Disentangling Accretion and Obscuration Phenomena in AGN

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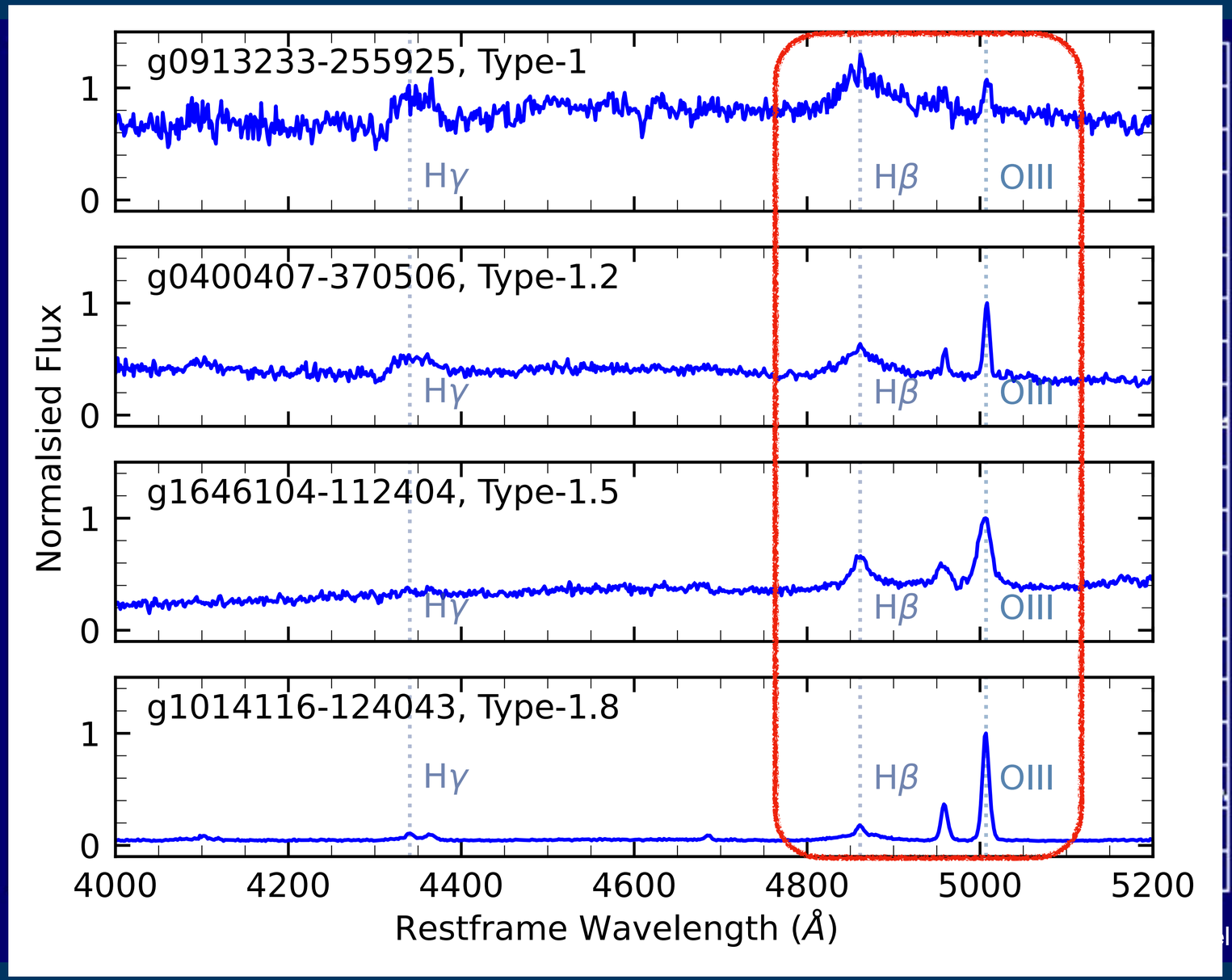
Optical AGN

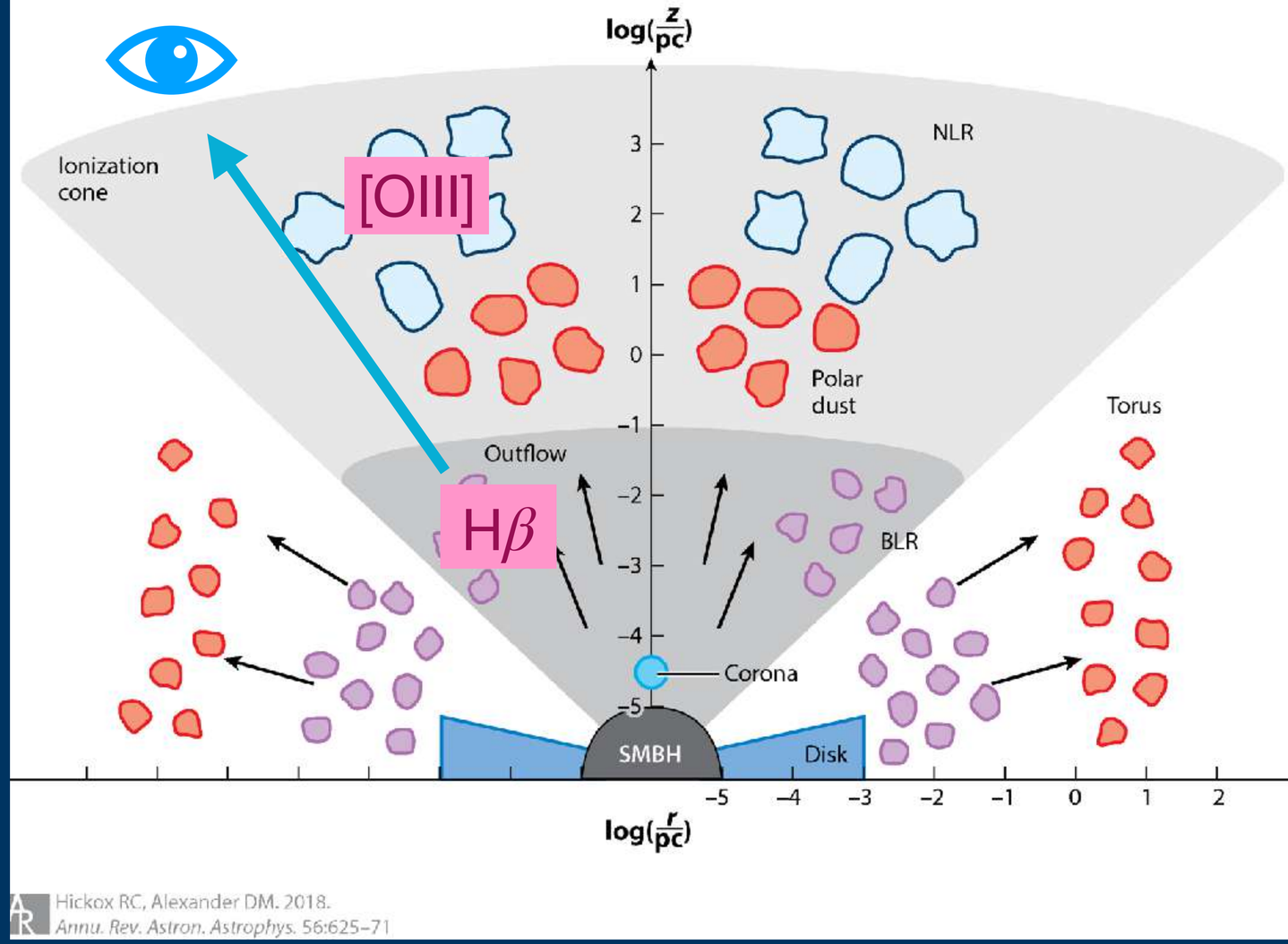
Type	R = Hβ/[OIII]
1	5 < R
1.2	2 < R < 5
1.5	0.33 < R < 2
1.8	R < 0.33
1.9	Broad Hα, no broad Hβ
2	No broad Balmer lines

