The continuum and emission line properties of low luminosity Type-1 AGN

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AGN – Open Questions

What is the dependence on L_{Bol}, L/L_{Edd} & M_{BH} of:

1. The continuum emission mechanism
2. The narrow and broad line-emitting gas properties

What is the dependence on broad line luminosity ($L_{bH\alpha}$) and width (FWHM) of:

1. The spectral energy distribution (SED)?
2. The broad and narrow emission line EW?
3. The BPT Position (narrow emission line ratios)?

Outline

A. The new Broad Hα selected sample

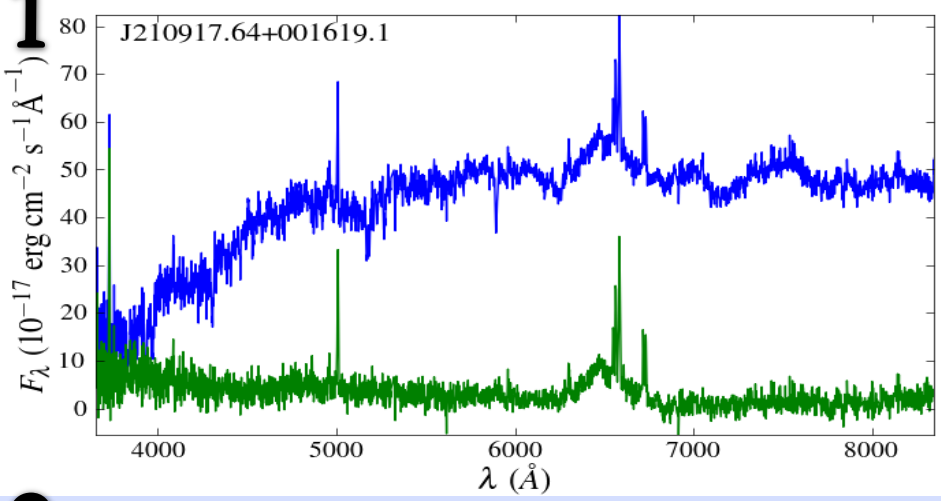
B. What is the dependence on $L_{bH\alpha}$ and FWHM of the:

1. spectral energy distribution (SED)?
2. broad and narrow emission line EW?
3. BPT Position (narrow emission line ratios)?

The Broad-Hα Selected Sample

SDSS DR7 (~***1M*** objects): z < 0.31, S/N>10 → ~***200K*** objects

1



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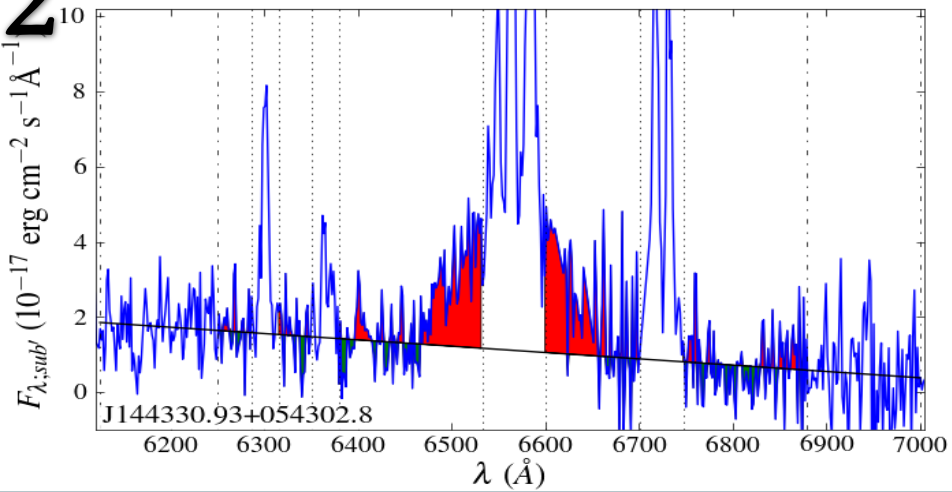
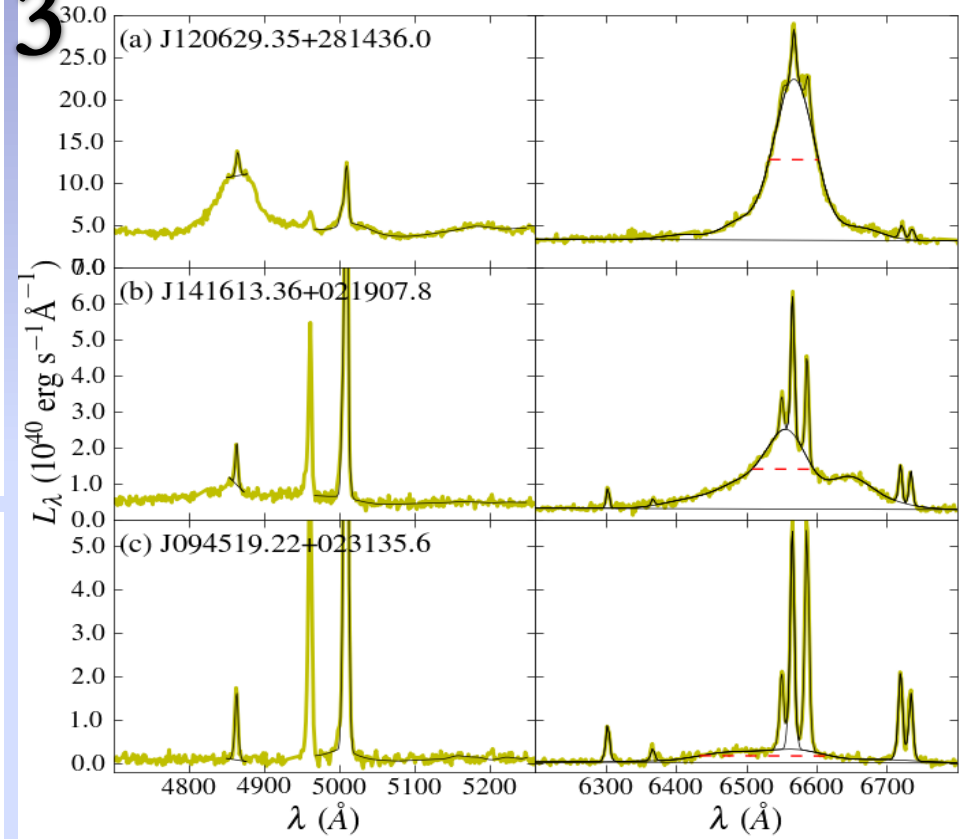


