The X-rays from Intermediate-mass Black Holes in Active Galaxies

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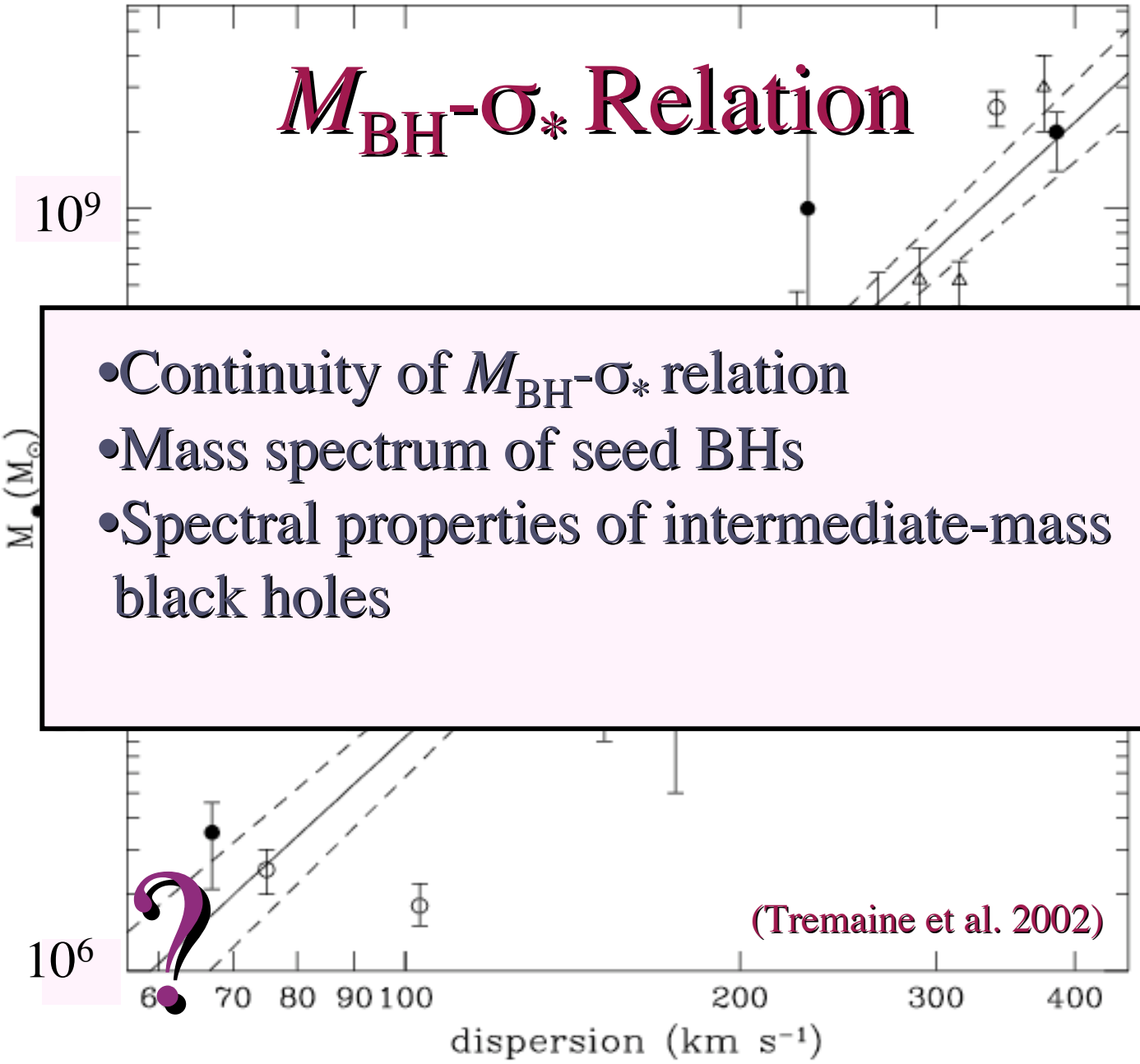
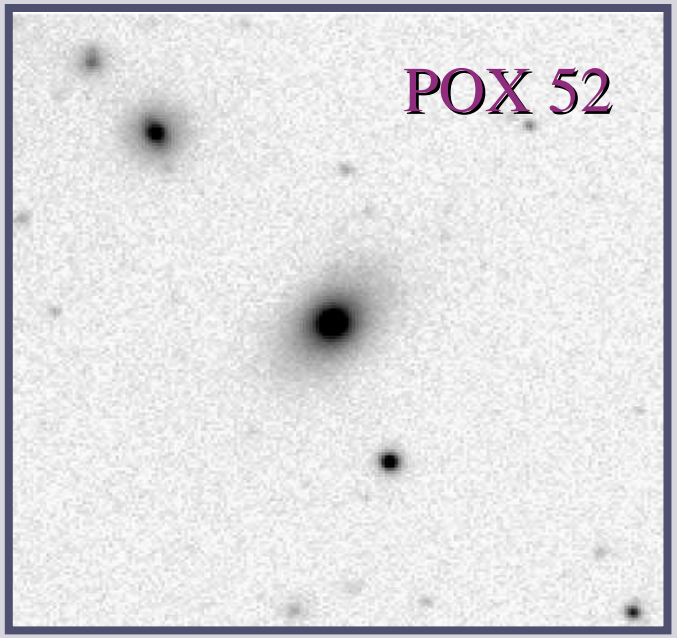
M_{BH}-σ_* Relation

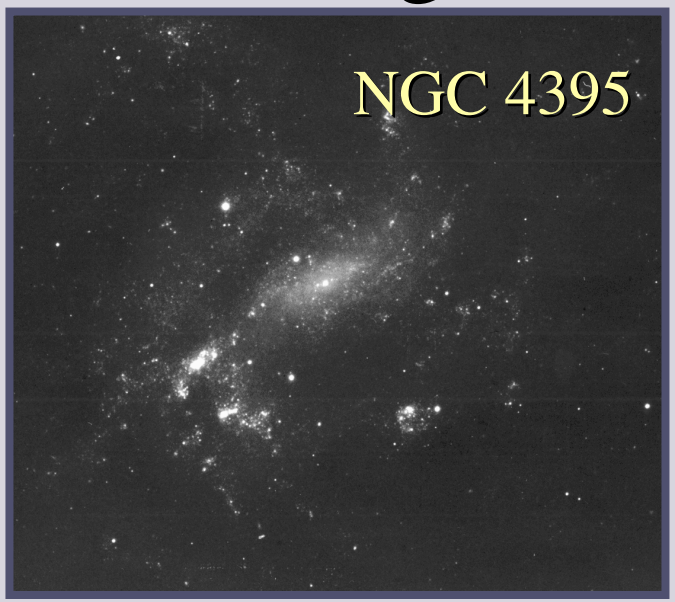


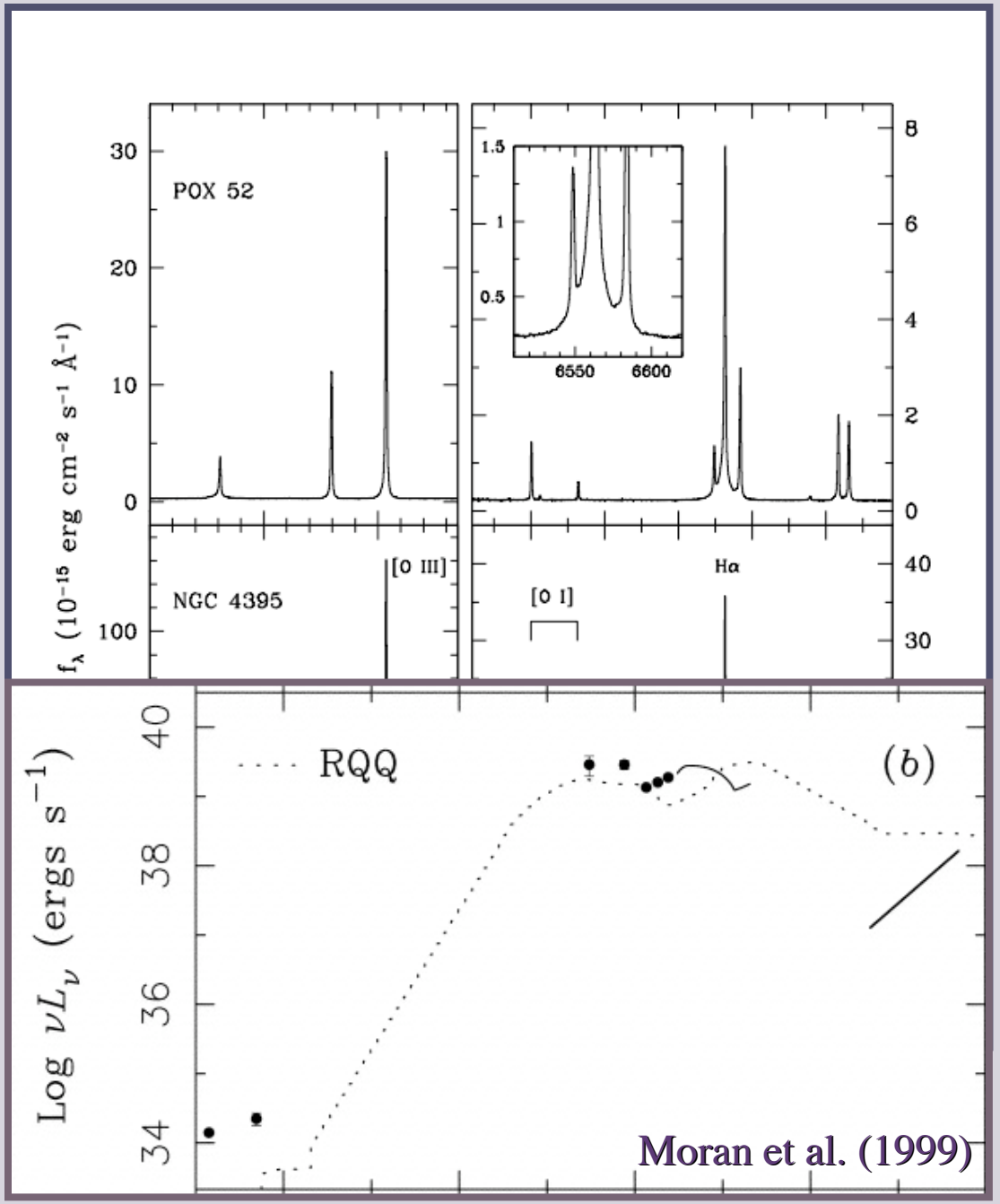
- Continuity of M_{BH}-σ_* relation
- Mass spectrum of seed BHs
- Spectral properties of intermediate-mass black holes

