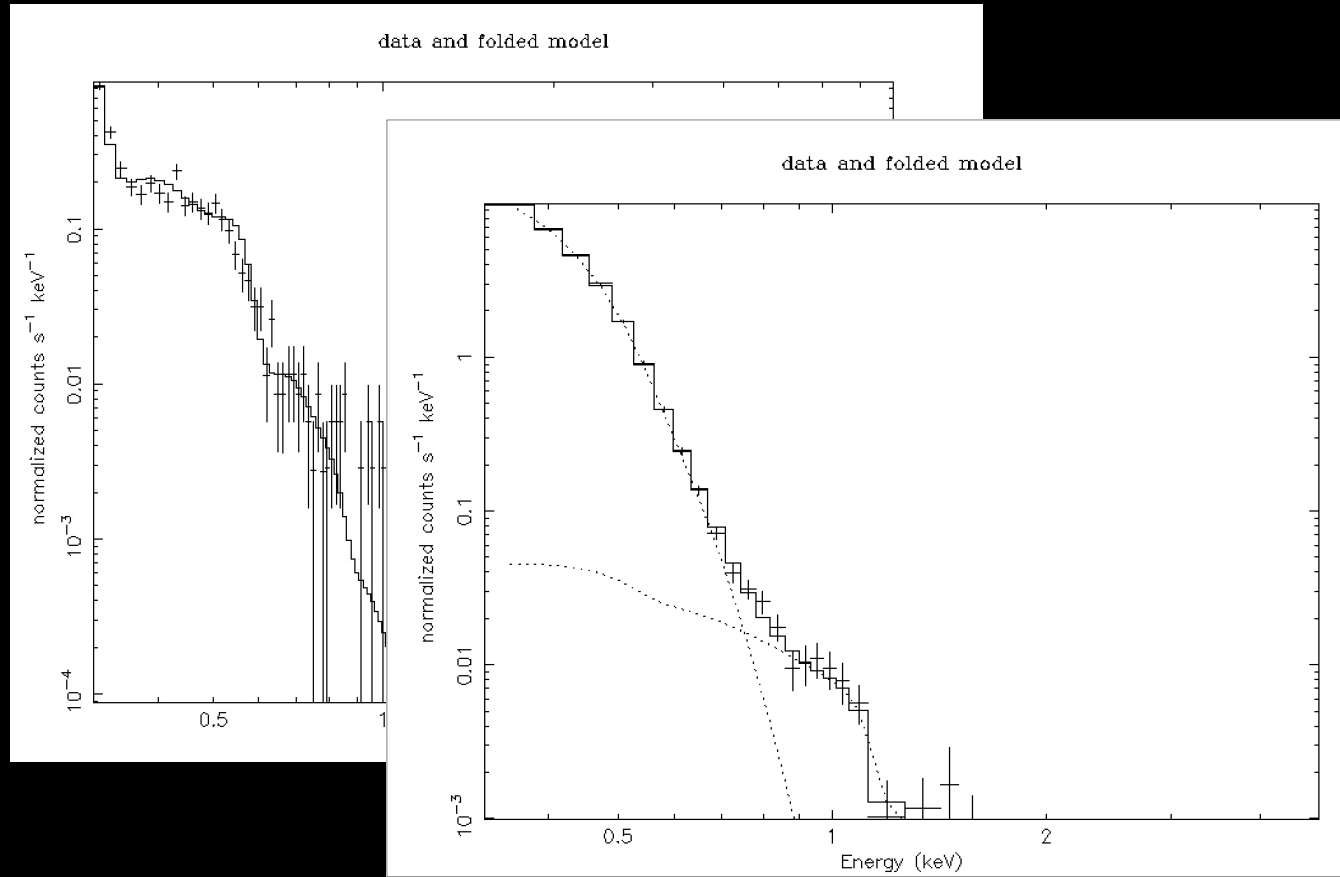


Multi-component modeling