→ ~***8K*** objects

3



4 1,000<FWHM<30,000 km s^{-1}; minimum Broad Hα S/N

→ Final sample: ***3,824*** objects

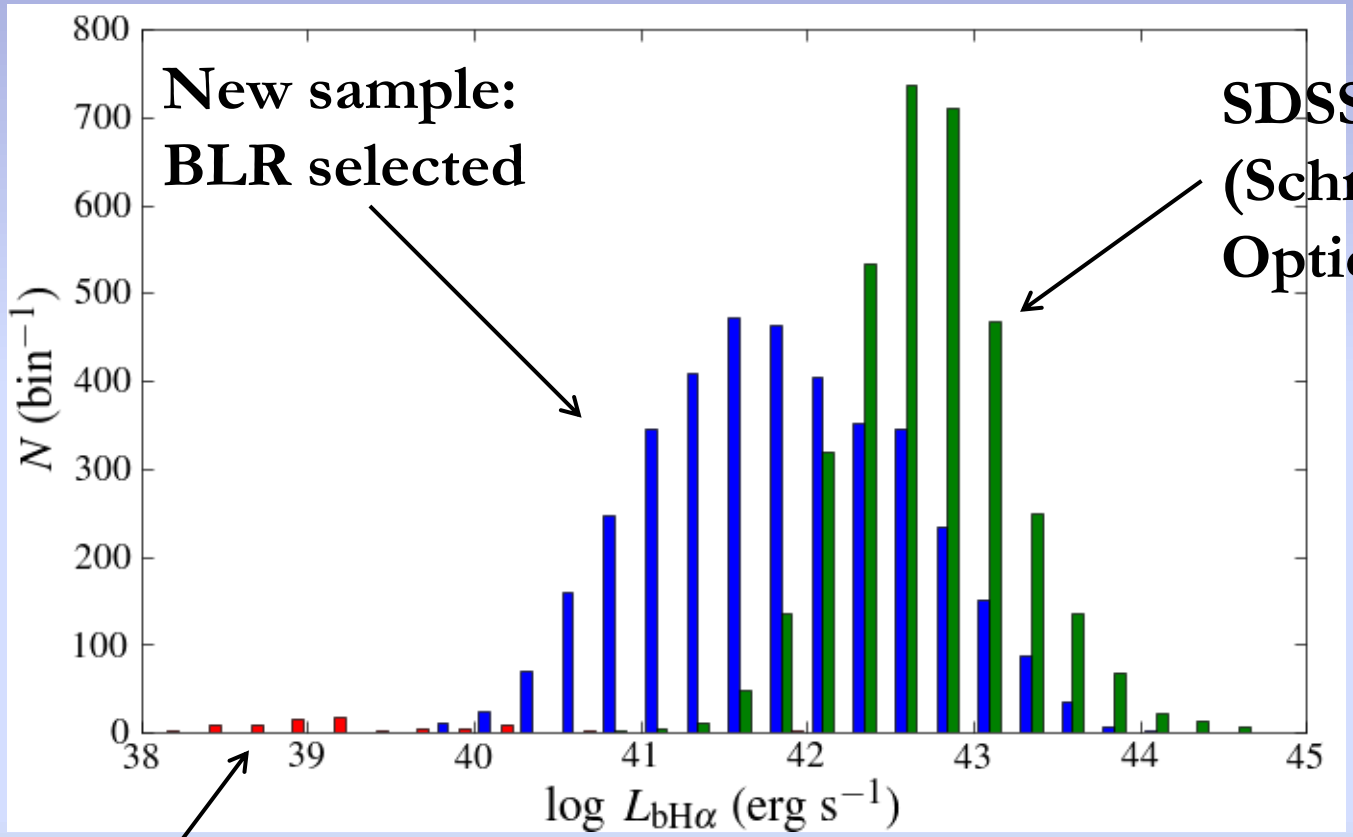
Similar Samples

Sample	Data Release	# of objects	Main Differences
New Sample	DR7	3,824	
Greene & Ho 2007	DR4	8,495	Lower S/N threshold, No published NL fluxes, $\Delta\lambda$= 300 Å (look for low M_{BH})
Vanden Berk et al. 2006	DR3	4,666	Lower S/N threshold, Require total FWHM (NL+BL) >1000 km s^{-1}, z < 0.75
Hao et al. 2005	DR2	1,317	Lower S/N threshold, Simpler NL / BL decomposition

Our additions:

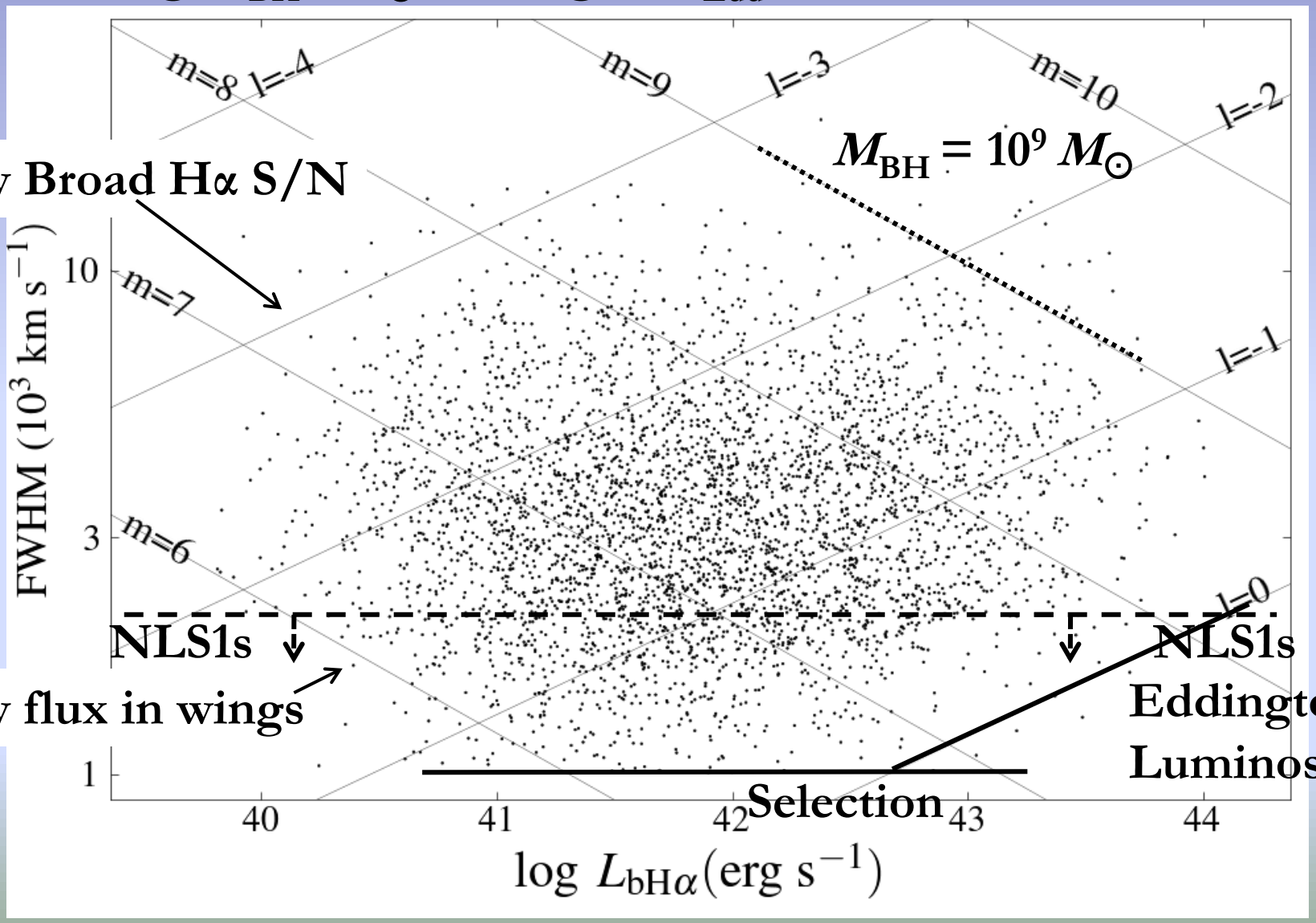
1. $\Delta\lambda$ = 600 Å, very broad lines are detectable
2. Narrow line measurements
3. Additional photometry:
   2MASS (detection fraction - 98%), GALEX (83%) , ROSAT (42%)