(Tremaine et al. 2002)

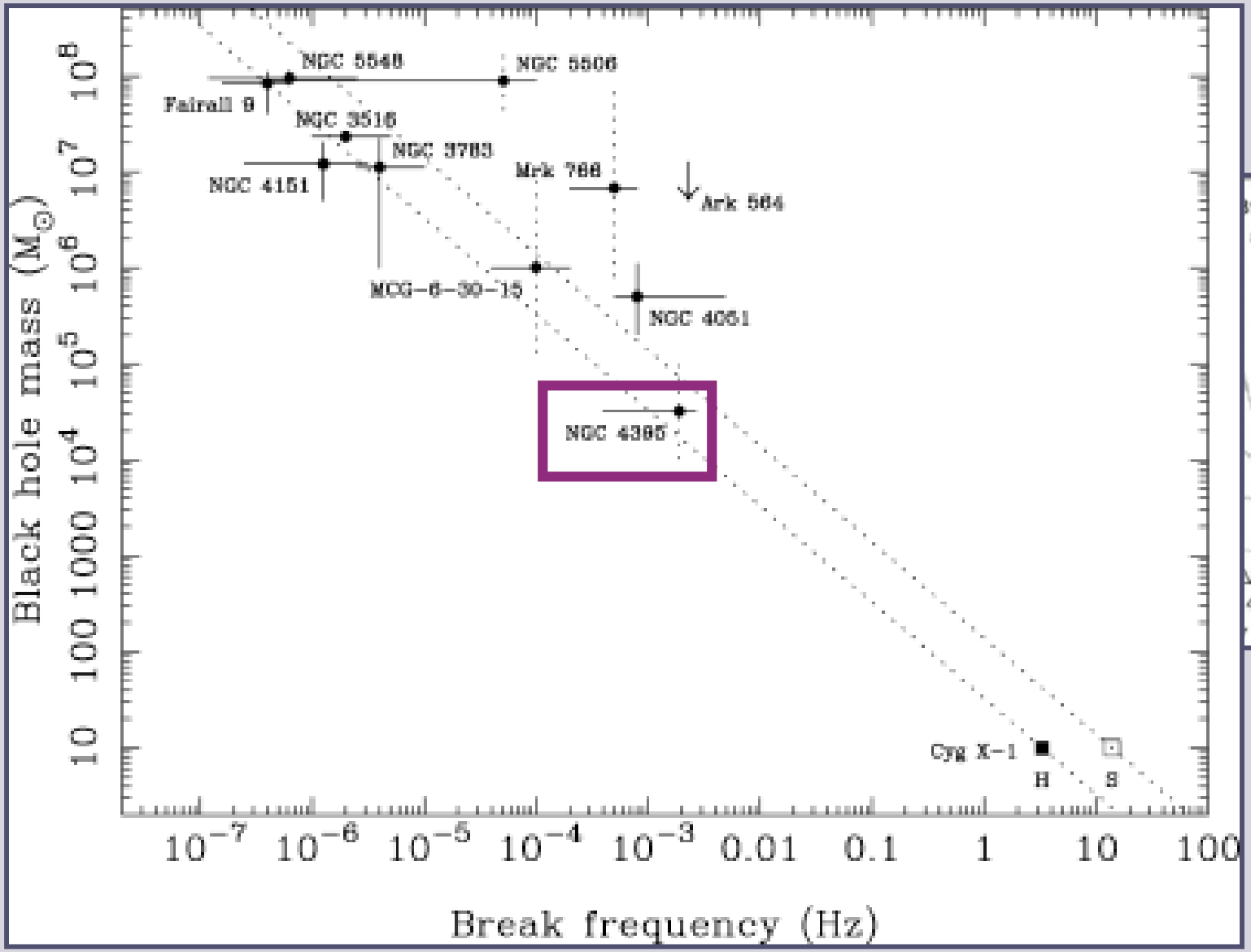

POX 52

No Bulges!

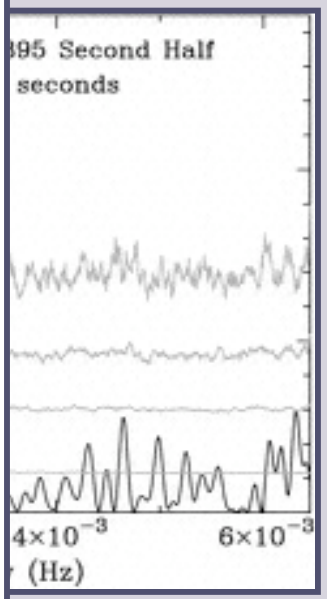

NGC 4395

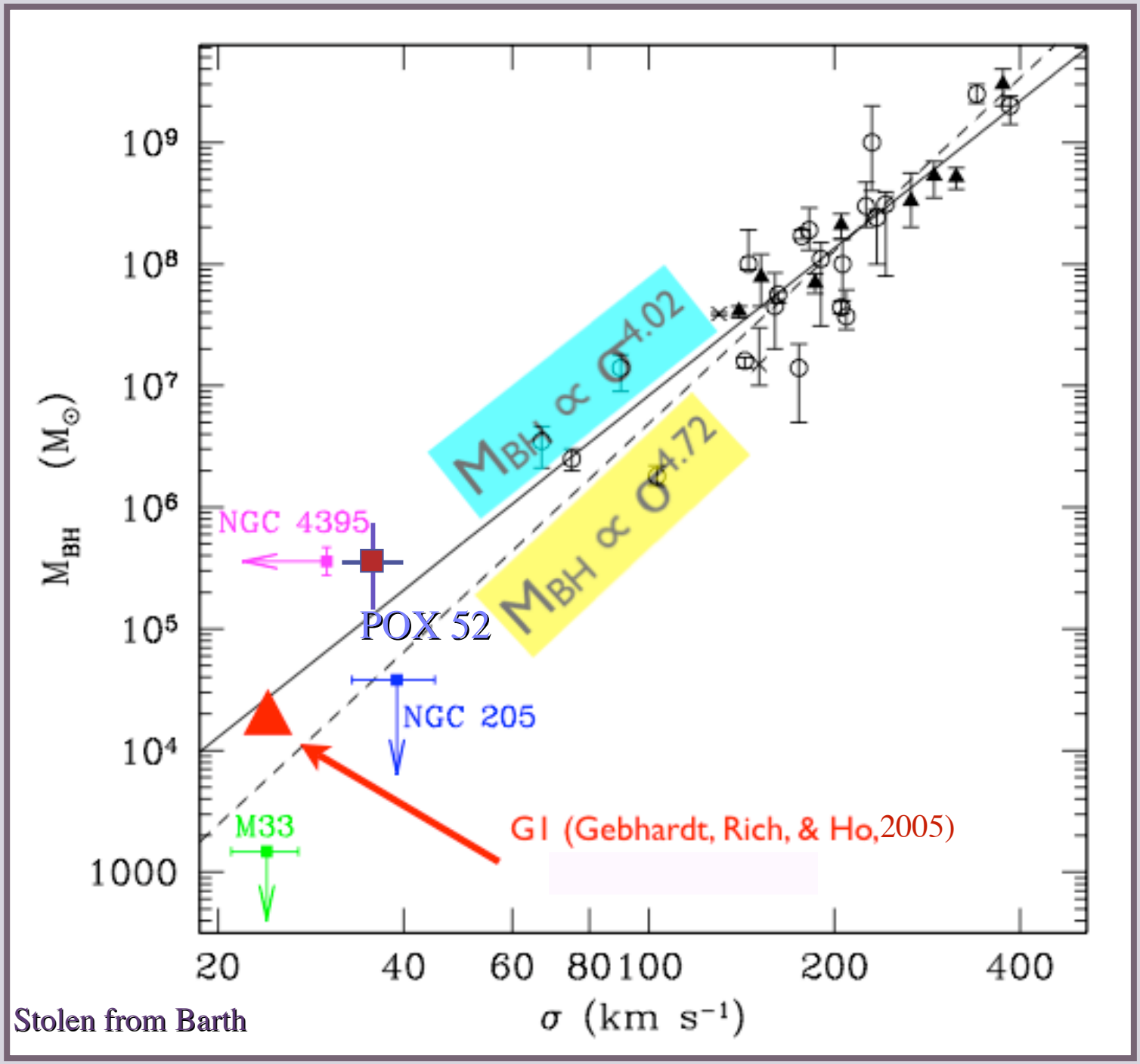

POX 52
NGC 4395
[O III]
[O I]
Hα
f_λ (10^{-15} erg cm^{-2} s^{-1} Å^{-1})
RQQ
(b)
Log νL_ν (ergs s^{-1})
Moran et al. (1999)

Extreme X-ray Variability



cycles)!