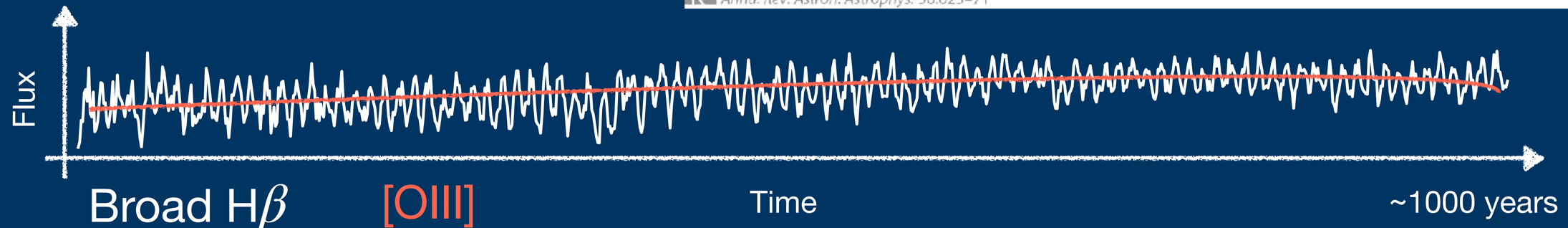
Winkler 1992

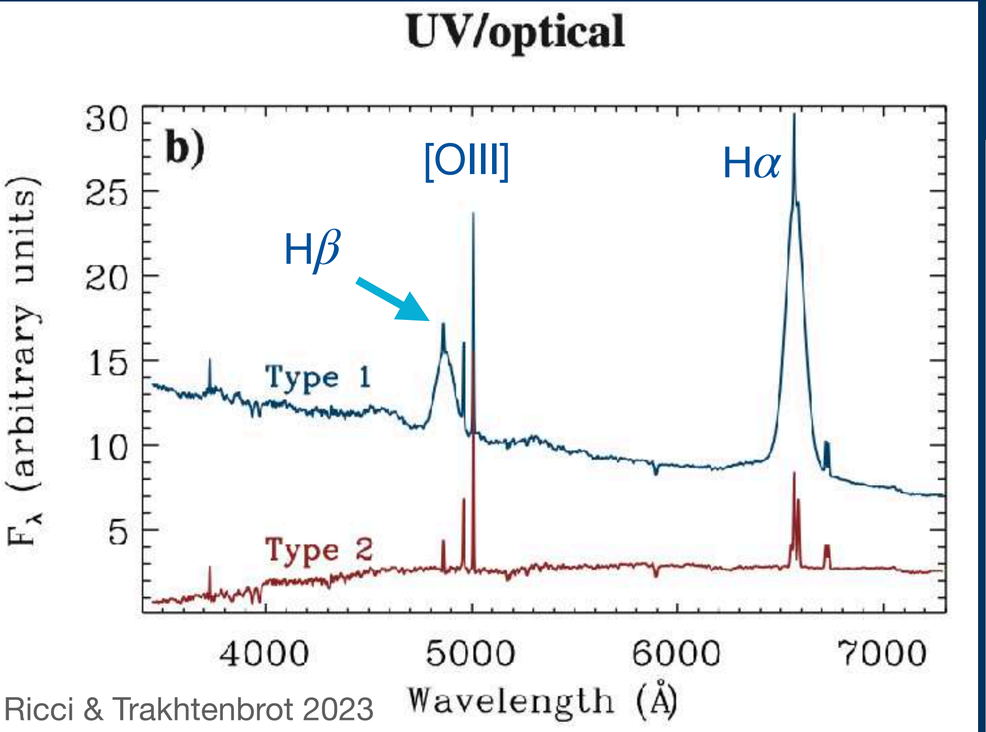


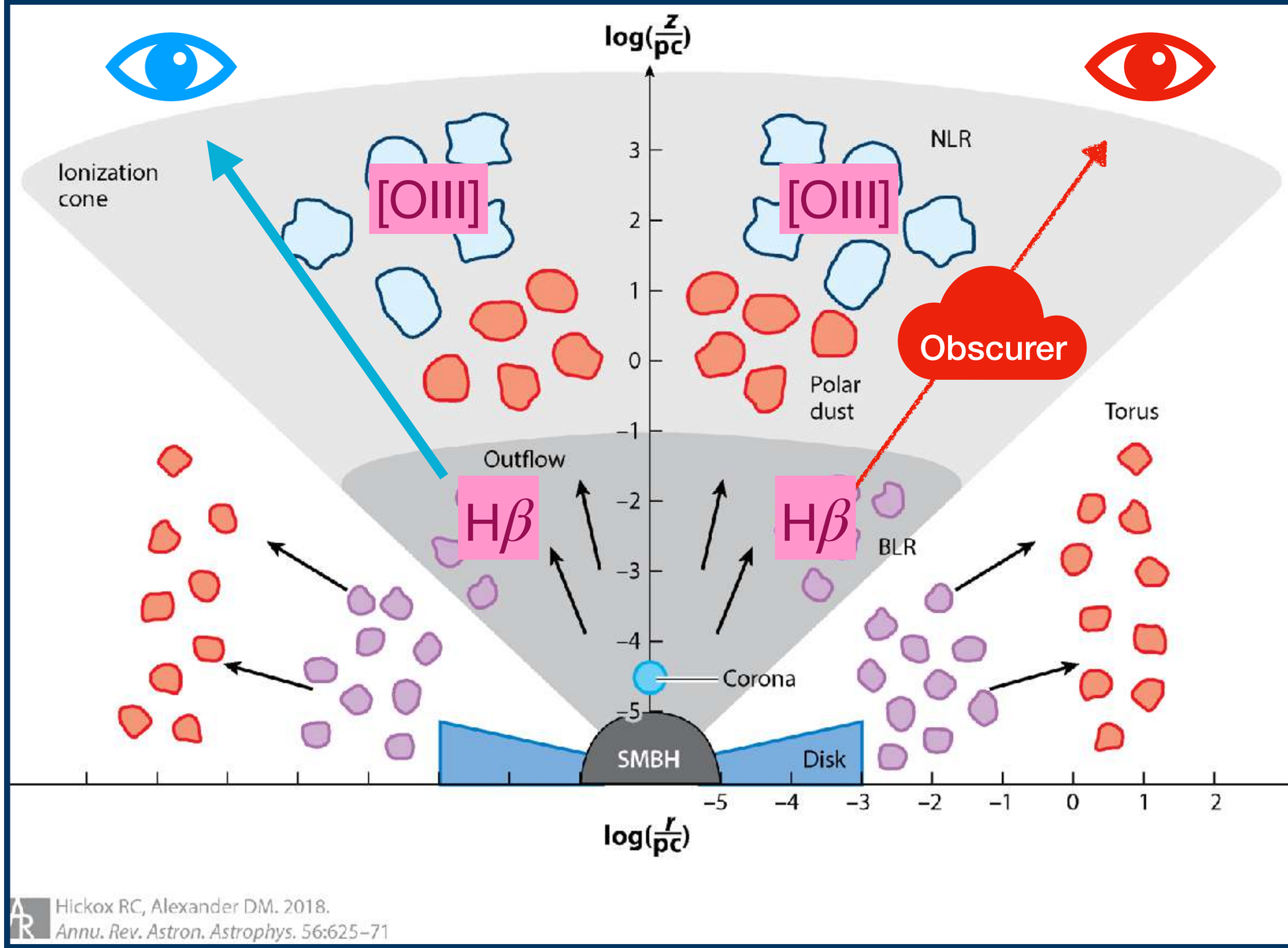
BLR, NLR, Accretion Rates

- BLR: current accretion rate (Balmer Lines)
- NLR: ~1000 year average (Forbidden Lines)
- Hβ/[OIII]: Measure of accretion rate relative to long term average