Broad Hα Luminosity ($L_{bH\alpha}$) Distribution

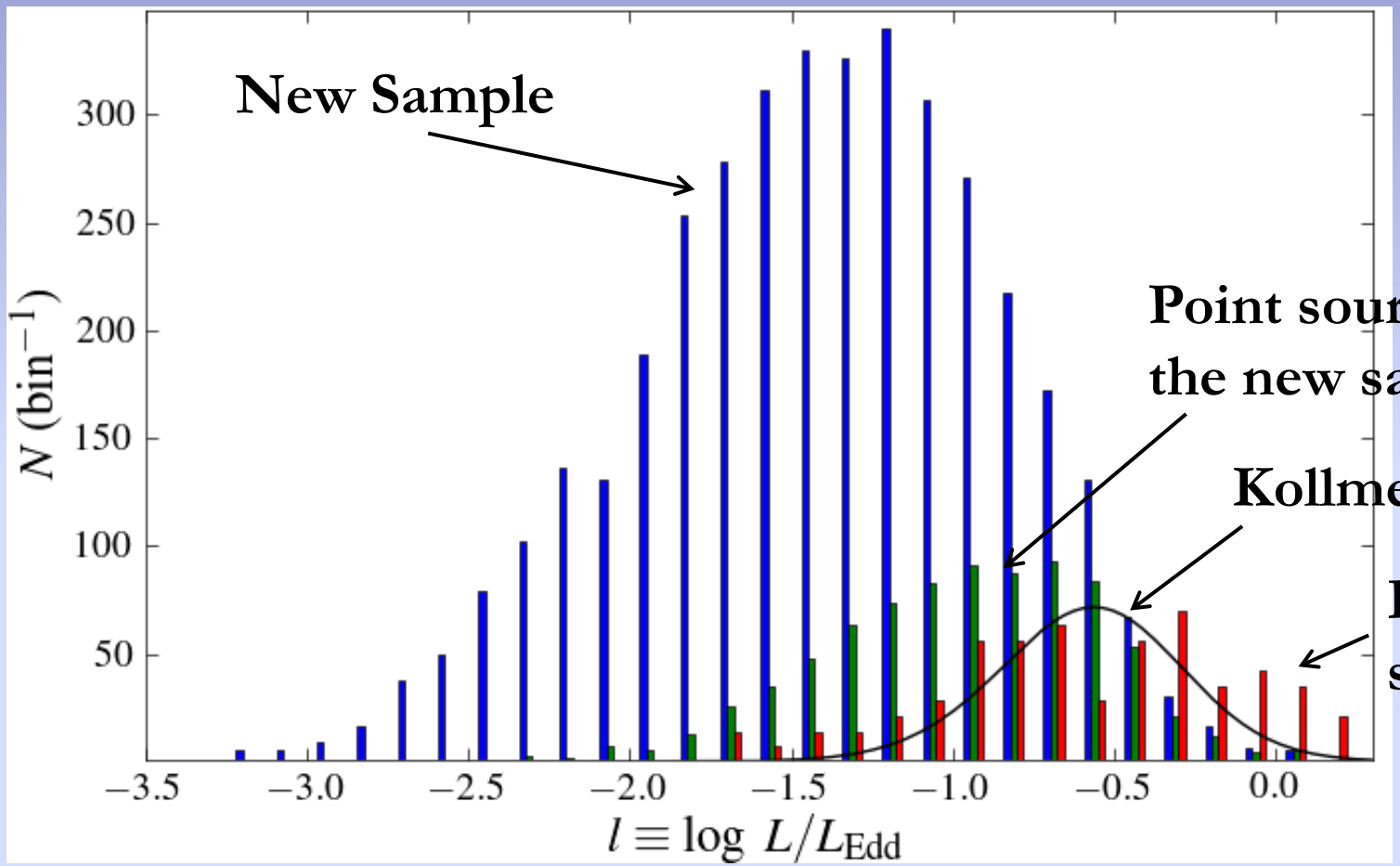


$L_{\mathrm{bH}\alpha}$ vs $\mathrm{FWHM}_{\mathrm{bH}\alpha}$

$m \equiv \log M_{BH}/M_{\odot}$; $l \equiv \log L/L_{Edd}$



Eddington Ratio Distribution



all 3 selected to be point sources