Stolen from Barth

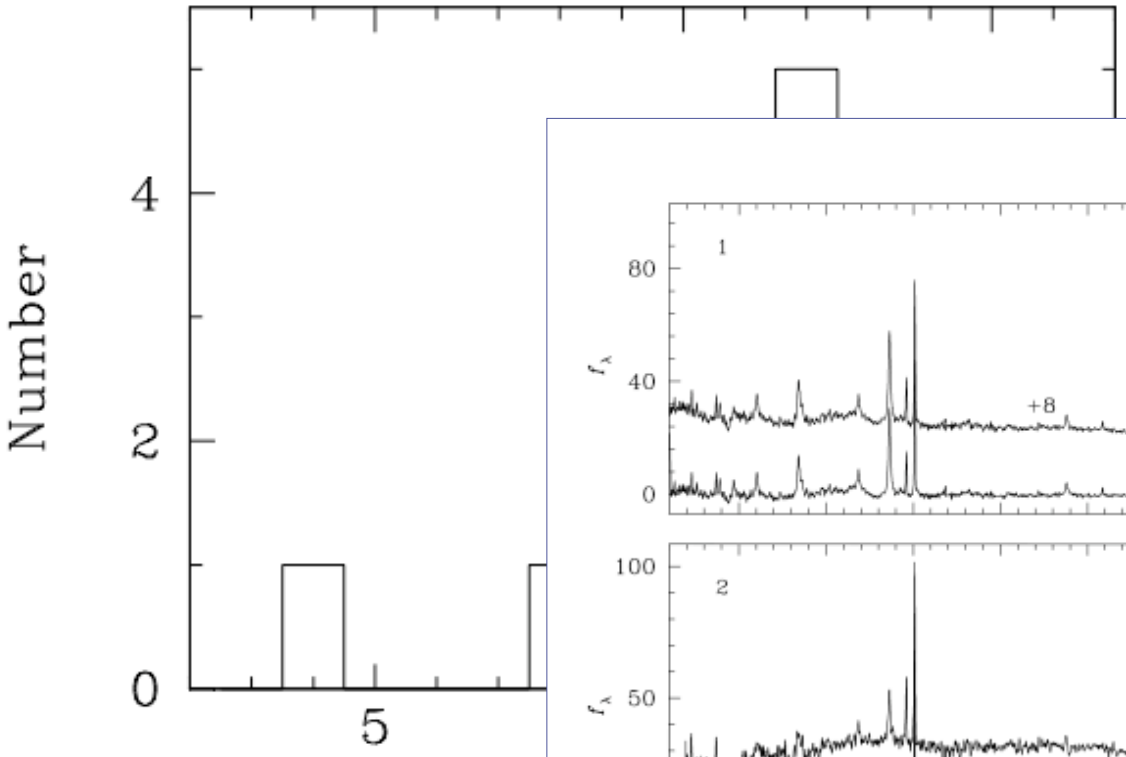
From 153,000 galaxy + QSO spectra in DR1 of Sloan. . .

19 objects $M_{BH} < 10^6 M_\odot$

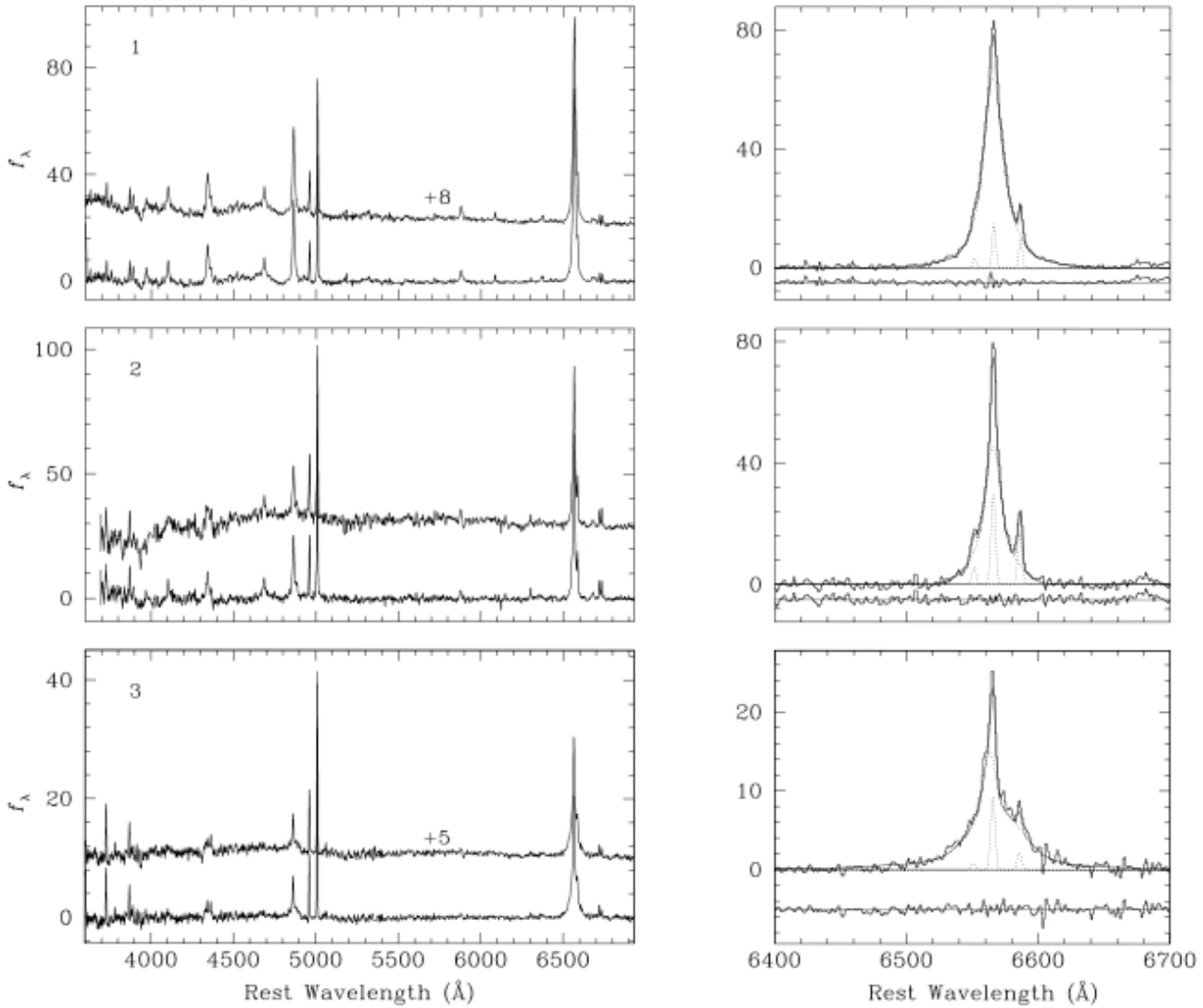
$0.0281 < z < 0.194$

Excluded galaxy-dominated

Used Hα



Greene & Ho (2004)




J010712.02+140844.8
J024912.86-081525.7
J032515.59+003408.4
J082912.71+500652.1
J094310.08+504559
1'
J101108.39+002908.7
J101627.36-000714.5
J114008.64+030711.4
J115138.15+004946.4
J124035.76-002919.4
J125055.19-015556.6
J135724.48+652505.8
J141234.56-003500
J143450.64+033842.5
J144507.2+593650
J170245.08+602818.8
J172759.03+542147.1
J232159.03+000738.8
J233837.19-002810.3

