X-ray Obscured Type 1 AGN in BASS

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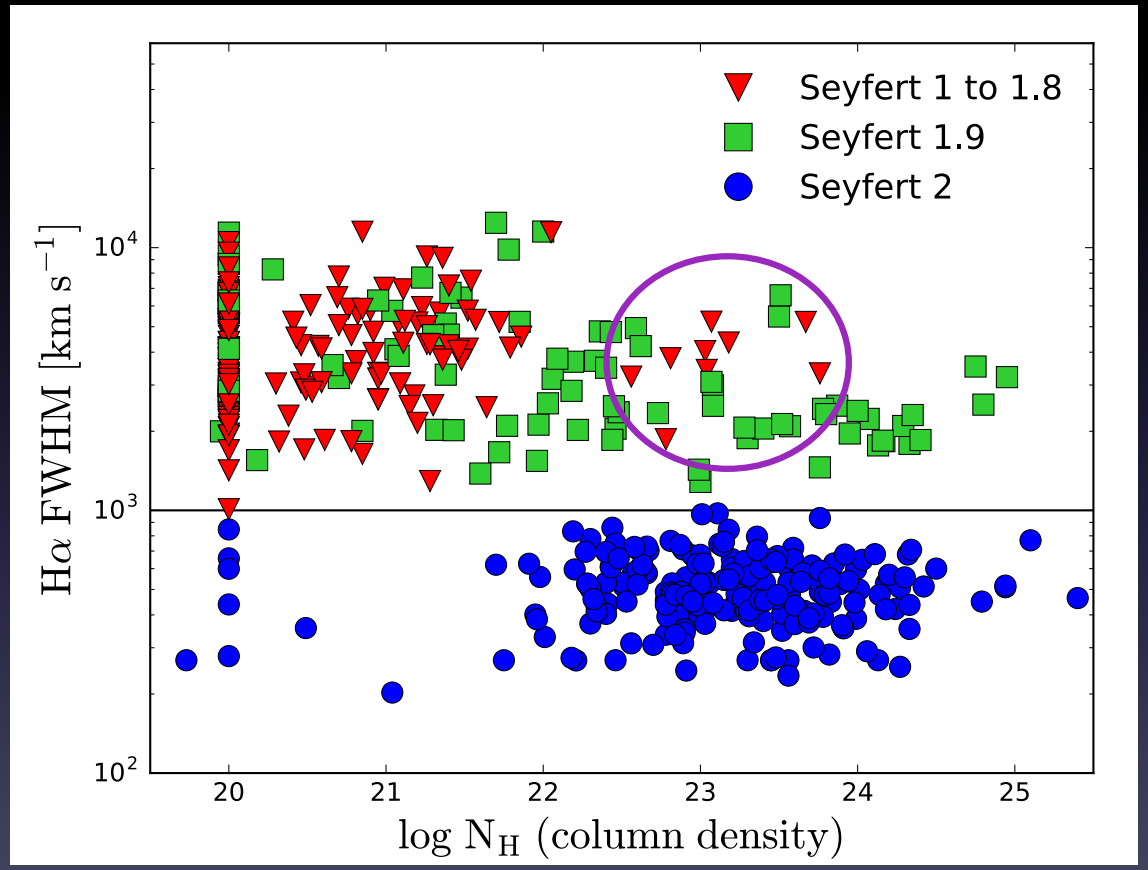
BASS Workshop 2019

OBSCURED TYPE 1 AGN IN BASS

- Optically classified as Type 1
- X-ray column density > 10^{22} cm^{-2}



Koss et al. 2017

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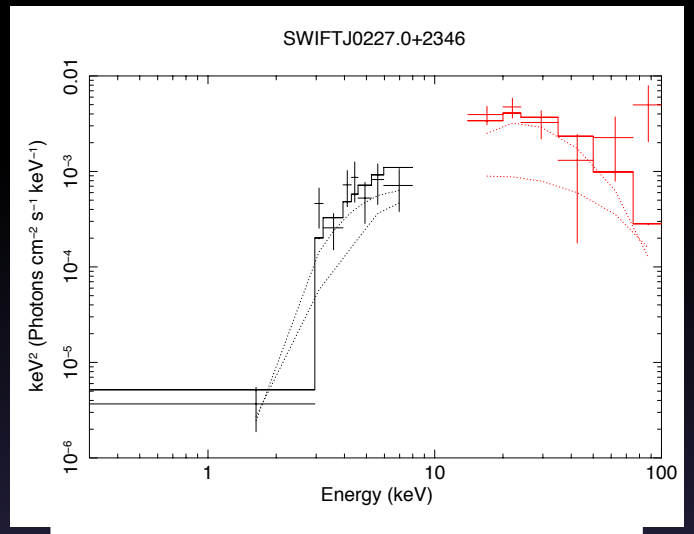