→ ***tendency for log L/L_{Edd} ~ -0.5 seems like a selection effect***

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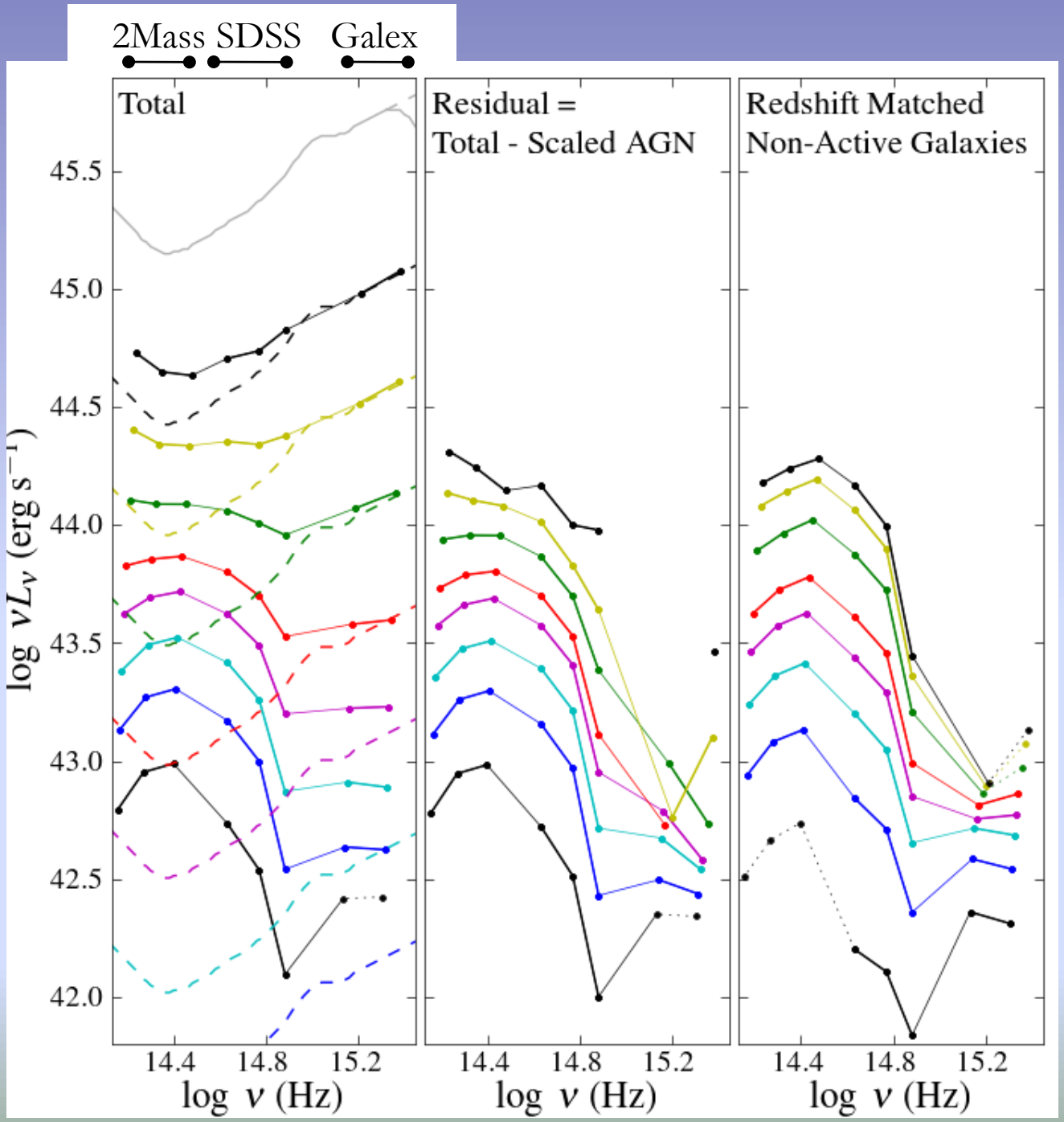
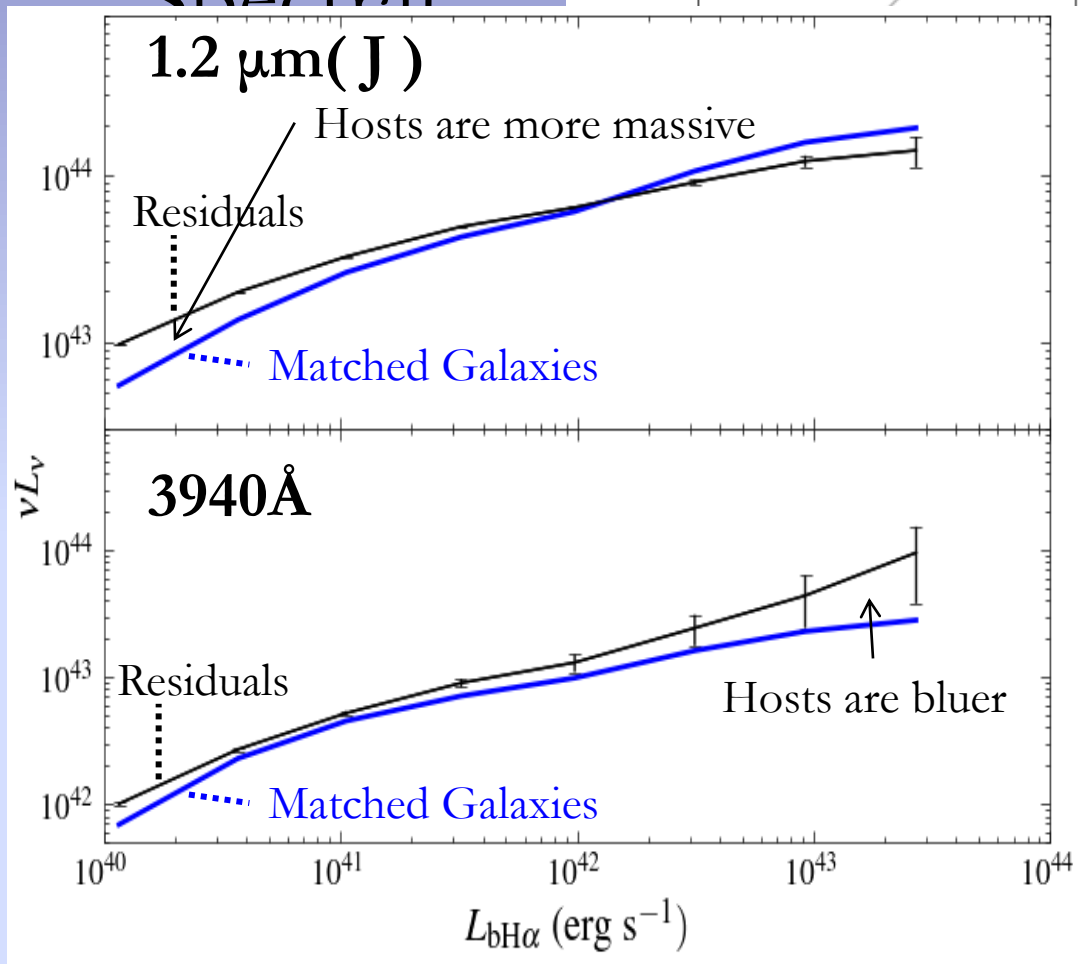
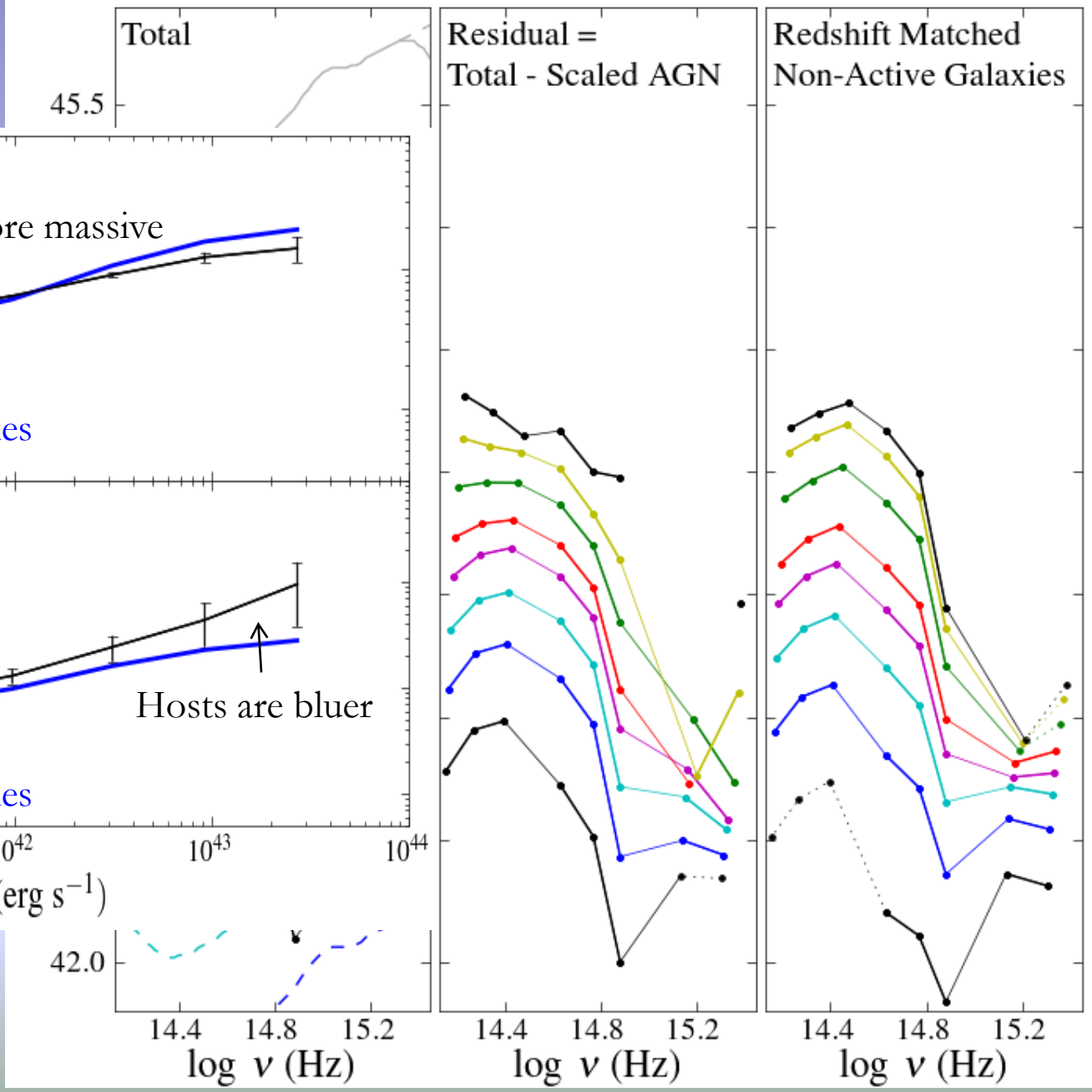
Mean Spectral Energy Distribution