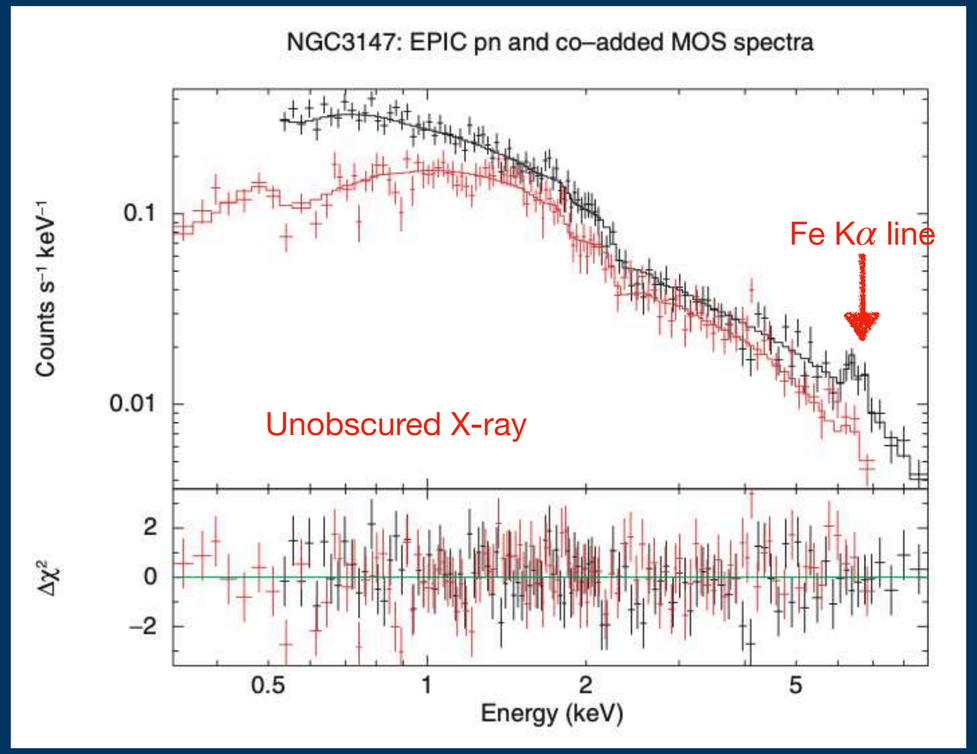


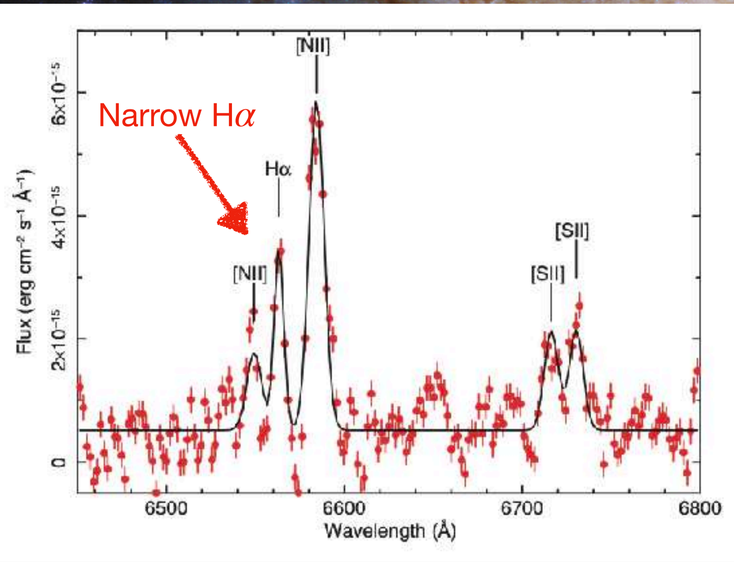

UV/optical
b)
[OIII]
Hα
Hβ
Type 1
Type 2
F_λ (arbitrary units)
Wavelength (Å)
Ricci & Trakhtenbrot 2023
X-rays
a)
Unobscured
Fe Kα
Obscured
$E^2 \times F_E$ (arbitrary units)
Energy (keV)