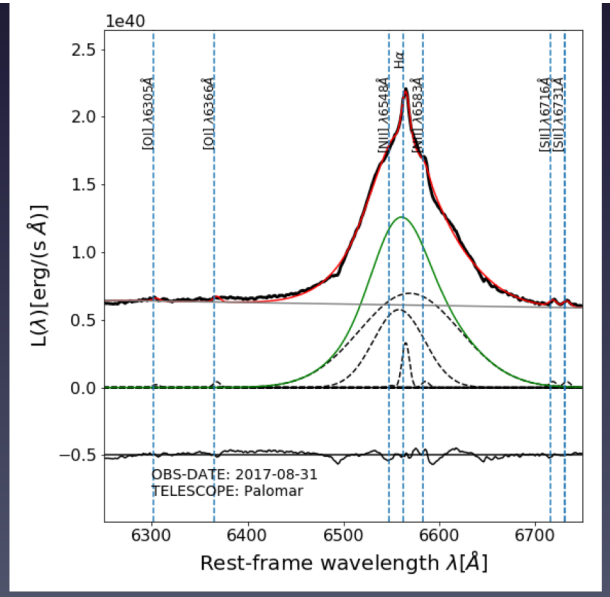

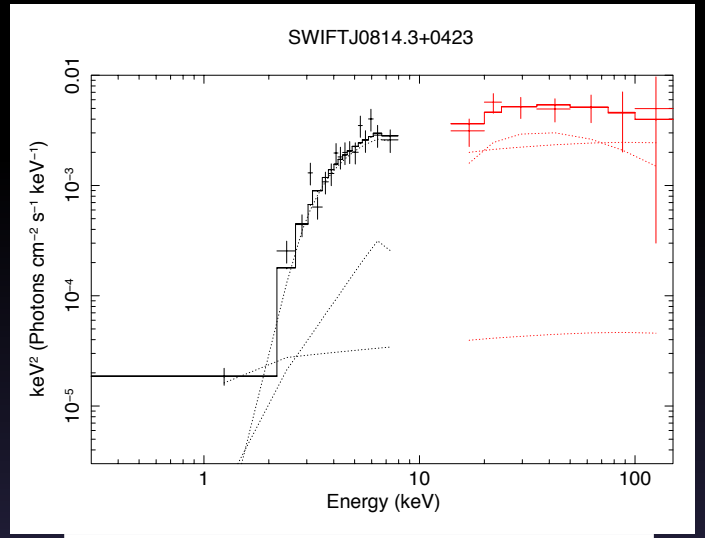

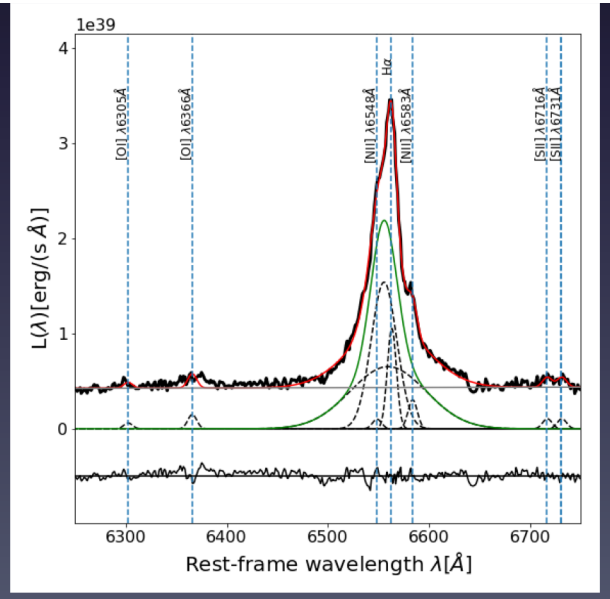

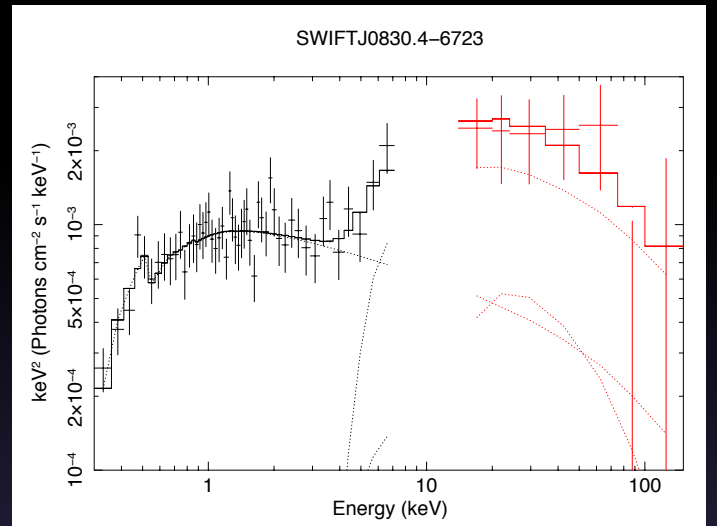

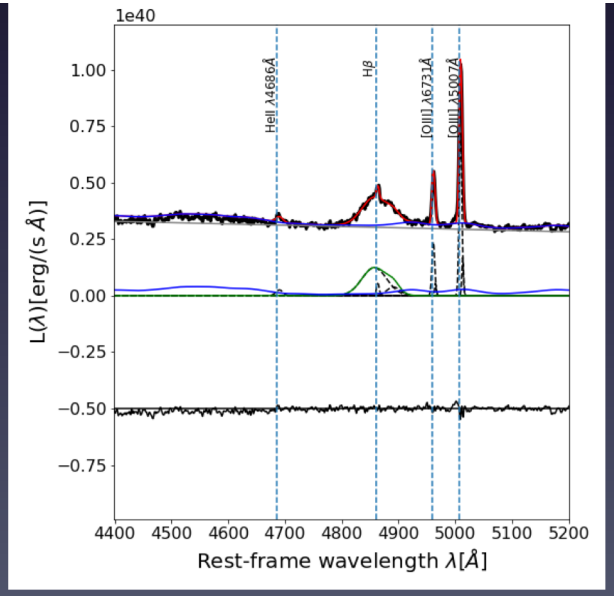

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