Mean Spectral





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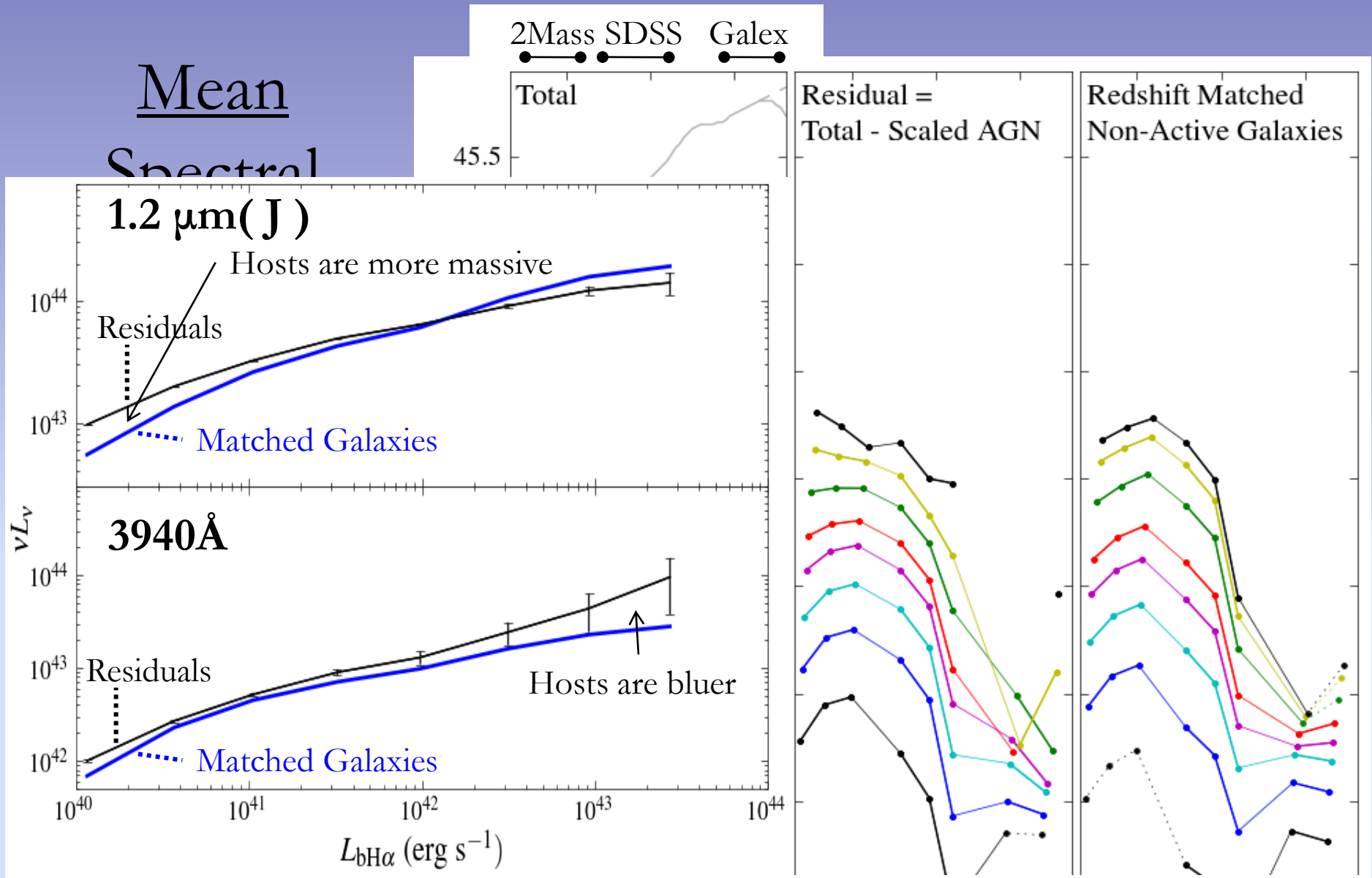
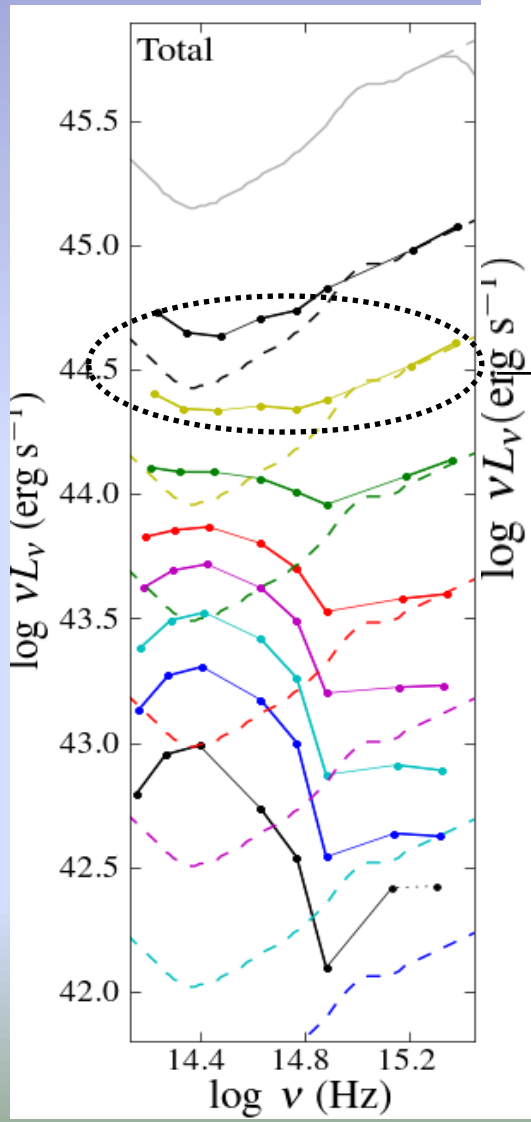
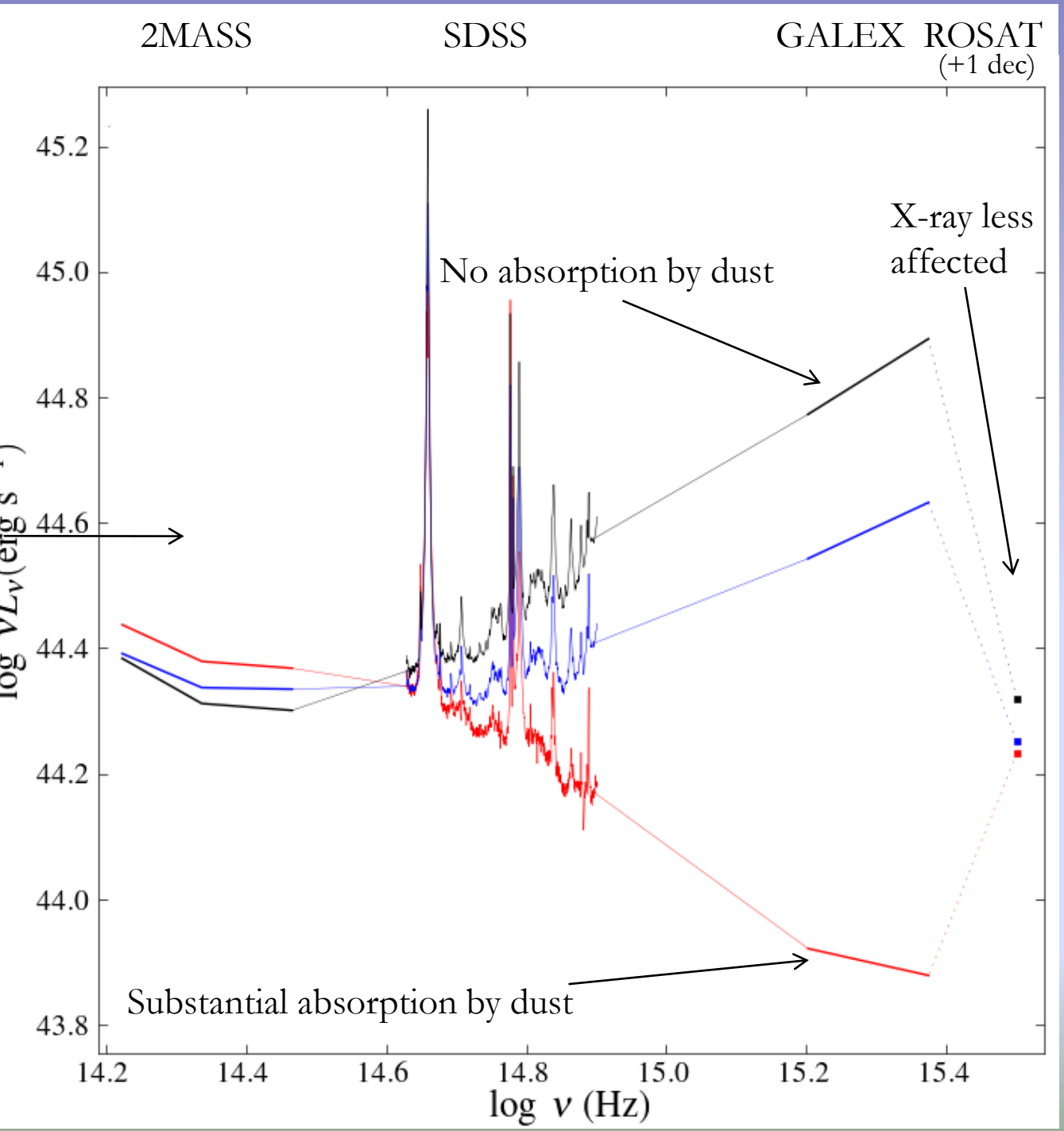