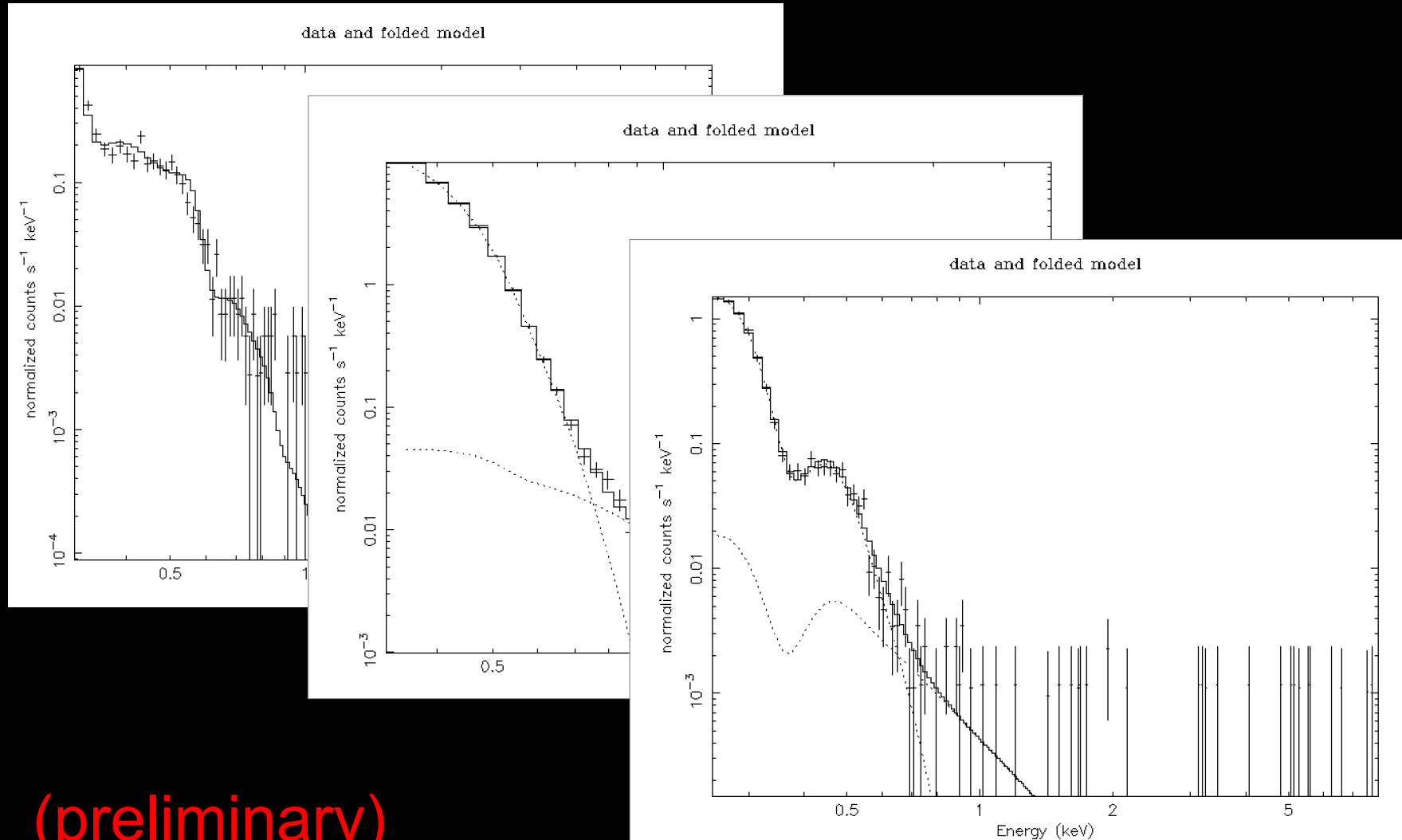
(preliminary)