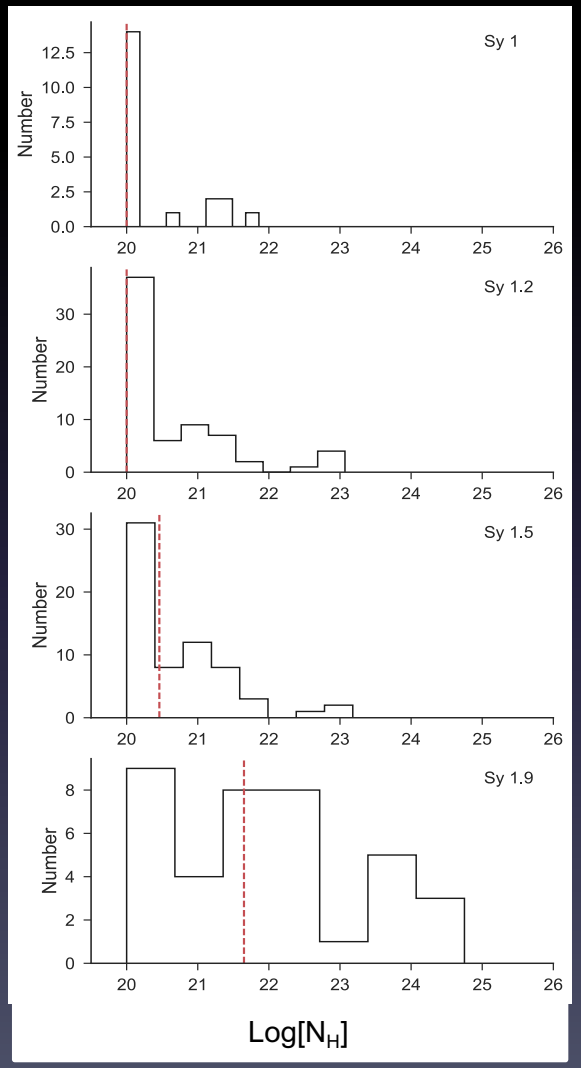
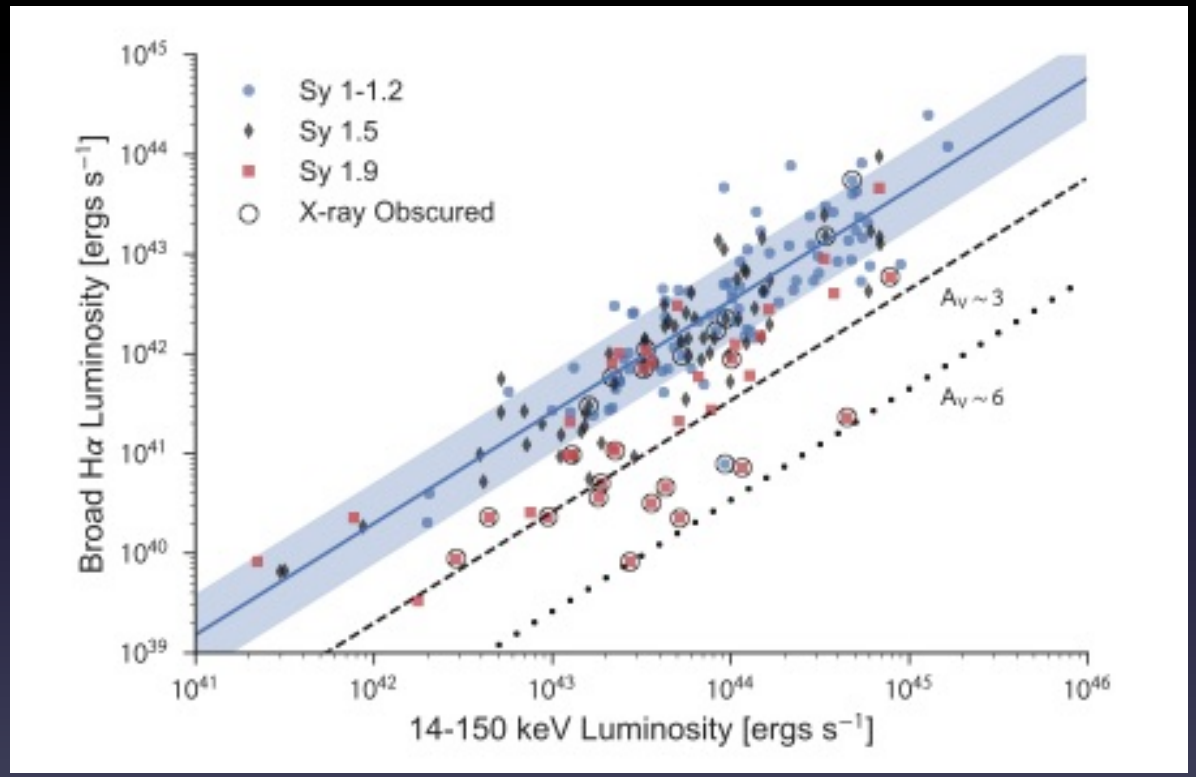


Shimizu et al. 2017



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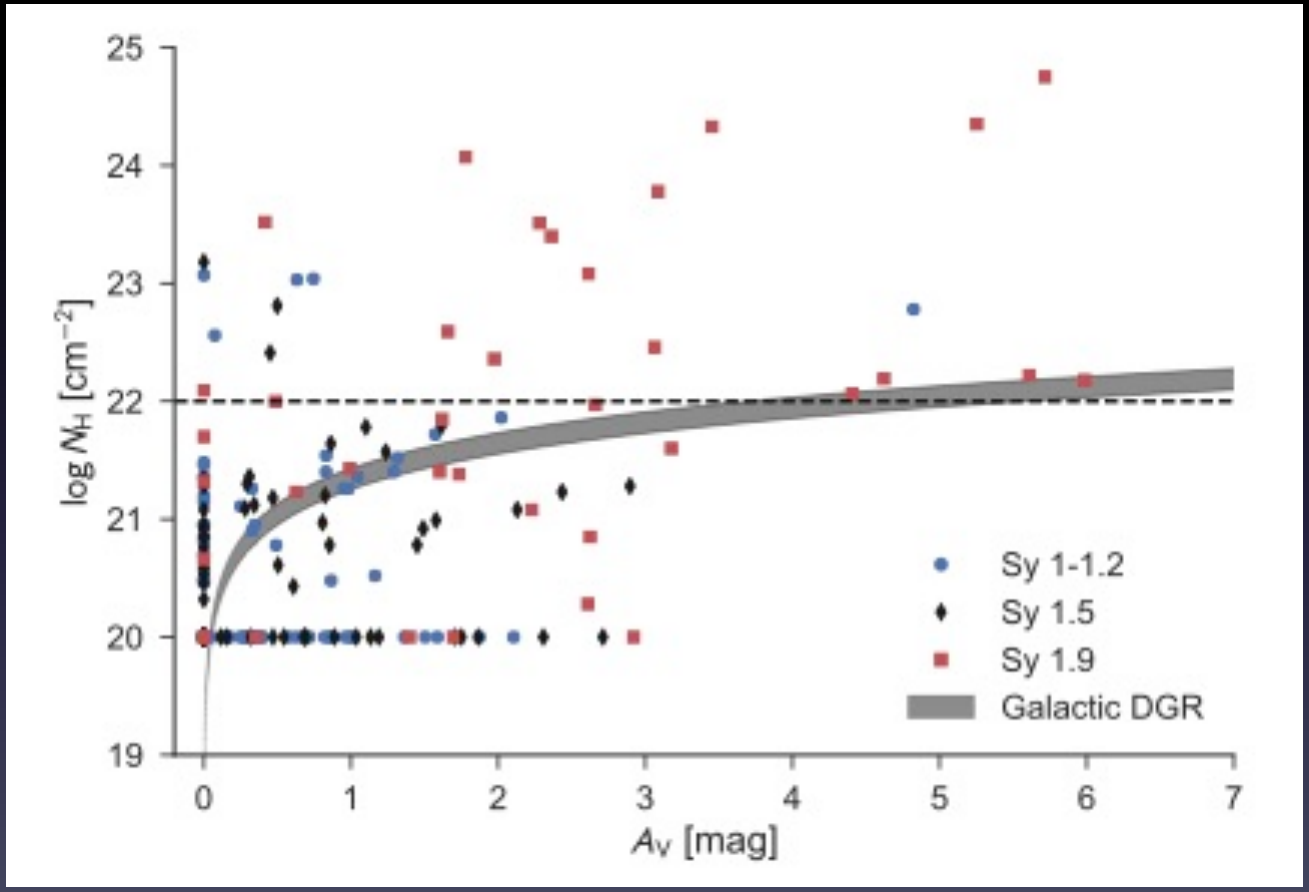
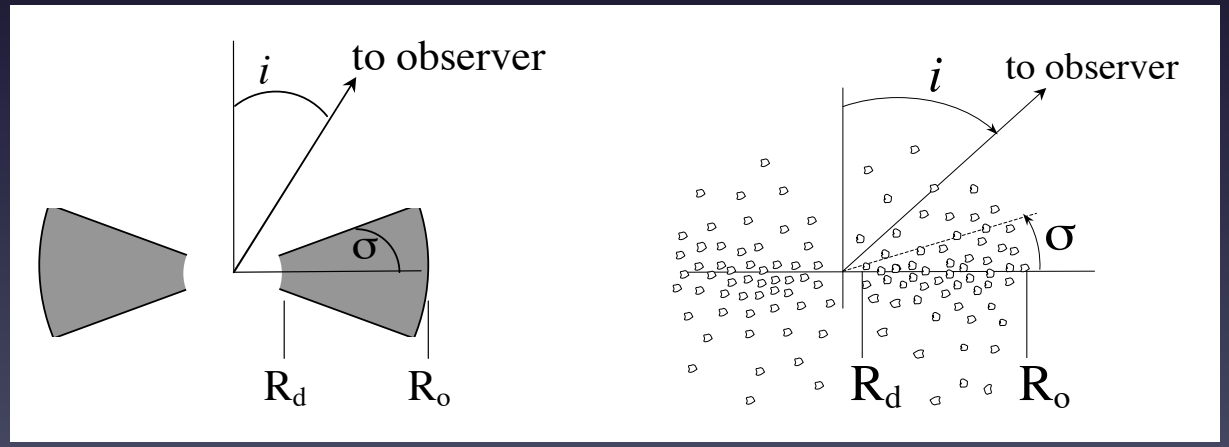