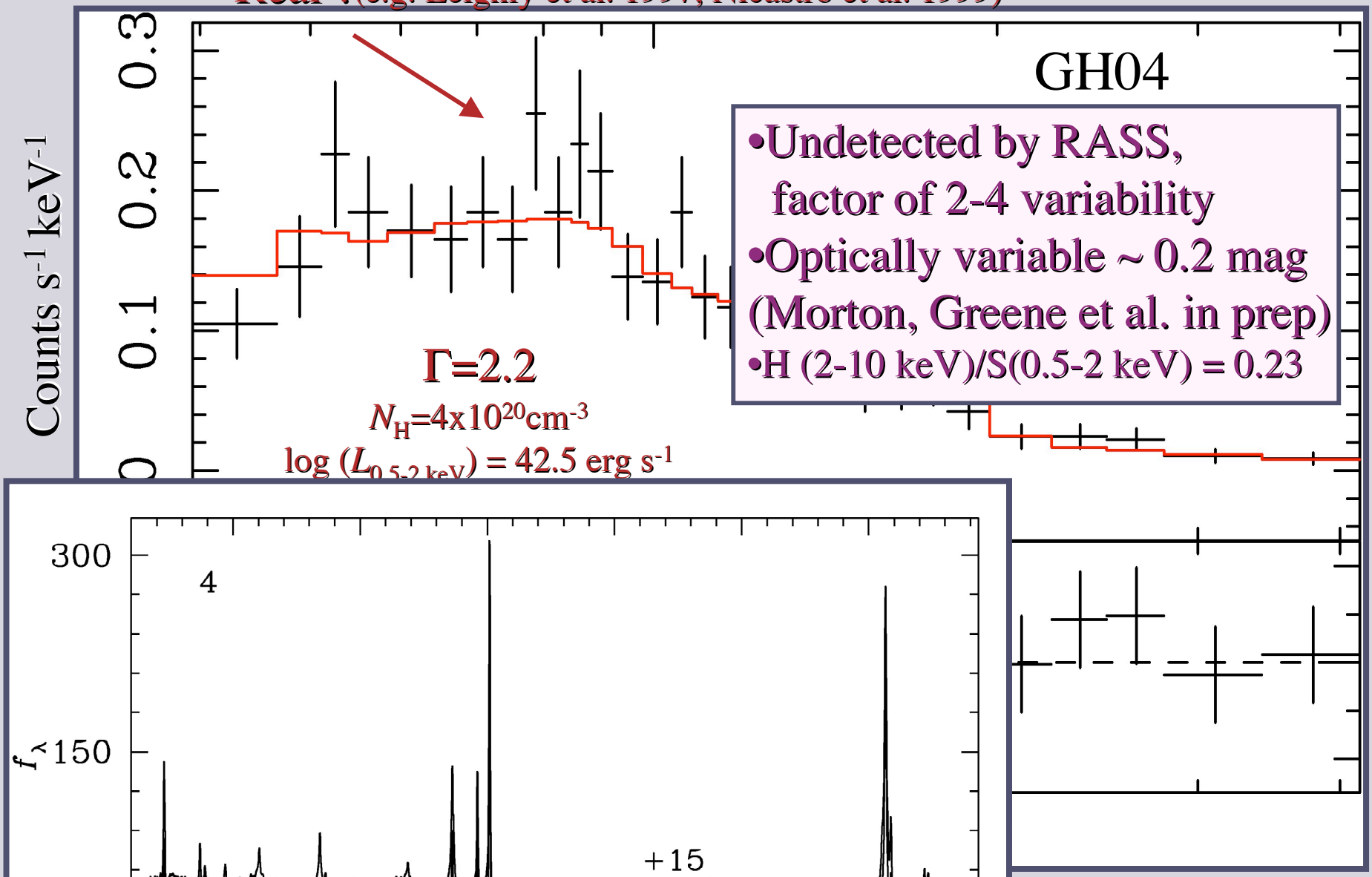
Chandra Observations

- 5 ks observations, 10 closest objects
- 8 observed, 2 upper limits (GH05, GH10)
- 2/4 *XMM-Newton* observations

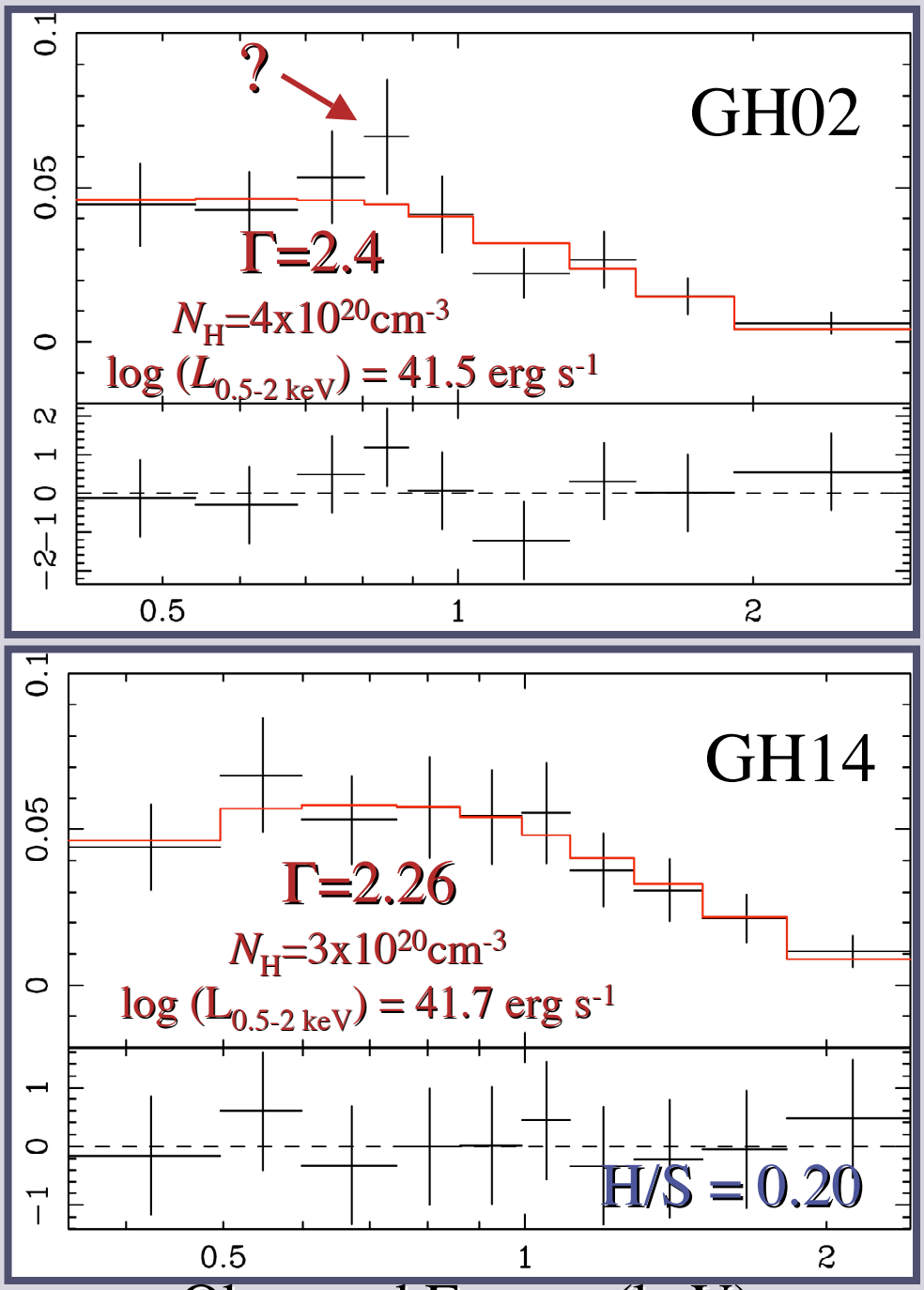
(PI G. Miniutti)

What will they look like?

Real ?(e.g. Leighly et al. 1997, Nicastro et al. 1999)