Multi-component modeling



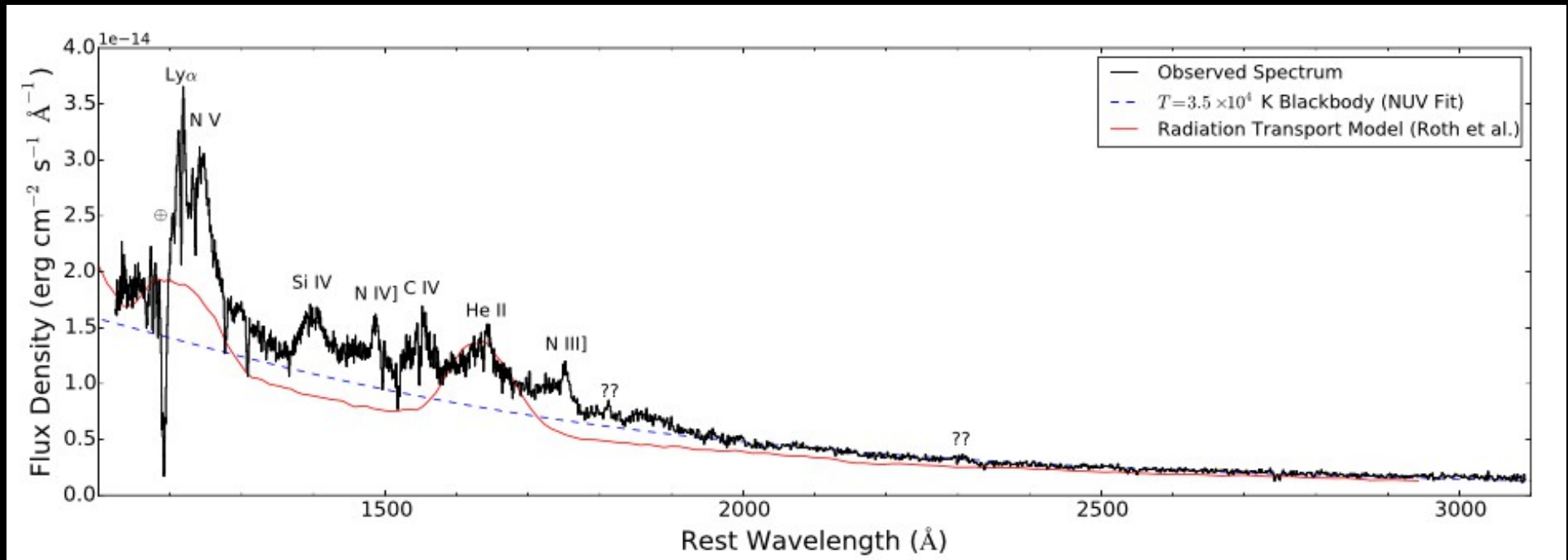
(preliminary)

Multi-component modeling



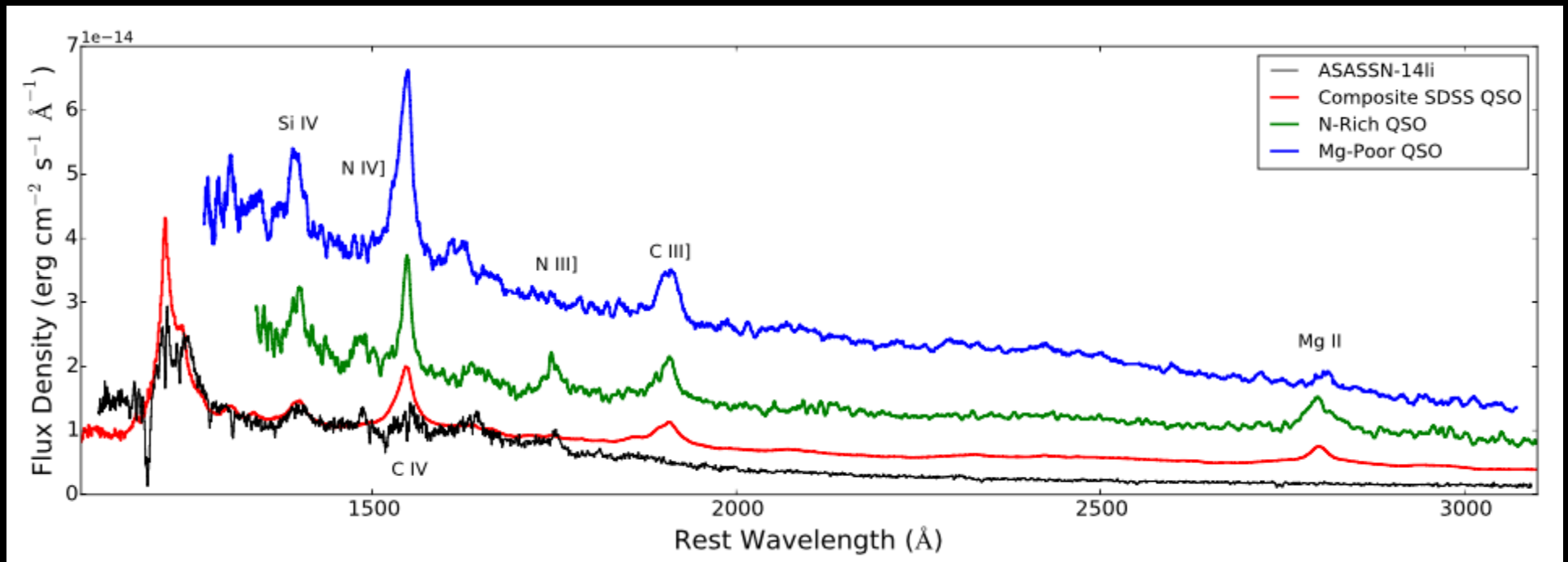
(preliminary)