Shimizu et al. 2017

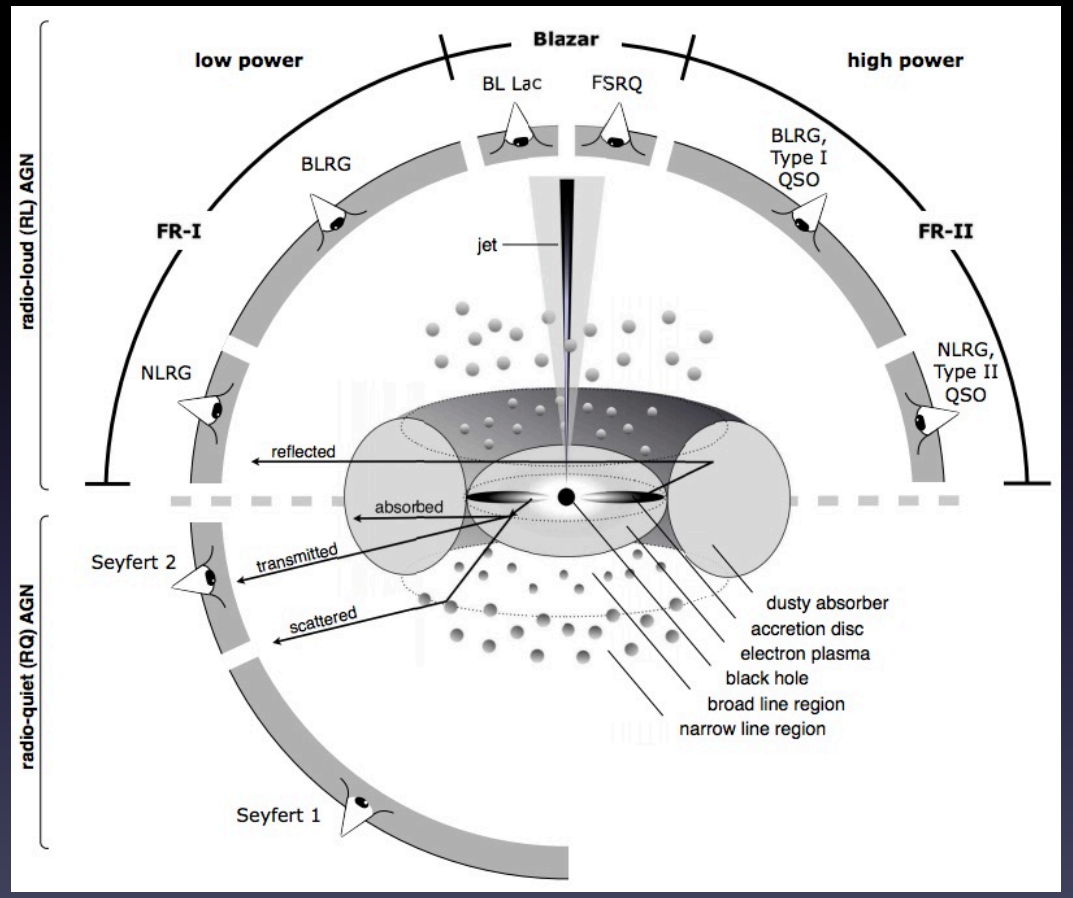
- ~14 % of Sy 1-1.9 from BASS sample are X-ray absorbed
- BLR provides extra obscuration towards corona

PHYSICAL SCENARIOS

- Neutral, dust free torus
- Line of sight grazing edge of torus
- Cloud passing line of sight in clumpy torus
- Ionized gas outflows