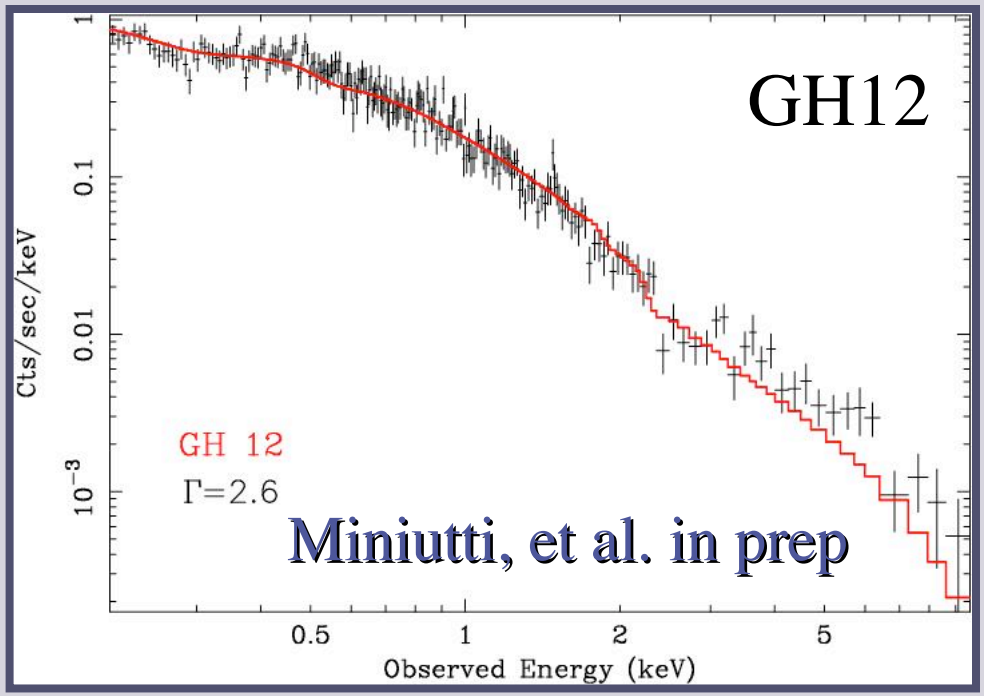


Greene & Ho in prep

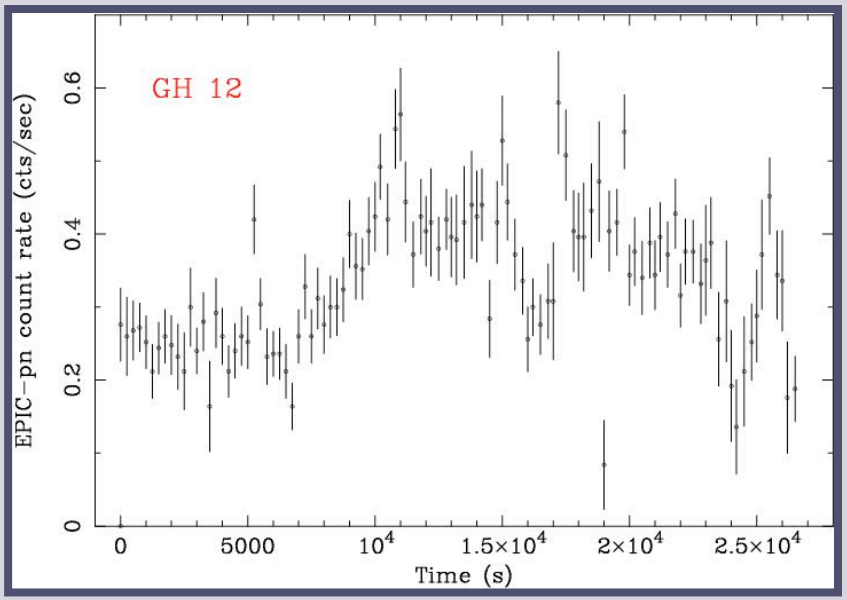


Object	H/S
GH07	0.15 (Γ~3)
GH10	1
GH11	0.46

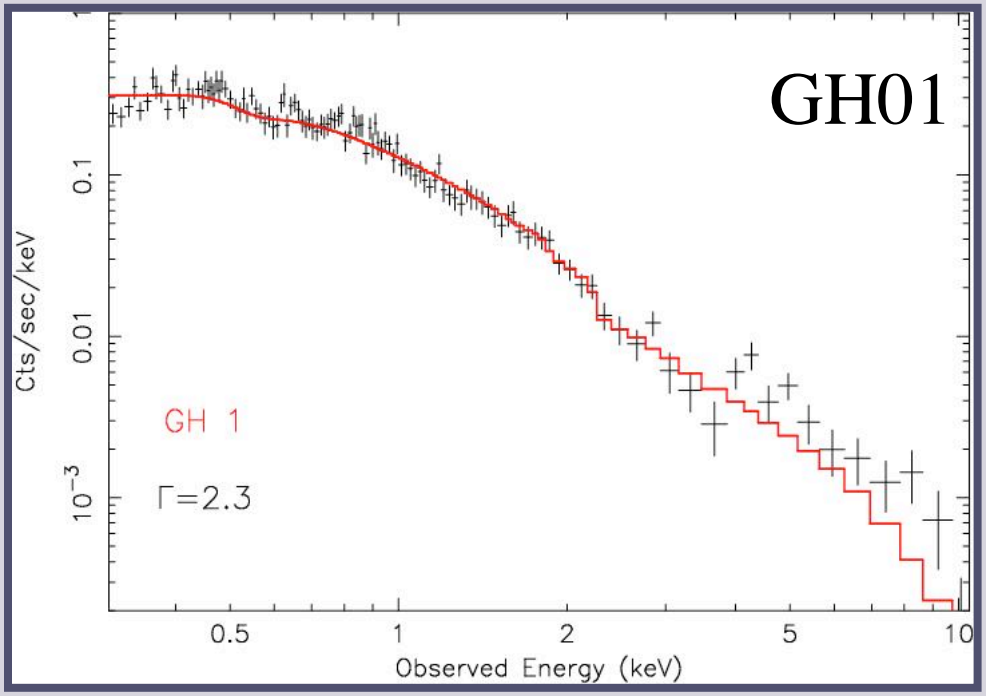
Greene & Ho in prep

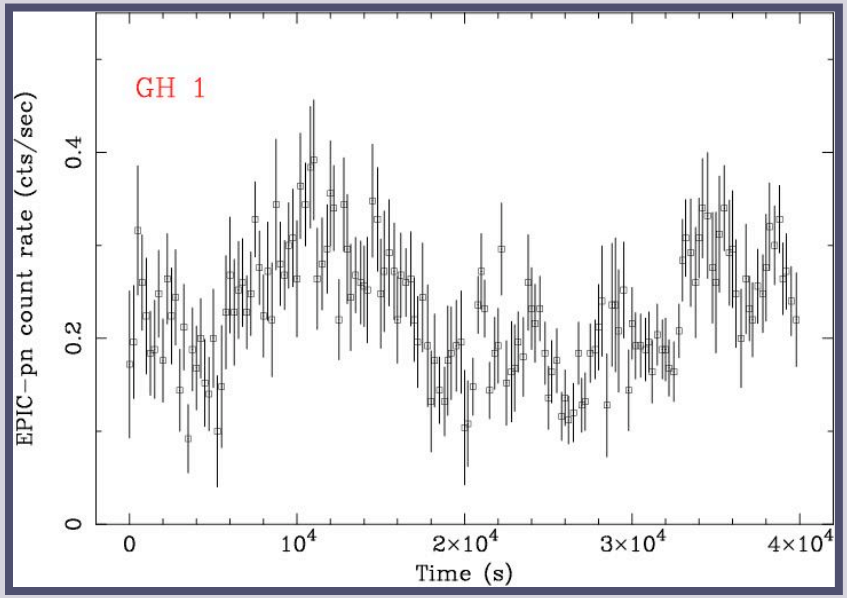


Miniutti, et al. in prep



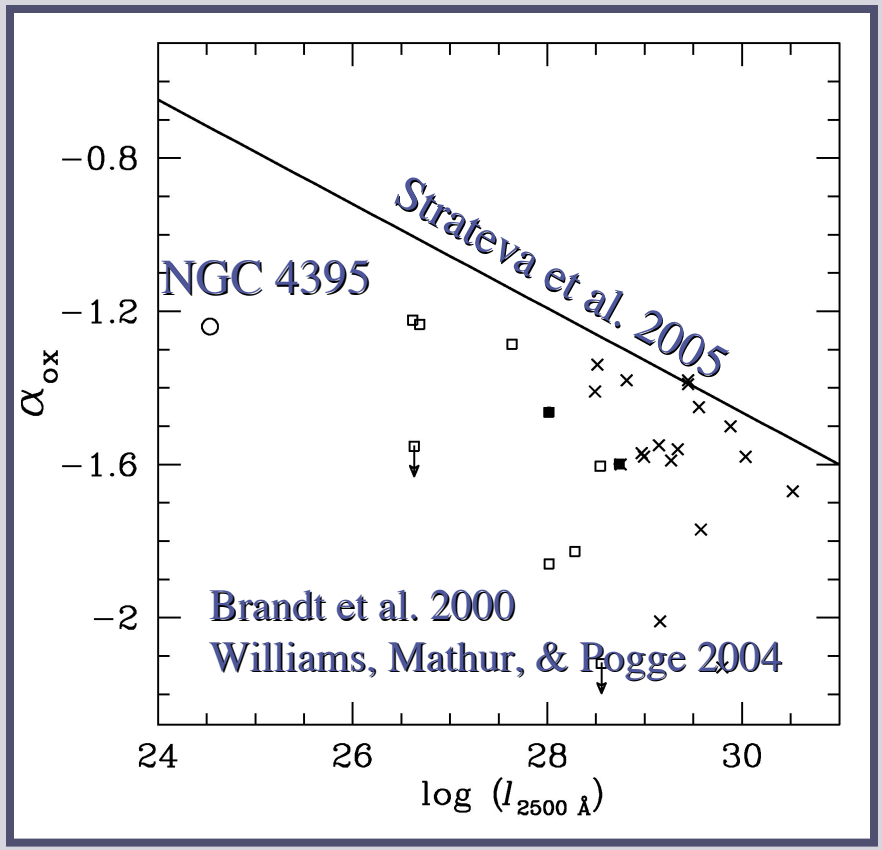
XMM-Newton

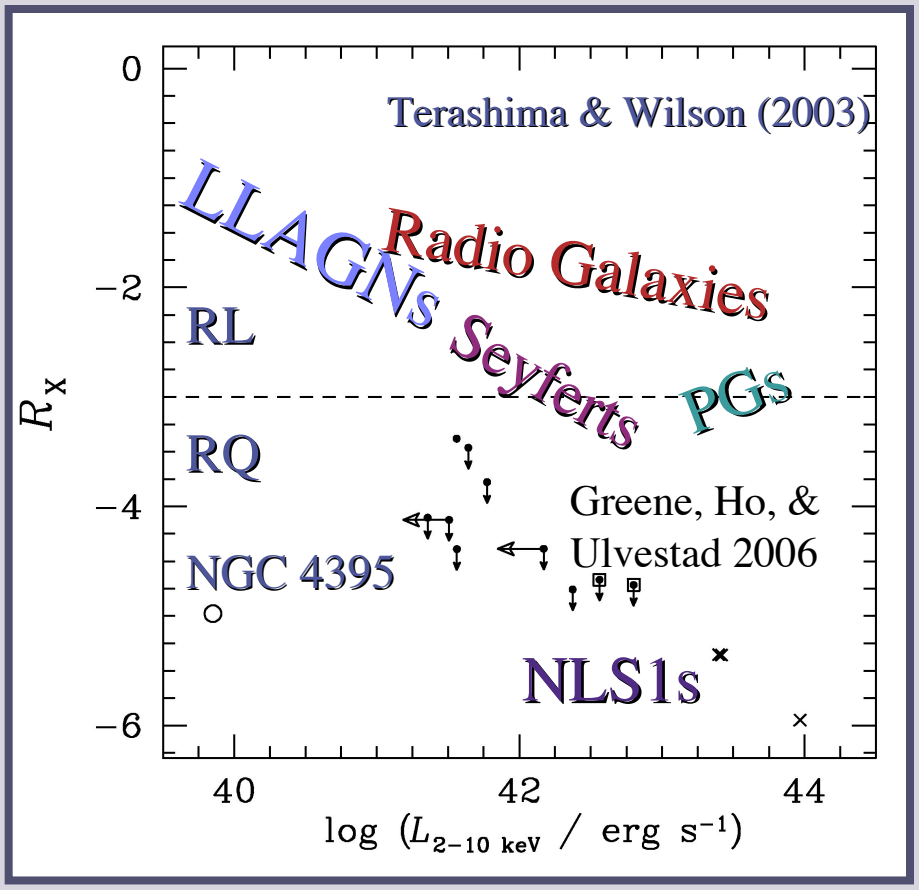