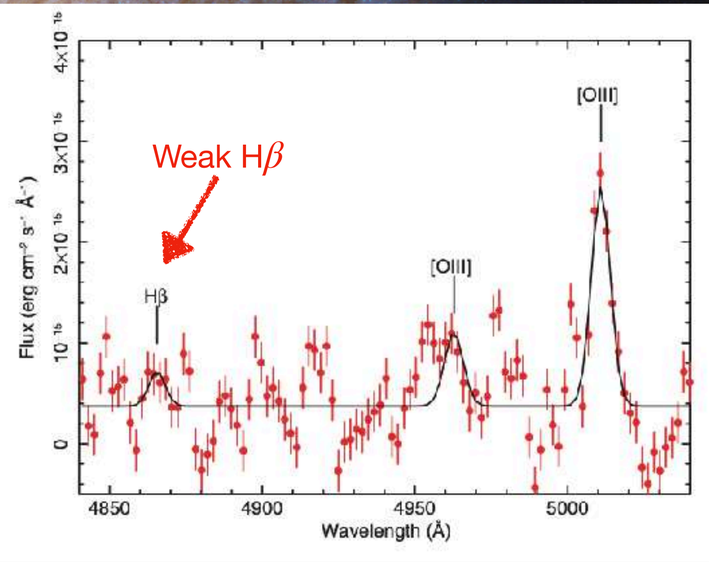

log(z/pc)
log(r/pc)
Ionization cone
[OIII]
[OIII]
NLR
Obscurer
Polar dust
Torus
Outflow
Hβ
Hβ
BLR
Corona
SMBH
Disk
Hickox RC, Alexander DM. 2018.
Annu. Rev. Astron. Astrophys. 56:625–71

Unobscured Type-2

NGC 3147 (Bianchi+2008)