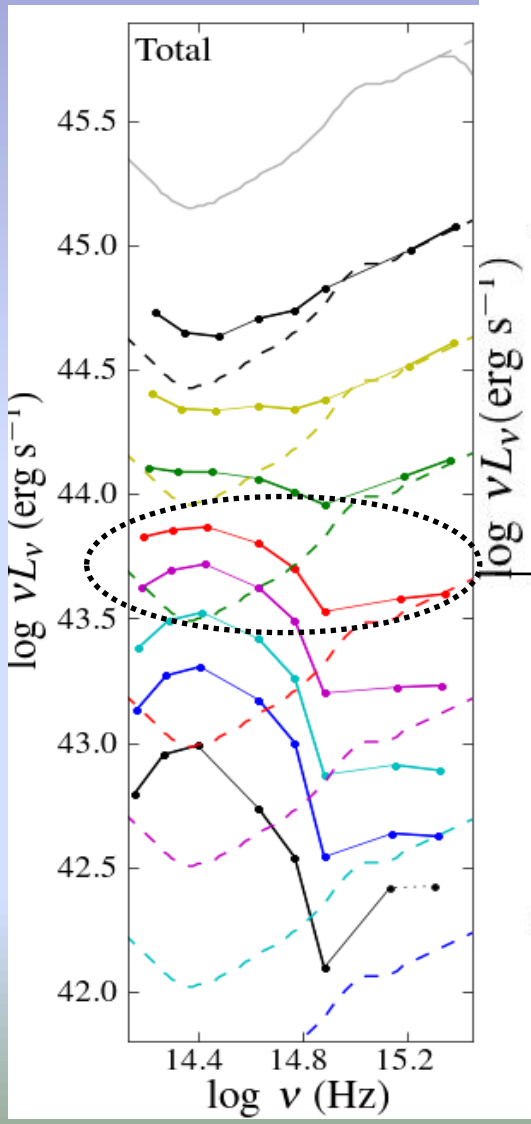
→ ***For $L_{bHa}>10^{41.5}$ erg s^{-1}, the mean SED remains constant with luminosity and scales with L_{bHa}.***