Broad Spectral Properties

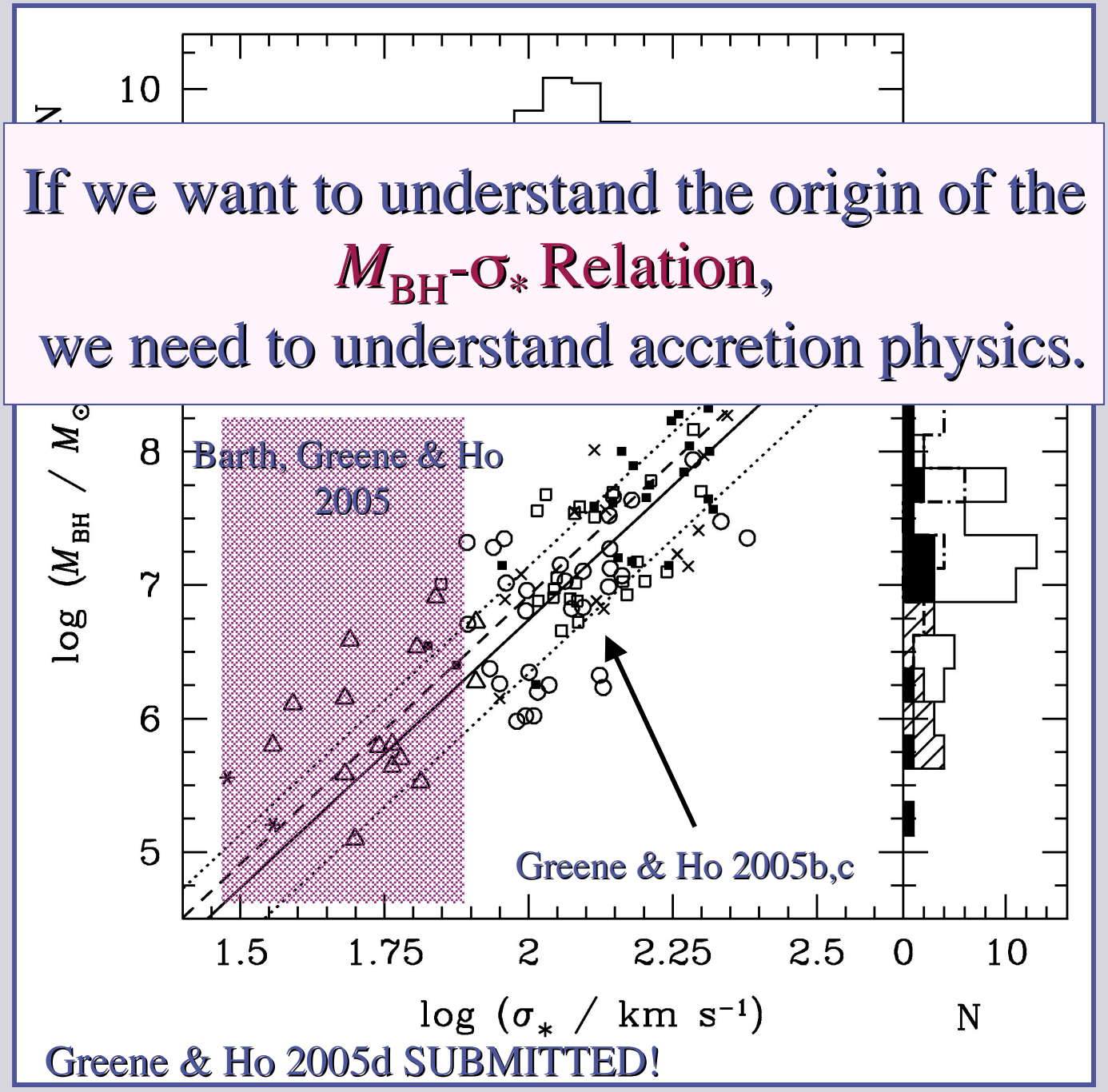
Greene & Ho in prep





- Soft spectral slopes, (probably) variability, SEDs, & Eddington ratios (median L_{bol}/L_{Edd}~0.3) similar to NLS1s
- What drives excess variance and Γ?

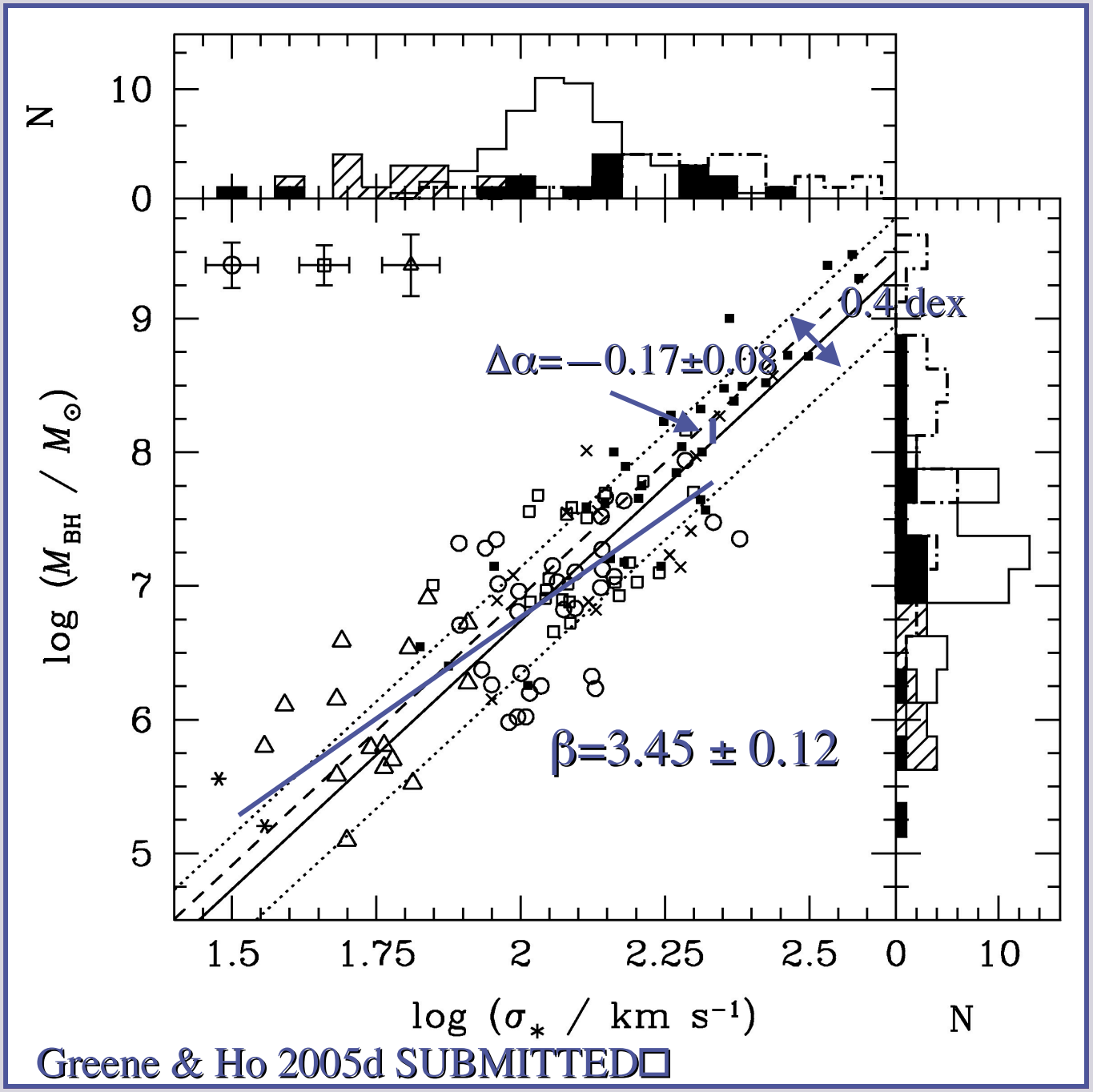
If we want to understand the origin of the
M_{BH}-σ_* Relation,
we need to understand accretion physics.