Following up the first FUV/MUV TDE spectroscopy



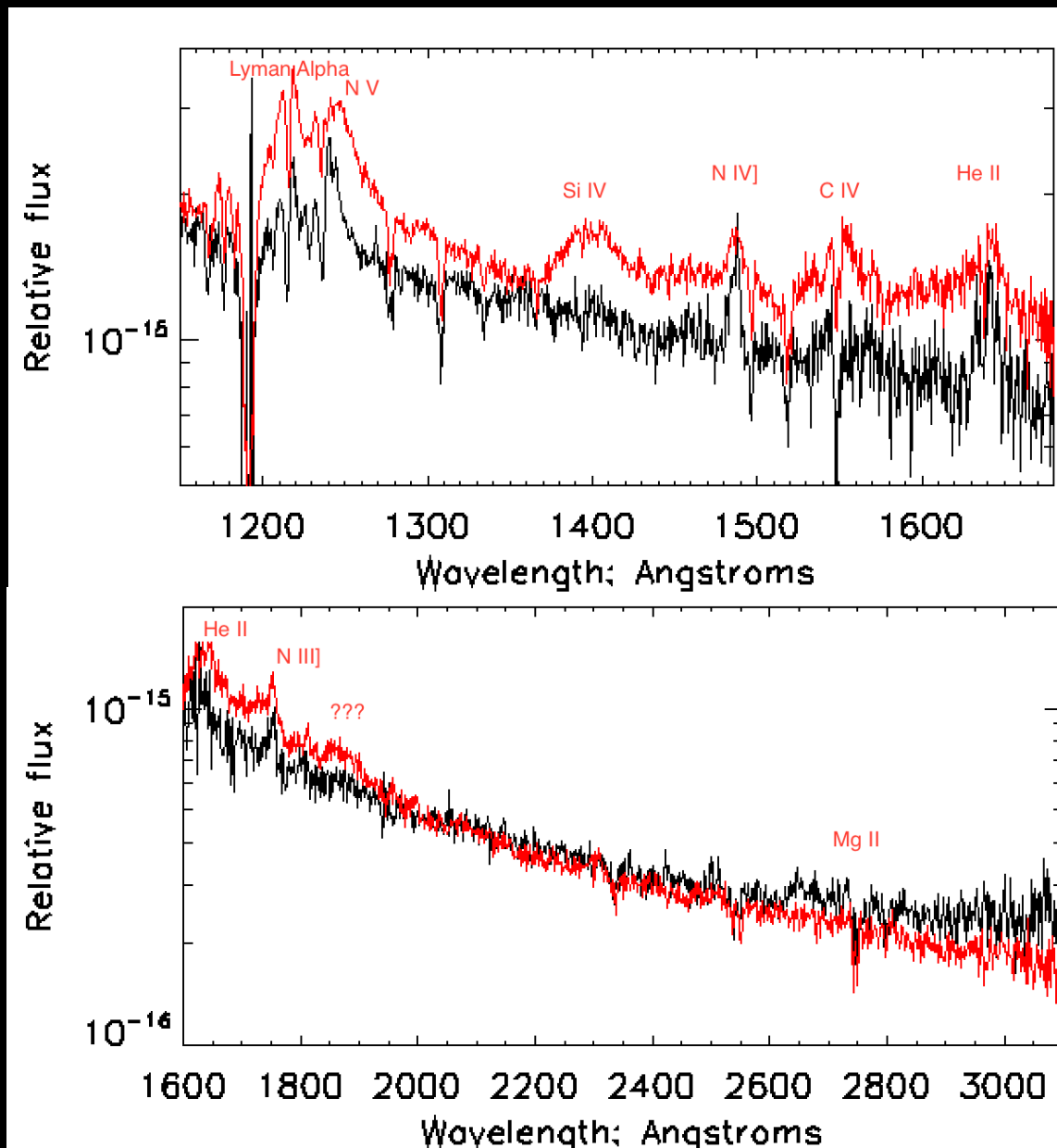
Cenko et al, 2016 (incl. WPM)