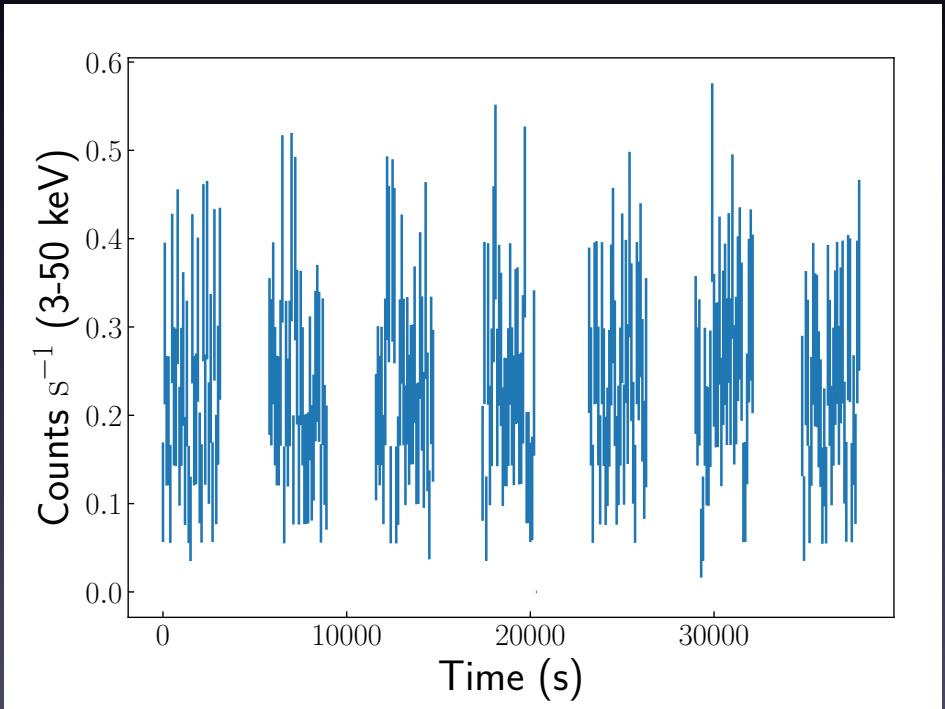
M. Elitzur 2006



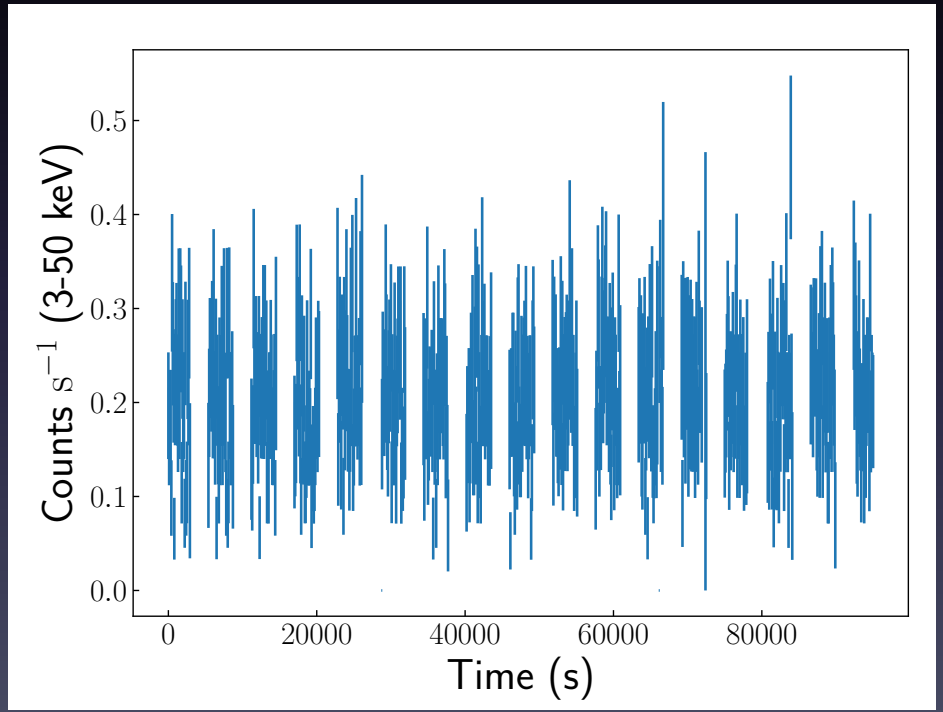
Beckmann & Schrader 2012

NuSTAR OBSERVATIONS OF 2MASX J19301380+3410495

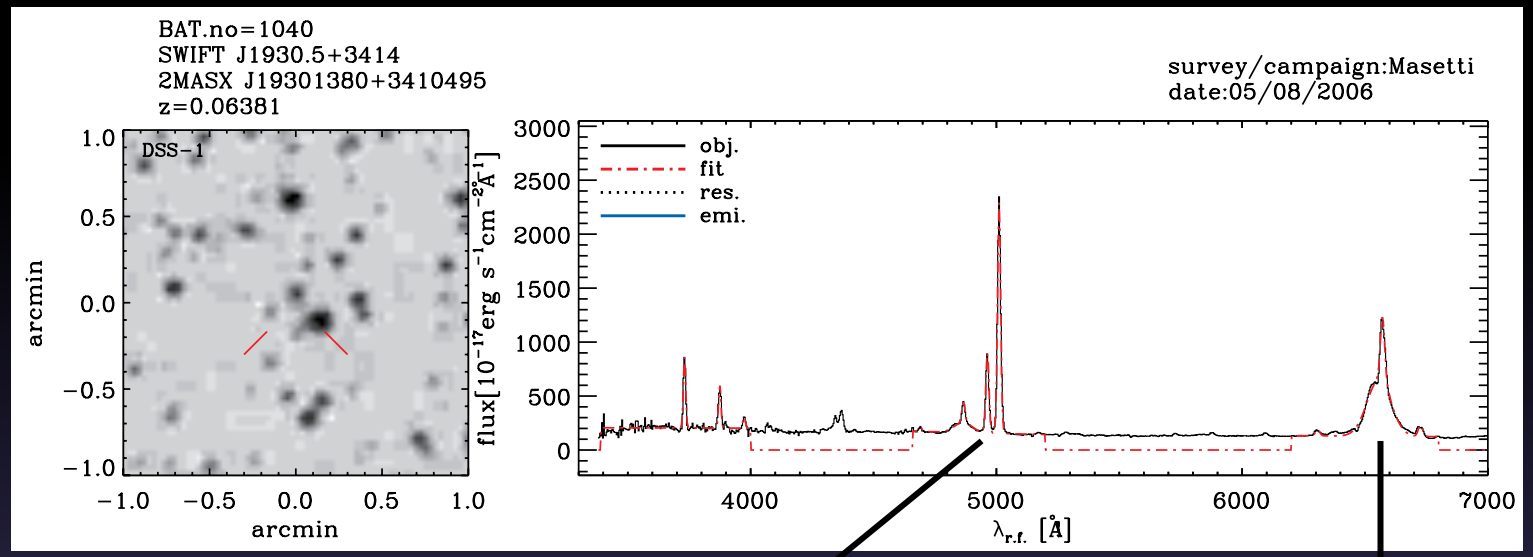
2016 obs, 20 ks

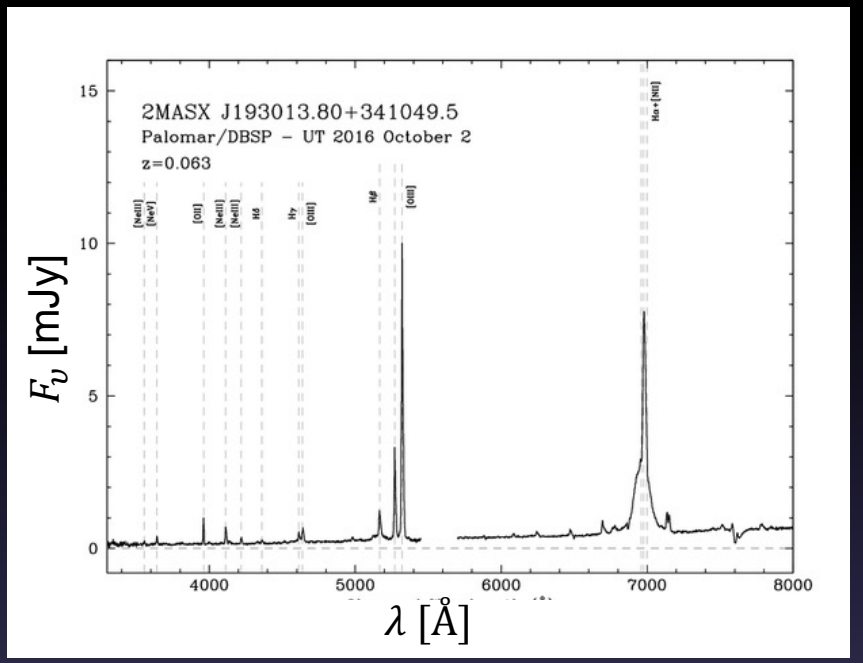


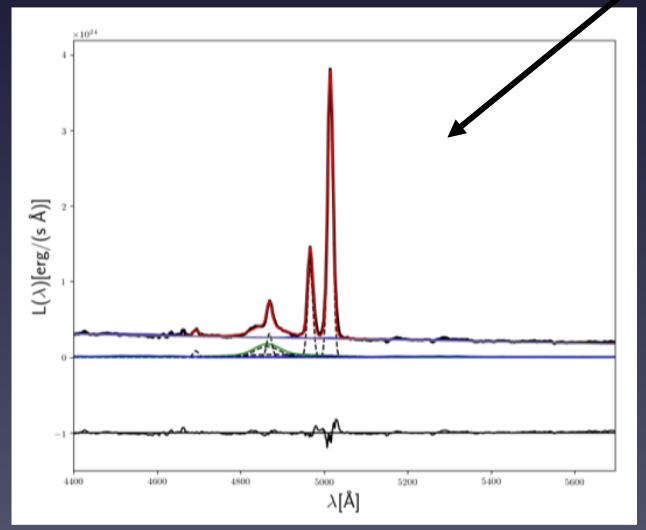
2017 obs, 50 ks

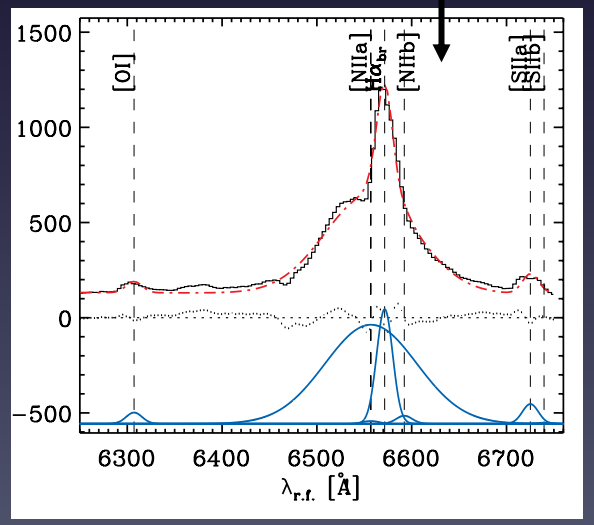


OPTICAL SPECTRA