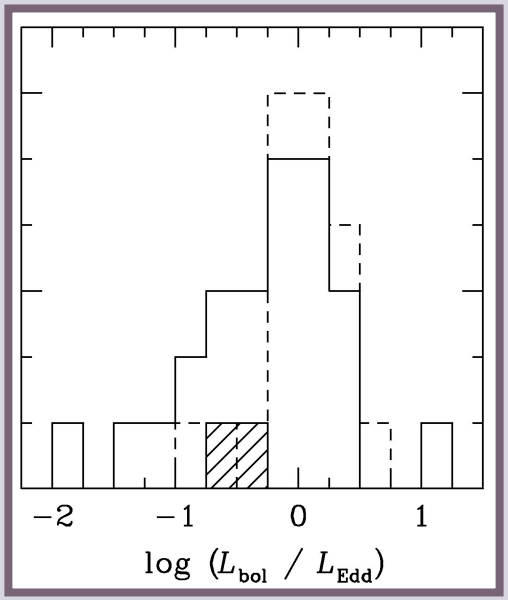


Greene & Ho 2005d SUBMITTED!

Acknowledgements

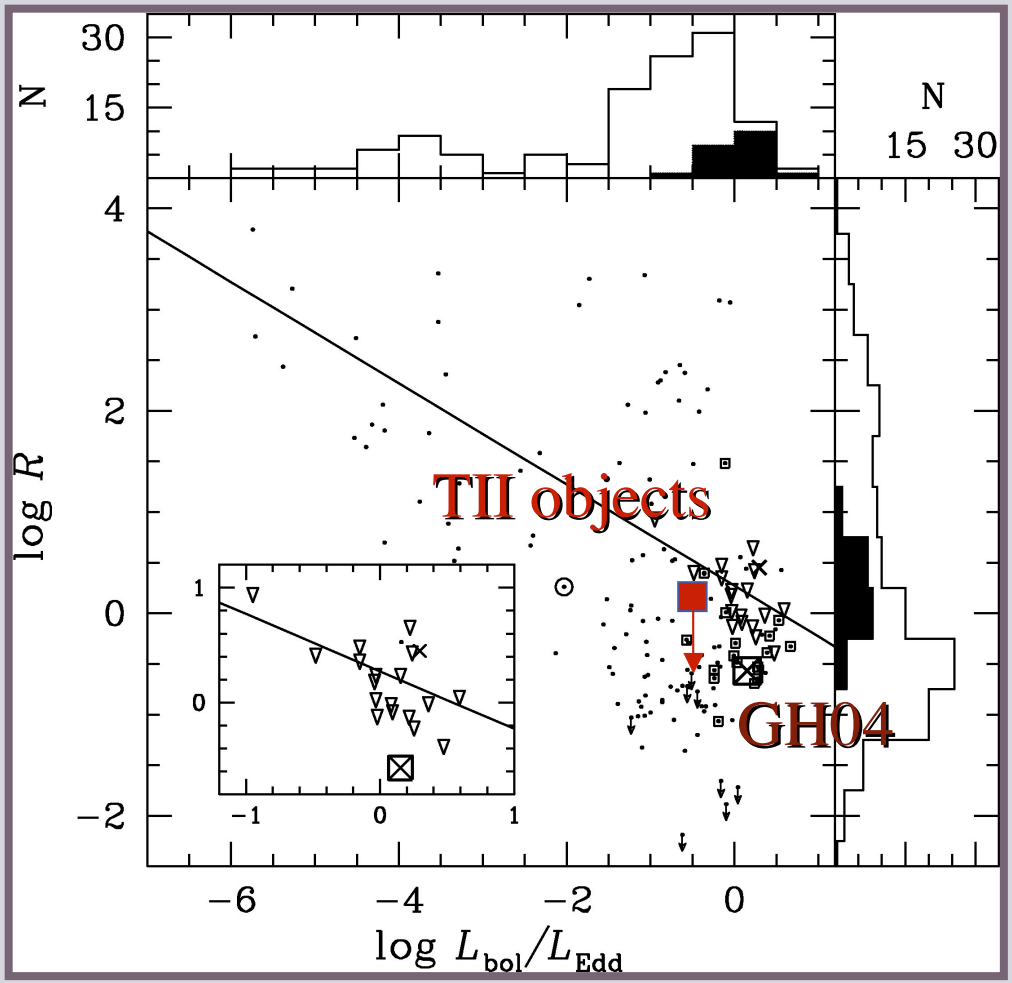
- R. C. Hickox
- S. B. Bogdanov
- C. Heinke
- J. C. McDowell


N
10
0
9
8
7
6
5
log (M_{BH} / $M_\odot$)
0.4 dex
Δα=−0.17±0.08
β=3.45 ± 0.12
1.5
1.75
2
2.25
2.5
0
10
log (σ_* / km s^{-1})
N
Greene & Ho 2005d SUBMITTED



Radio Power?