Not a Typical Quasar!

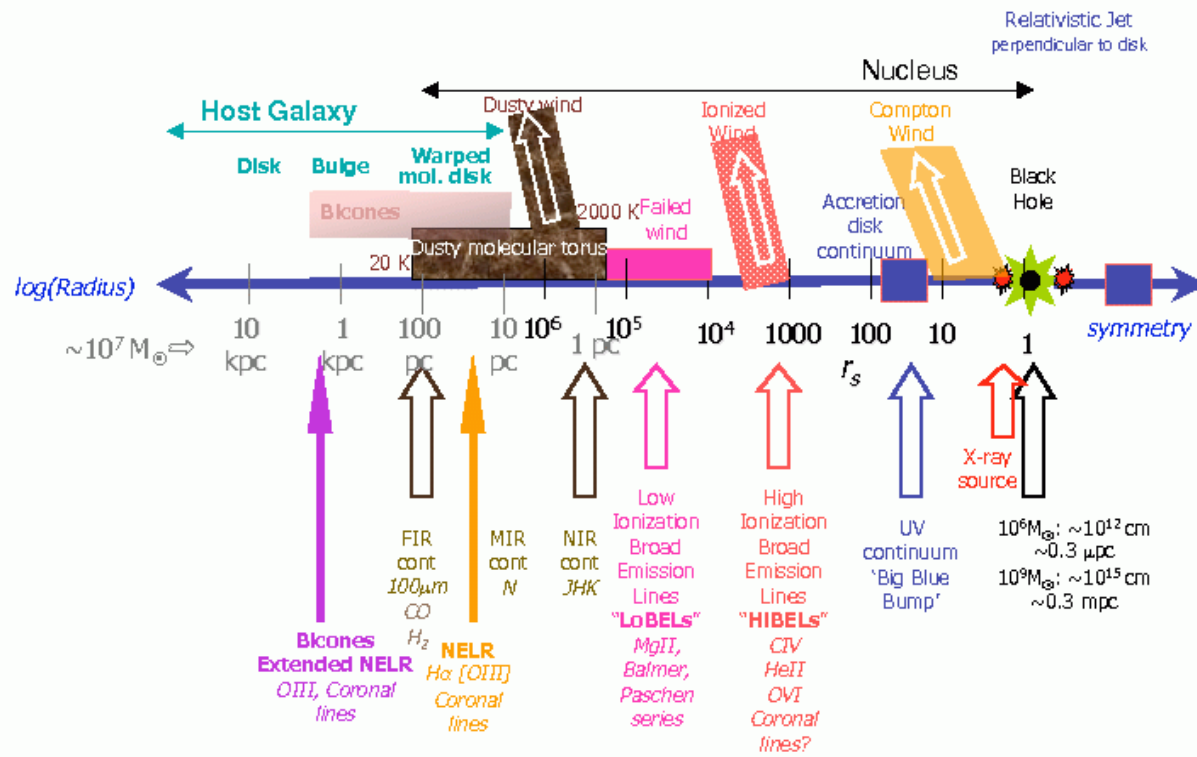


Cenko et al, 2016

(preliminary)