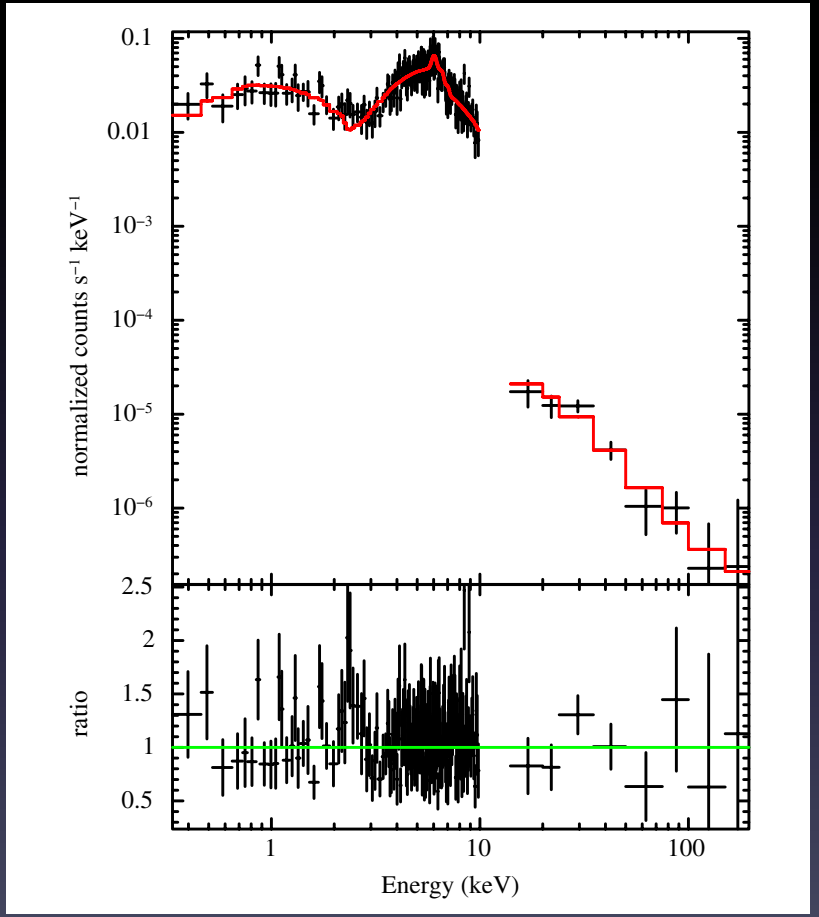


Optical spectra consistently show broad Hα and Hβ lines → Type 1 AGN

X-RAY SPECTRAL MODELING

- Archival *Swift*/BAT, XRT, XMM spectra show $N_H > 10^{23}$ cm^{-2}
- XSPEC models (this work):

1. `zphabs x cabs x cutoffpl + pexrav + zgauss + (const. x cutoffpl)`
2. `cabs x Tbfeo x cutoffpl + pexmon + (const. x cutoffpl)`
3. `Borus`