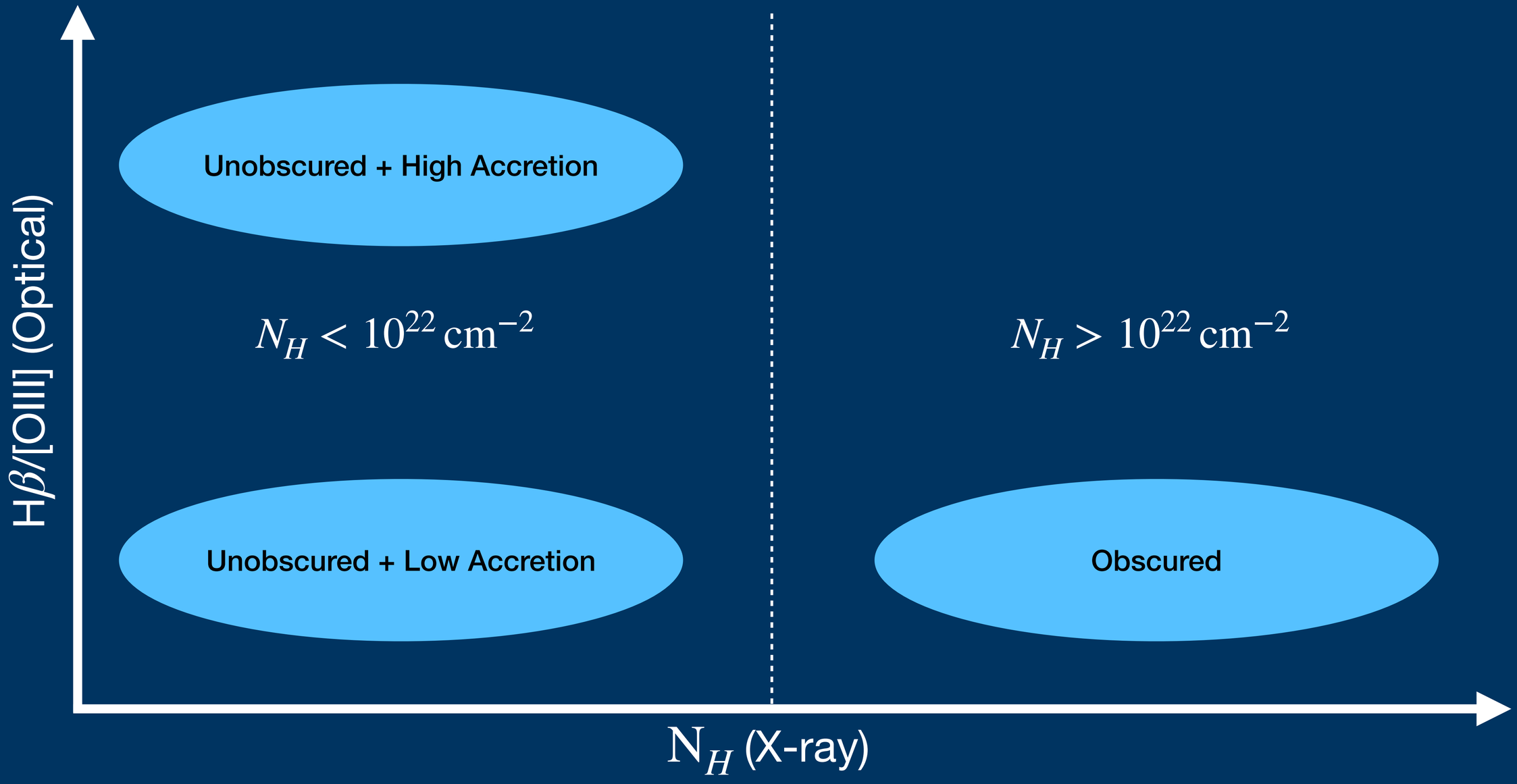




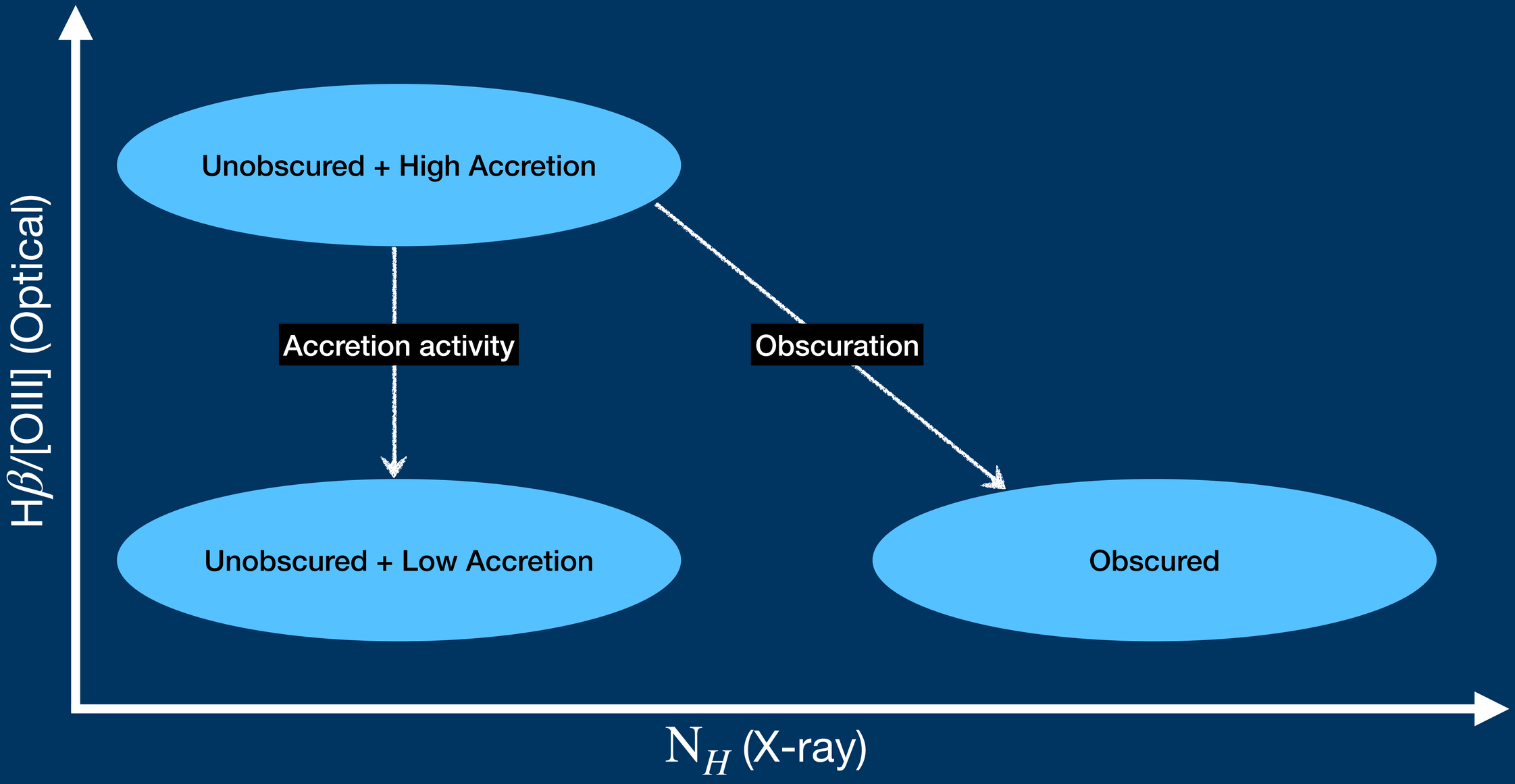


NGC 3147 (Hubble image)