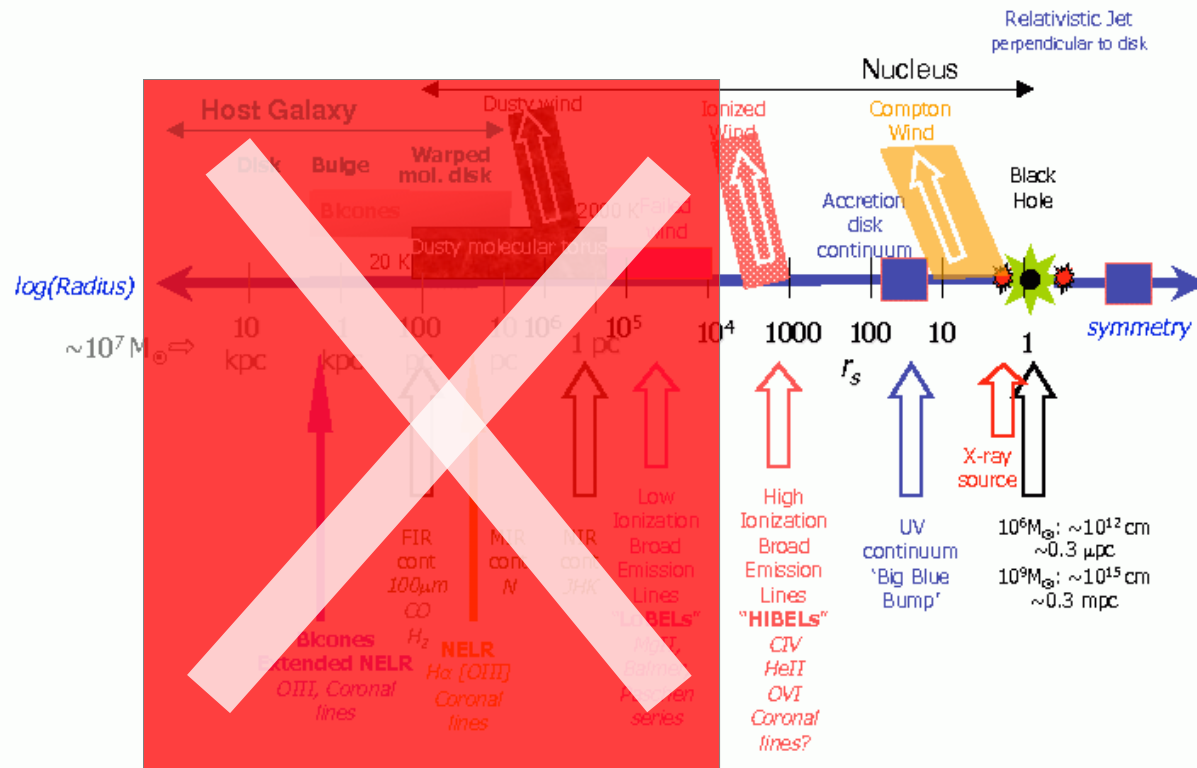


Scale of Quasar/AGN Components



Martin Elvis, September 2007

Scale of Quasar/AGN Components



Martin Elvis, September 2007

Closing Thoughts

- X-ray absorption is likely more complex than previously modeled; needs more exploration. But some components are stable after ~1 year!
- Good S/N critical for multi-component models, but still lots of options to choose from.
 - These can make a huge difference in L_x , particularly towards L_{EUV} .
 - Use caution interpreting Swift XRT data: XRT can't really constrain evolving models of ultrasoft emission.
 - Note for the 2020 decadal: ATHENA+ wavelength resolution suffers at supersoft energies. A grating (such as on Lynx) would be a huge improvement!
- UV spectra:
 - Line emission damped at late times: has the wind died with the accretion rate?
 - Helium and semi-forbidden Nitrogen: still going strong!
 - But still no Lo-BELs
- More to come!