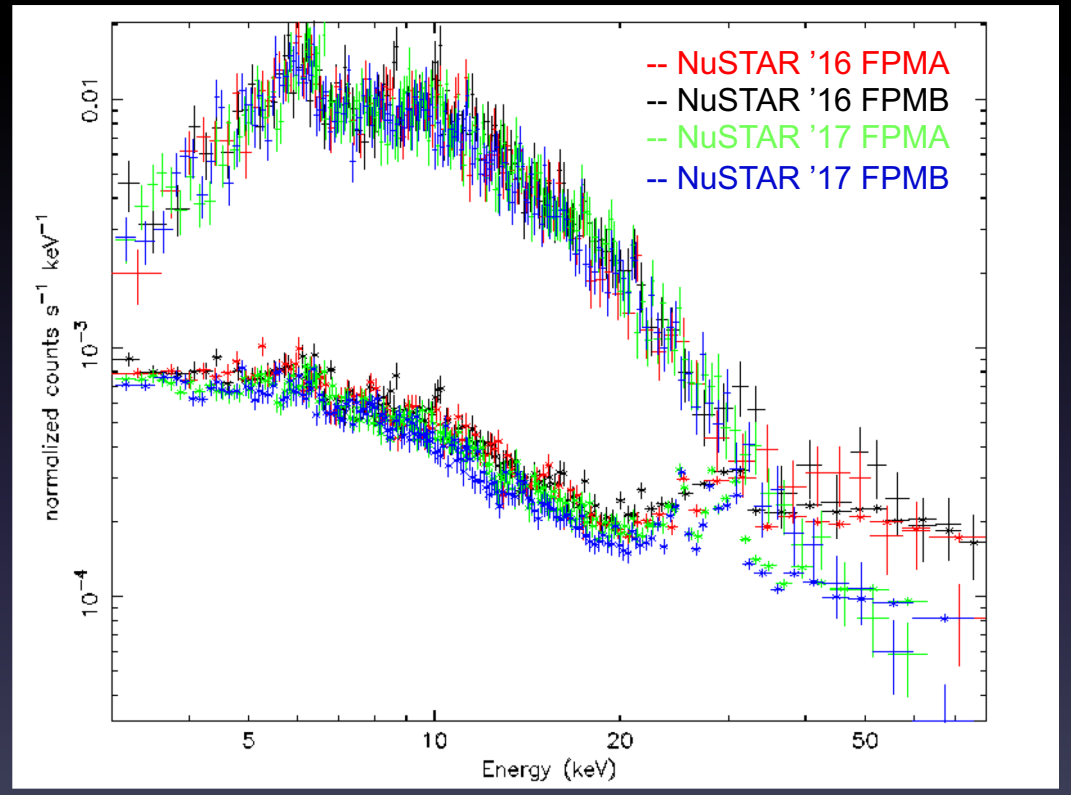


Hogg et al. 2012

X-RAY SPECTRAL MODELING

Data:

- NuSTAR – 2016 (up to 30 keV) + 2017 (3-79 keV)
- Archival XMM – 2009 (PN+MOS1+MOS2)
- Swift/BAT 70-month averaged spectra



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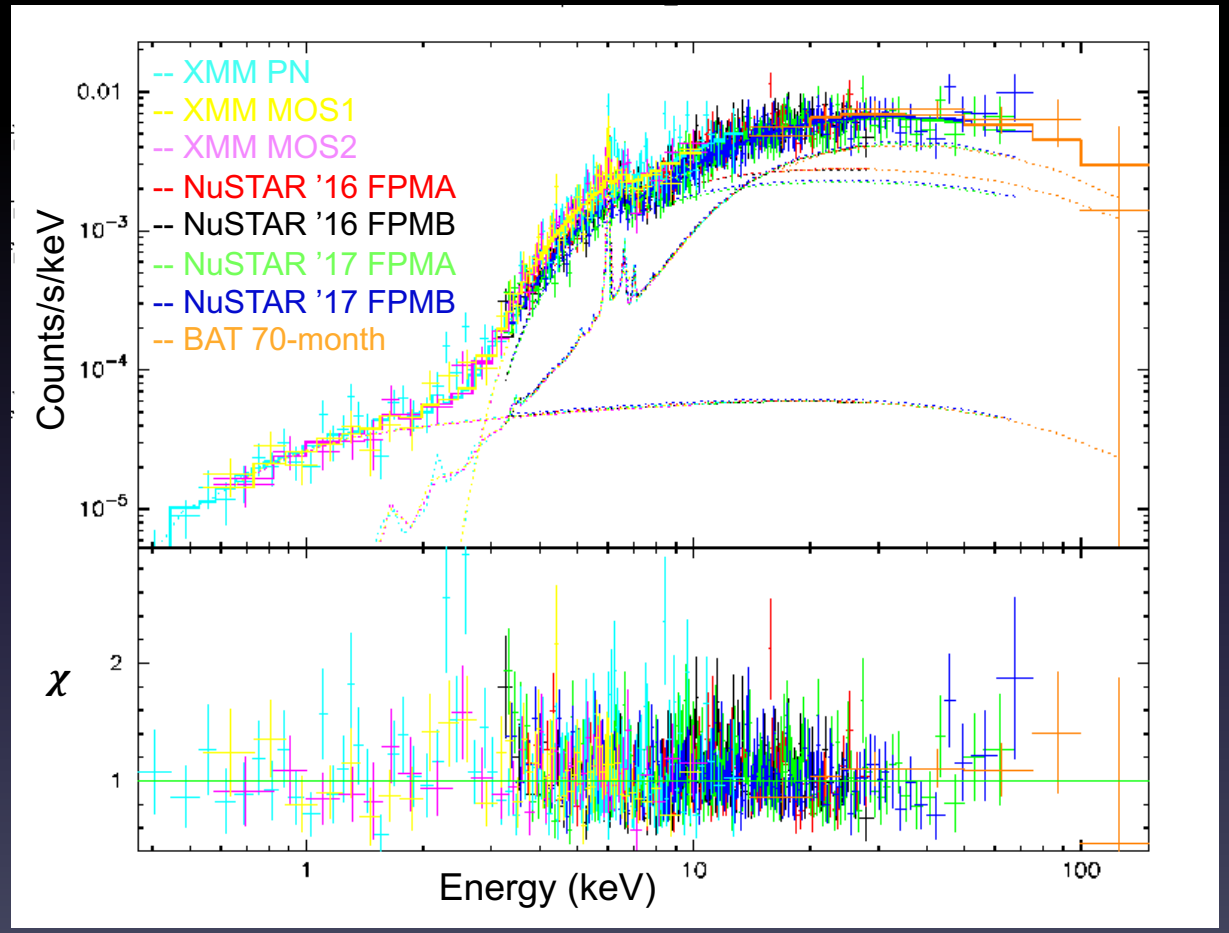
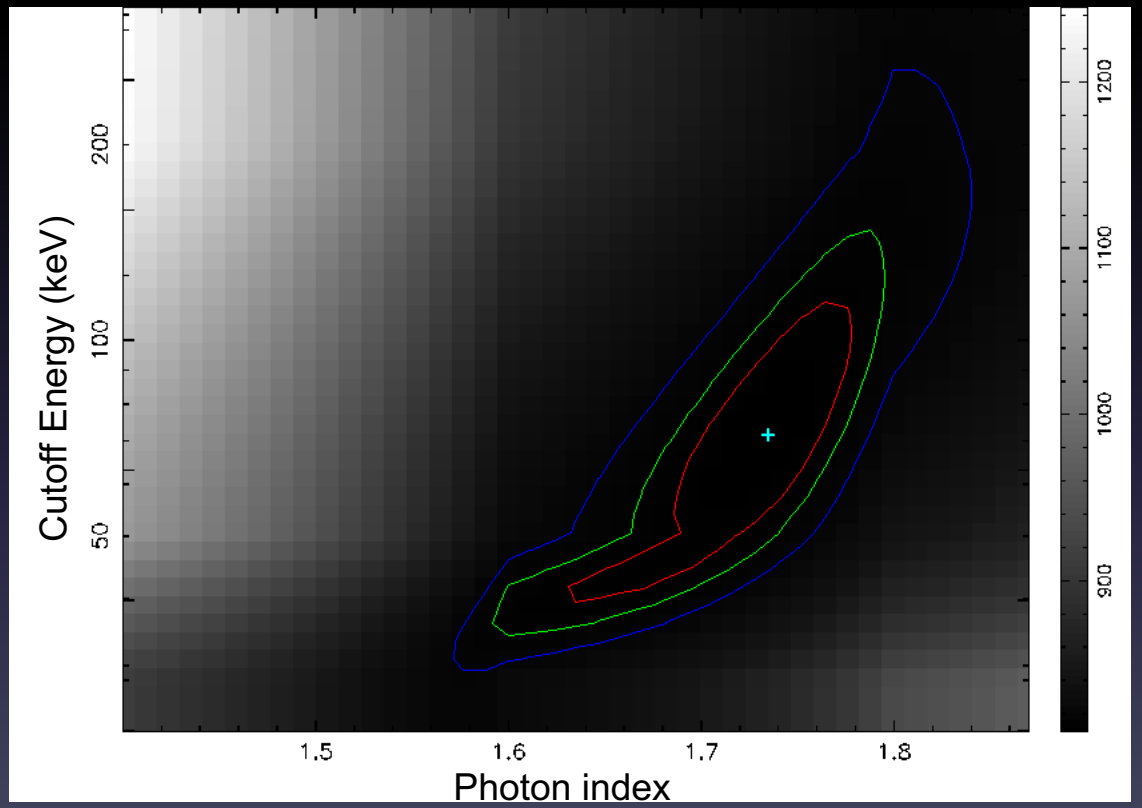