Disentangling Accretion and Obscuration

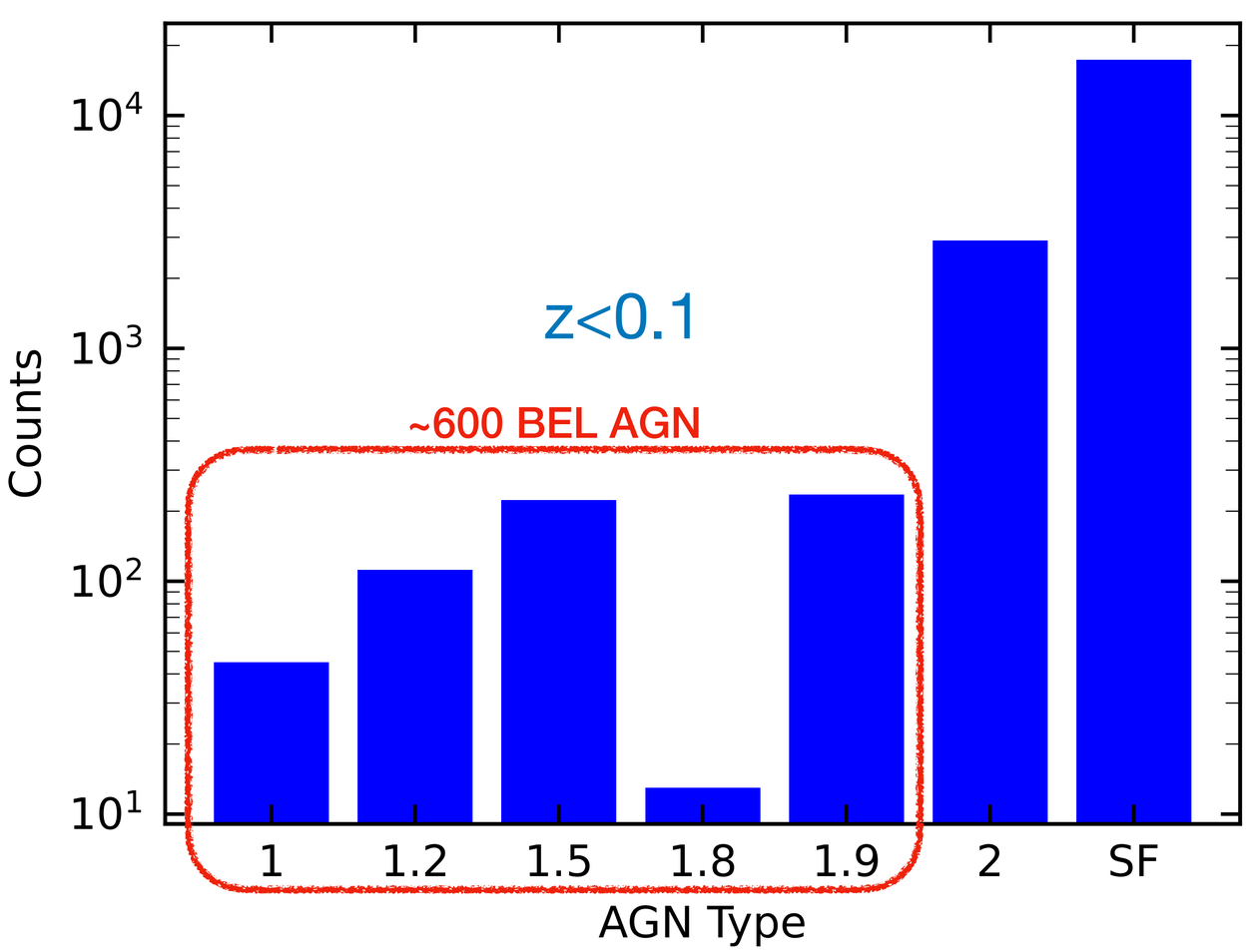


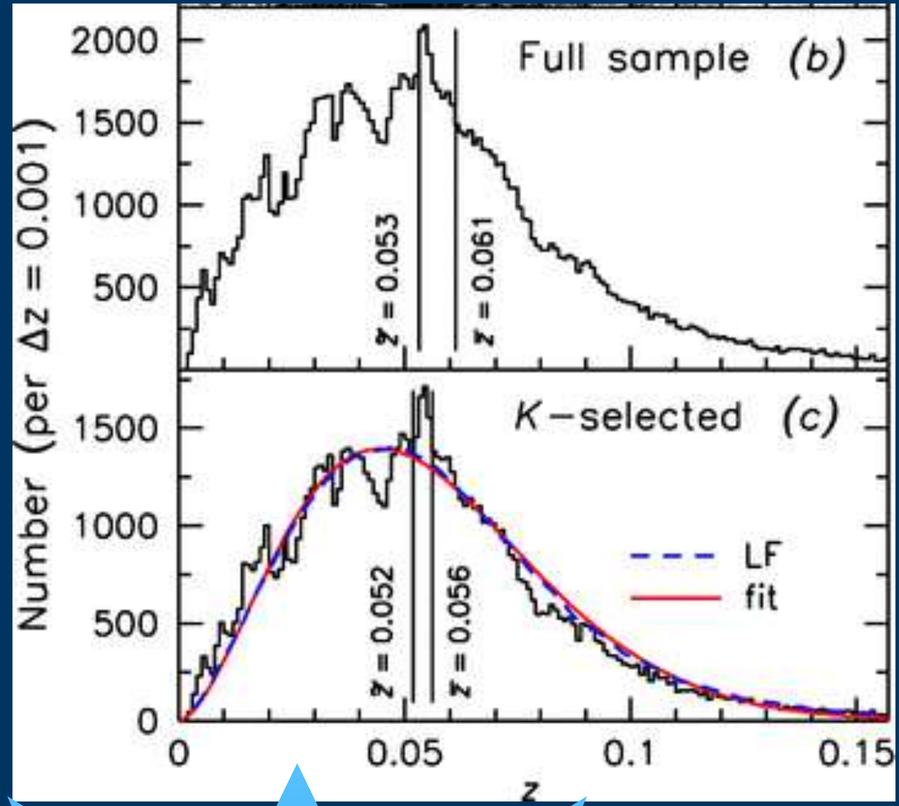
Disentangling Accretion and Obscuration



6dFGS

- Six-degree Field Galaxy Survey (2000s)
- 125,071 galaxies, 136,304 spectra in Southern Sky

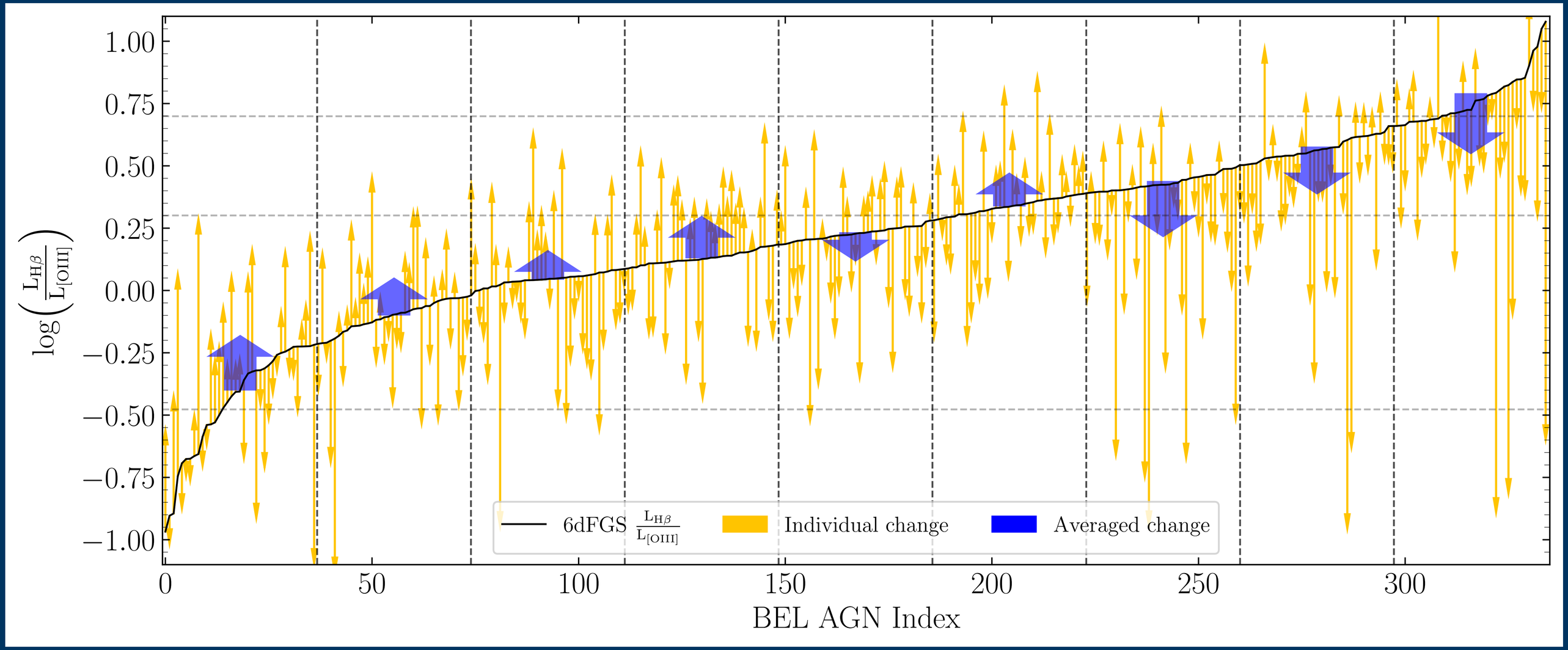




Jones+2009

The 20-year old complete reference sample (Hon+2024; in prep)