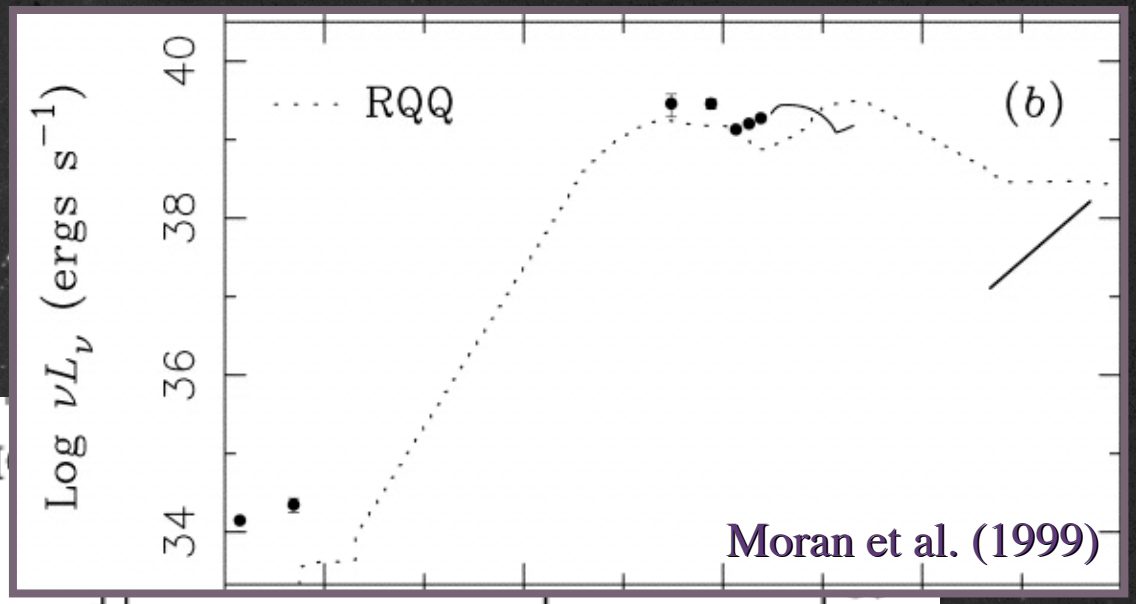
Greene, Ho, & Ulvestad 2006

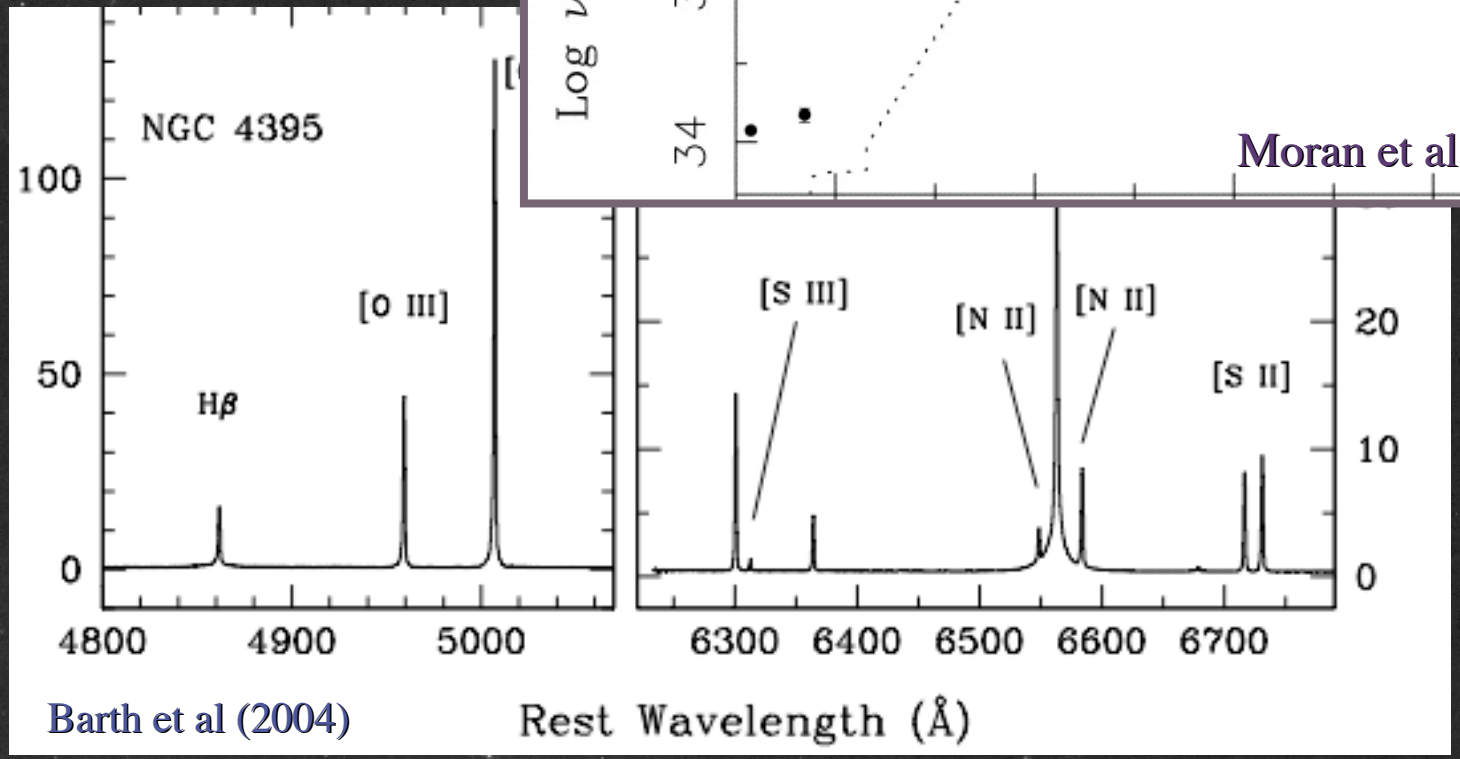


1629+4254: $f_{20\ cm}$=1.65 mJy

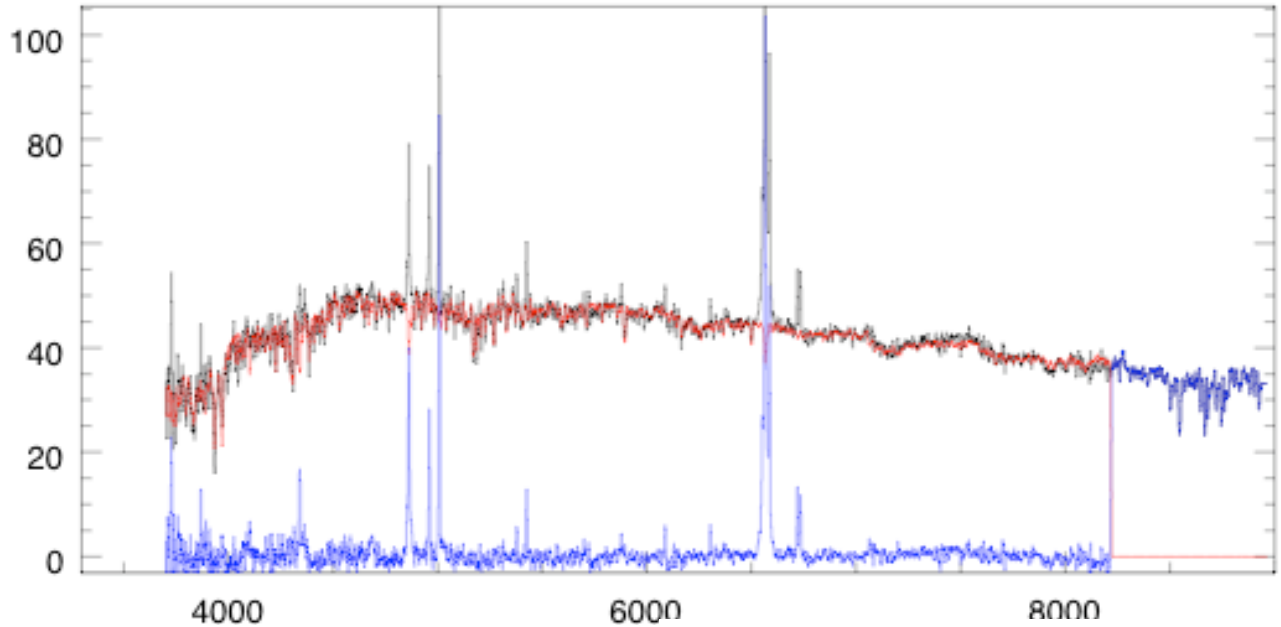
Stacked FIRST image of
23 non-detections
$f_{20\ cm}$< 0.09 mJy/bm

NGC 4395 (Sd spiral)
D = 4.2 Mpc
M_B = –17.5 mag

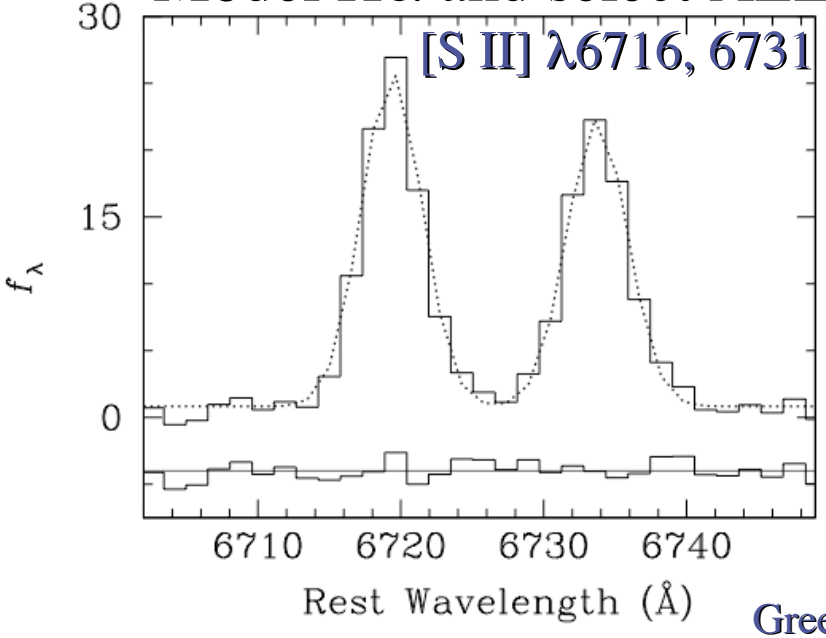


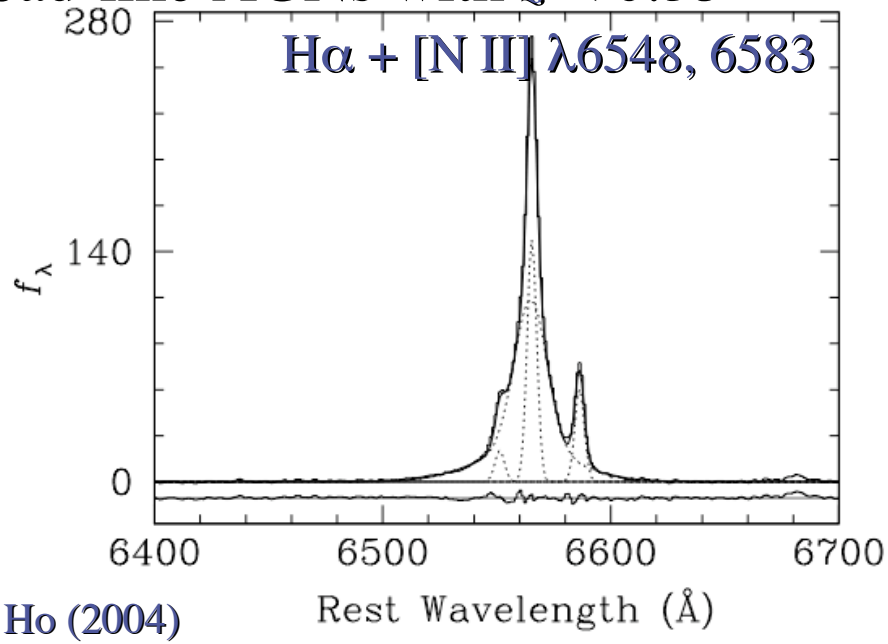


1. Remove galaxy continuum with PCA from Hao (2005)



2. Model Hα and select ALL Broad-line AGNs with $z < 0.35$





Greene & Ho (2004)

Variable Spectral Slope

See also:

Shih et al. (2003), Iwasawa et al. 2000 [ASCA], Lira et al. 1999, Moran et al. 1999 [ROSAT]