Borus model

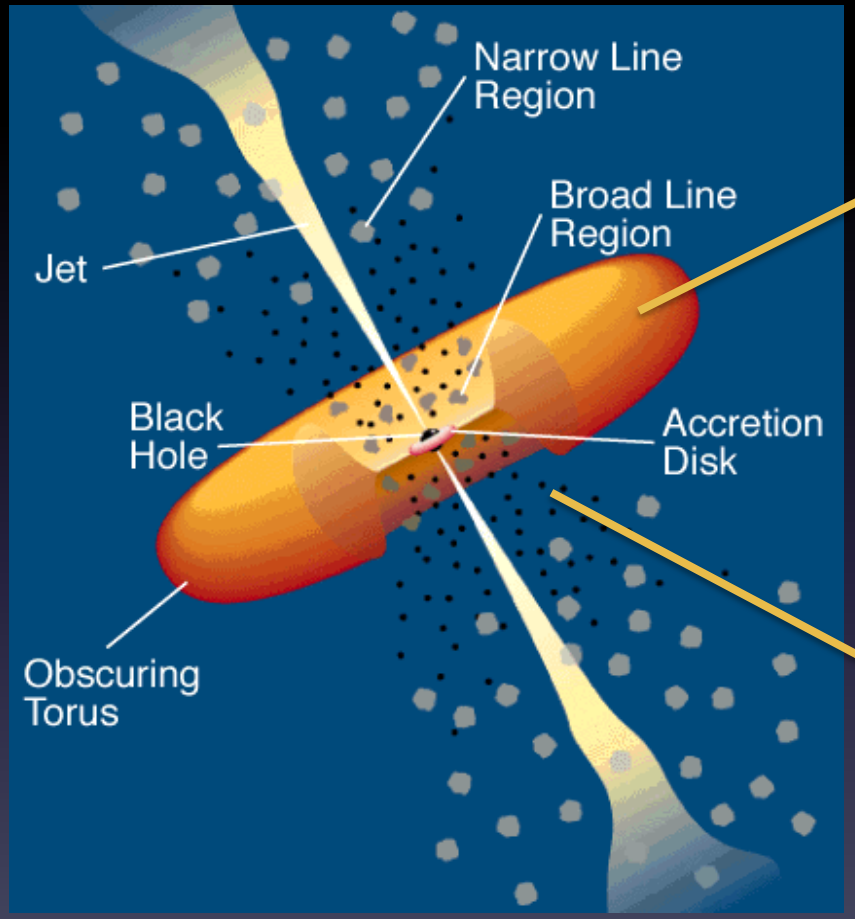
X-RAY SPECTRAL MODELING

Model	χ^2/dof	NuSTAR 2017 N_H (cm^{-2})	Γ	E_{cut} (keV)	R	Fe abundance
pexrav	826/798	(3.8±0.3) x 10^{23}	$1.35^{+0.18}_{-0.15}$	$49.9^{+19.0}_{-11.2}$	-$[0.90^{+0.23}_{-0.32}]$	1 (fixed)
pexmon	806/798	$5.5^{+0.7}_{-0.5}$ x10^{23}	$1.33^{+0.21}_{-0.14}$	$49.9^{+38.3}_{-13.2}$	-$[0.70^{+0.10}_{-0.22}]$	1.09
borus	808/795	$4.9^{+0.5}_{-0.7}$ x10^{23}	$1.73^{+0.05}_{-0.27}$	$71.9^{+24.2.}_{-41.0}$	-	$0.45^{+0.06}_{-0.05}$

FUTURE PLANS

- NuSTAR Cycle 5 proposal to study subsample of obscured type 1 AGN
- Currently available X-ray data: NuSTAR 20 ks legacy survey observations of some sources
- Ideas/thoughts/comments?

AGN UNIFICATION



Urry & Padovani 1995