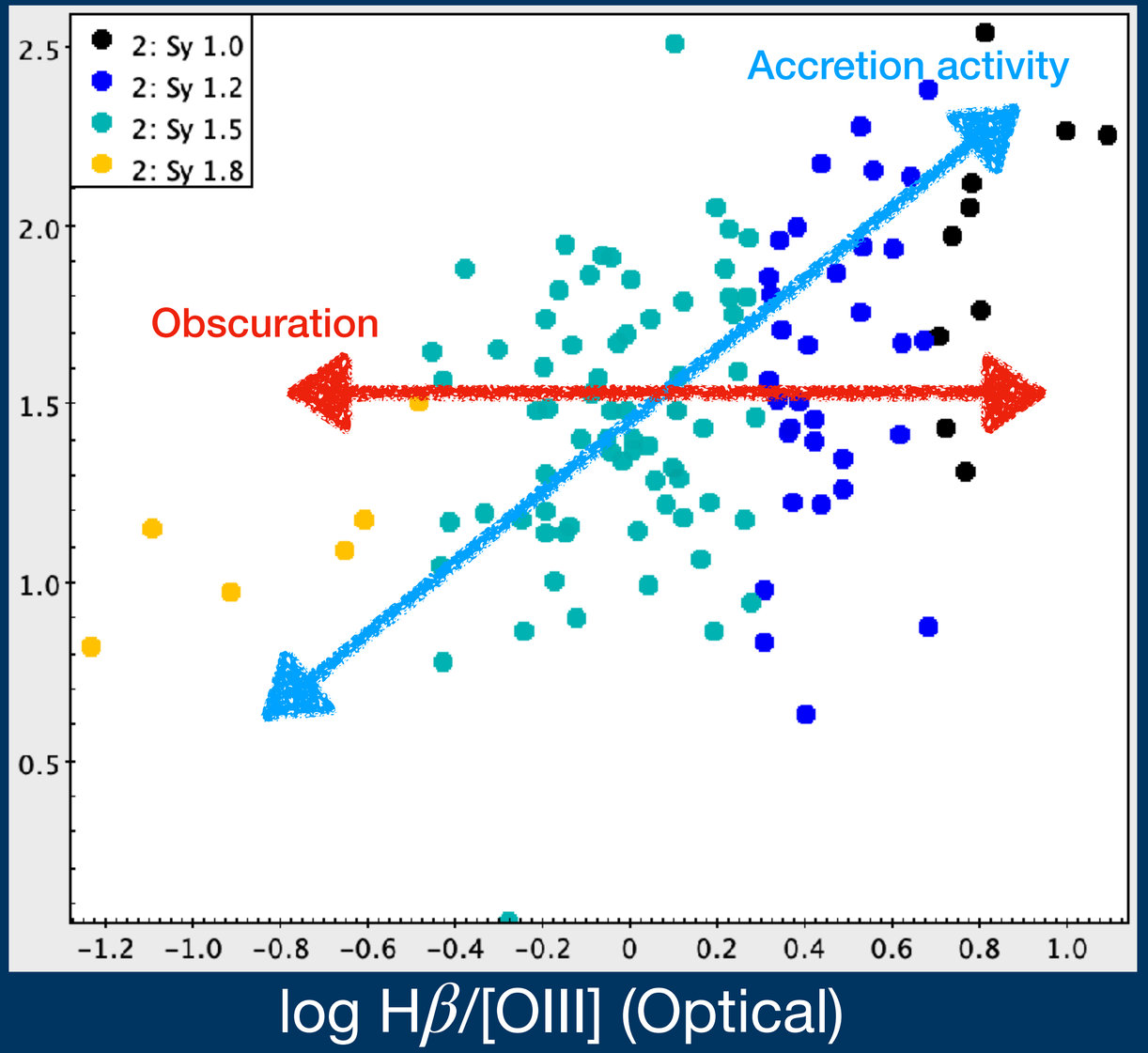
2-Epoch BEL AGN Variability (~20 years)



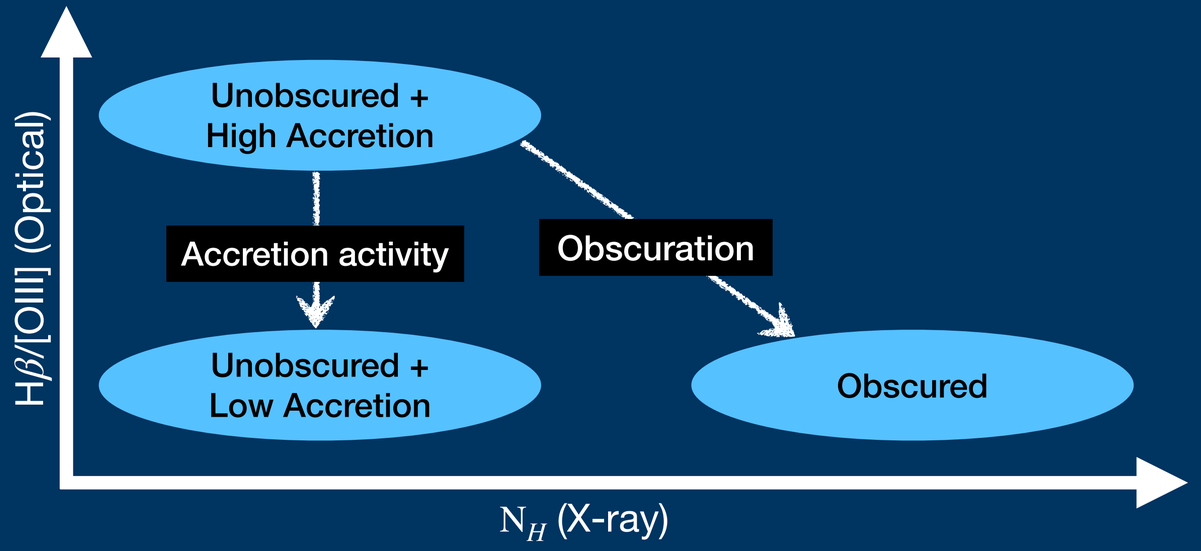
The Next Step: X-ray

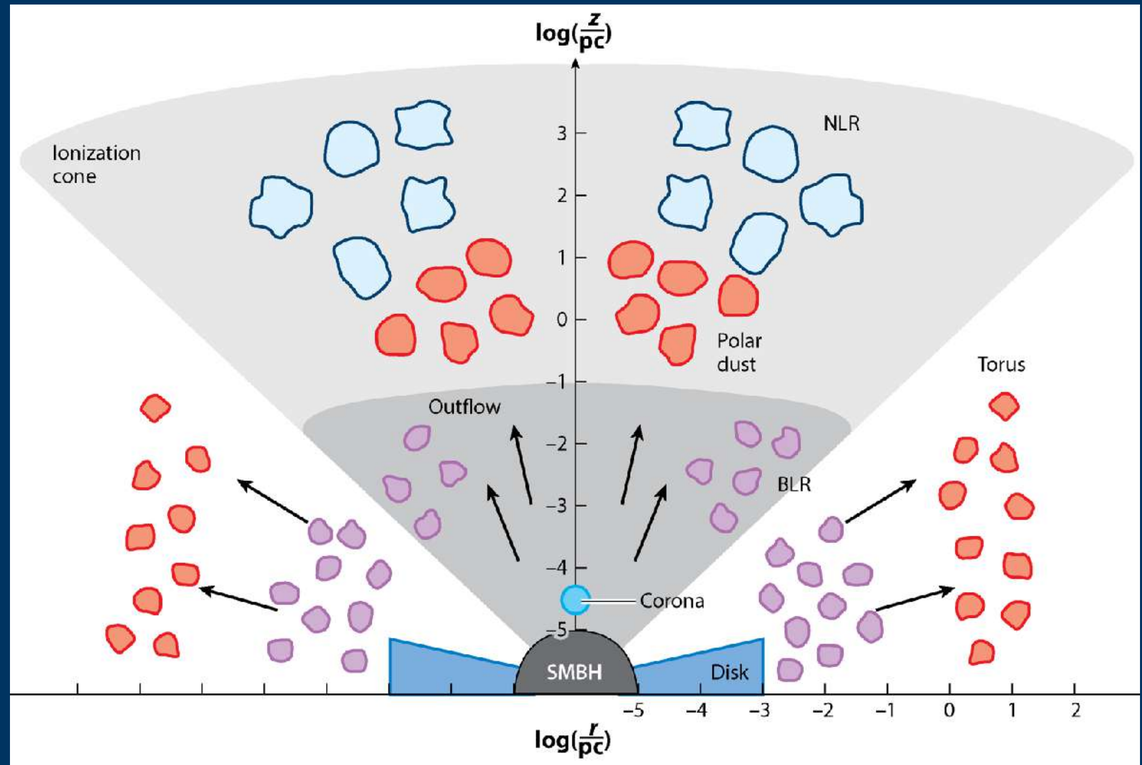
Use N_H after X-ray spectral fitting to correct for obscuration

eRASS4-5:
5x more photons,
deeper



Summary


Unobscured +
High Accretion
Accretion activity
Obscuration
Unobscured +
Low Accretion
Obscured
Hβ/[OIII] (Optical)
N_H (X-ray)


log(z/pc)
log(r/pc)
Ionization cone
NLR
Polar dust
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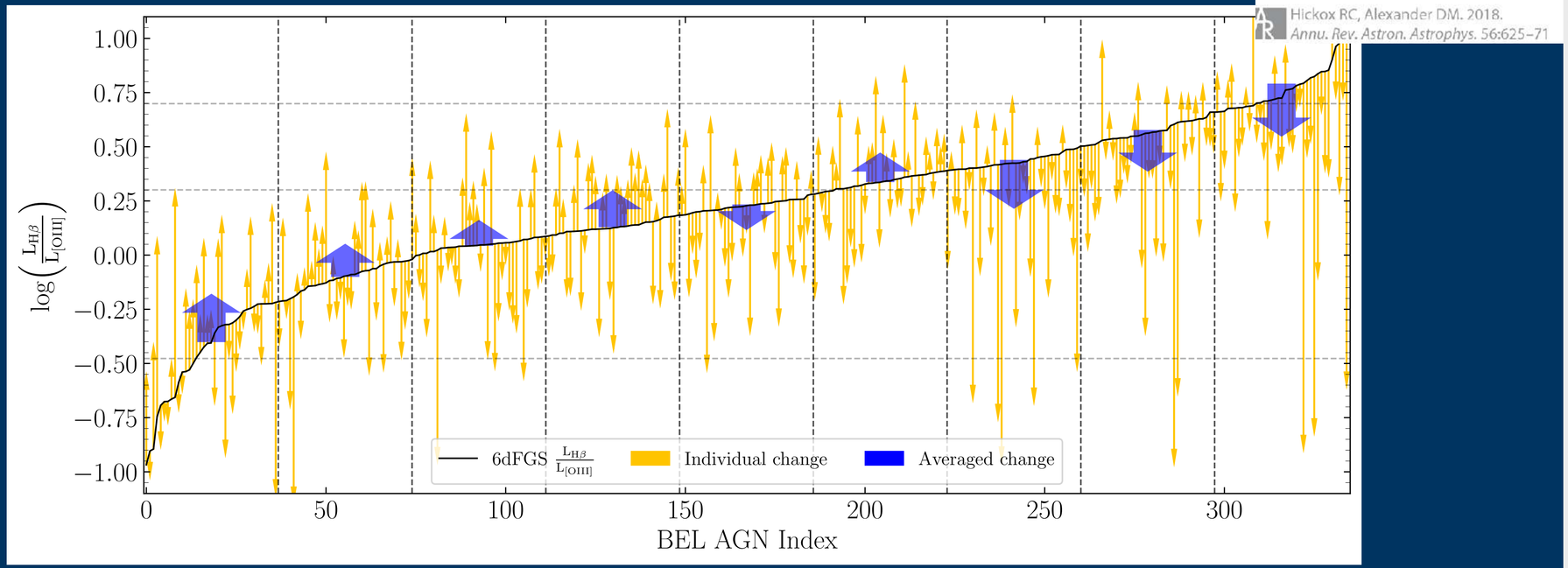
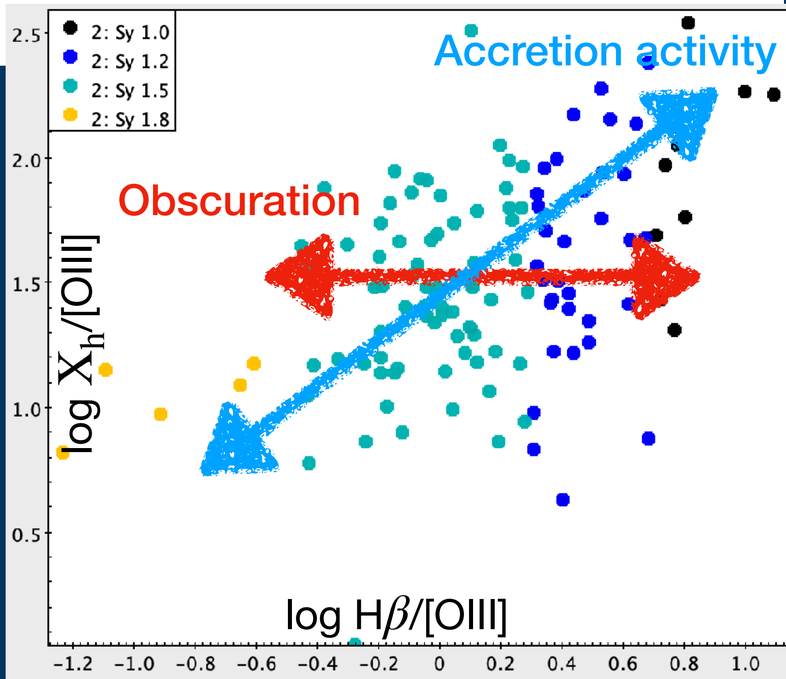

Hickox RC, Alexander DM. 2018.
Annu. Rev. Astron. Astrophys. 56:625–71
log(L_Hβ/L_[OIII])
6dFGS L_Hβ/L_[OIII]
Individual change
Averaged change
BEL AGN Index


2: Sy 1.0
2: Sy 1.2
2: Sy 1.5
2: Sy 1.8
Accretion activity
Obscuration
log X_h/[OIII]
log Hβ/[OIII]