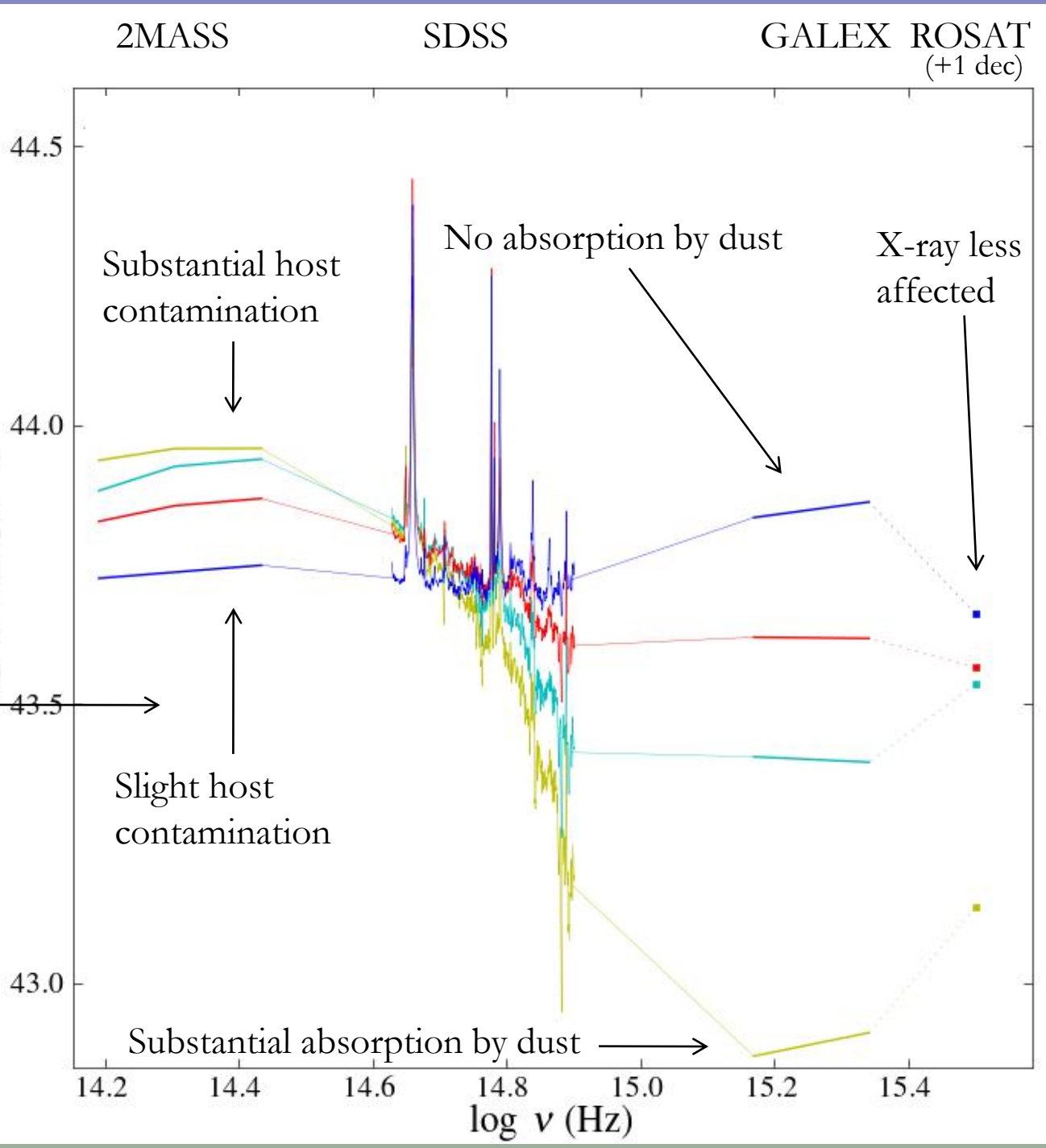
SED by $L_{bH\alpha}$ & Slope





SED by $L_{bH\alpha}$ & Slope





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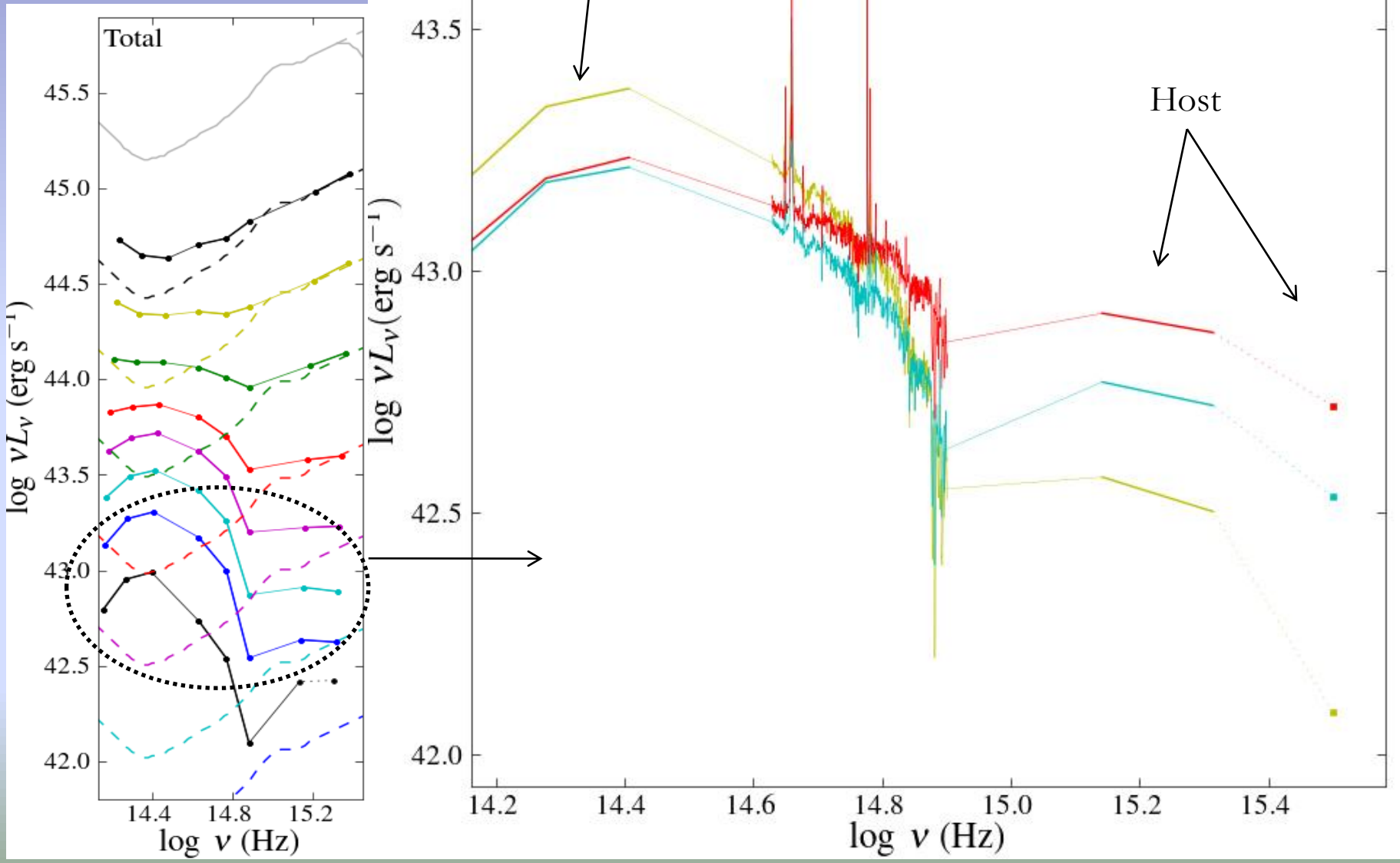

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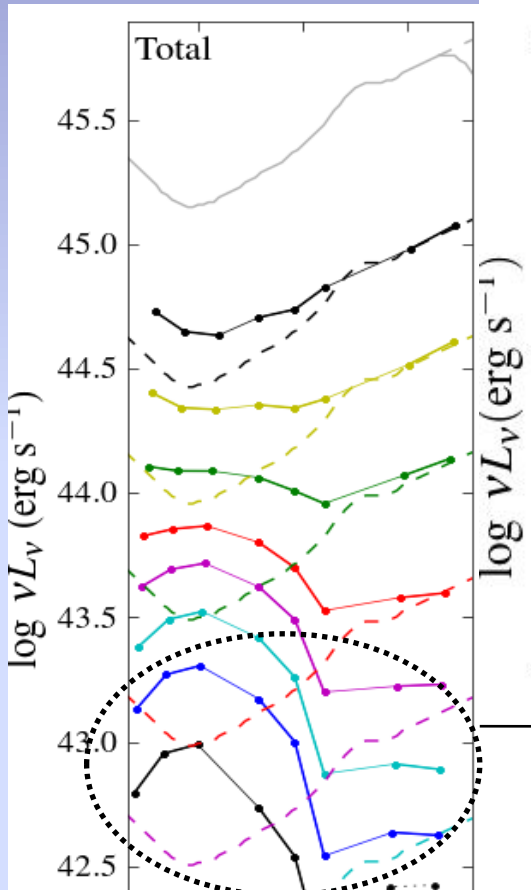
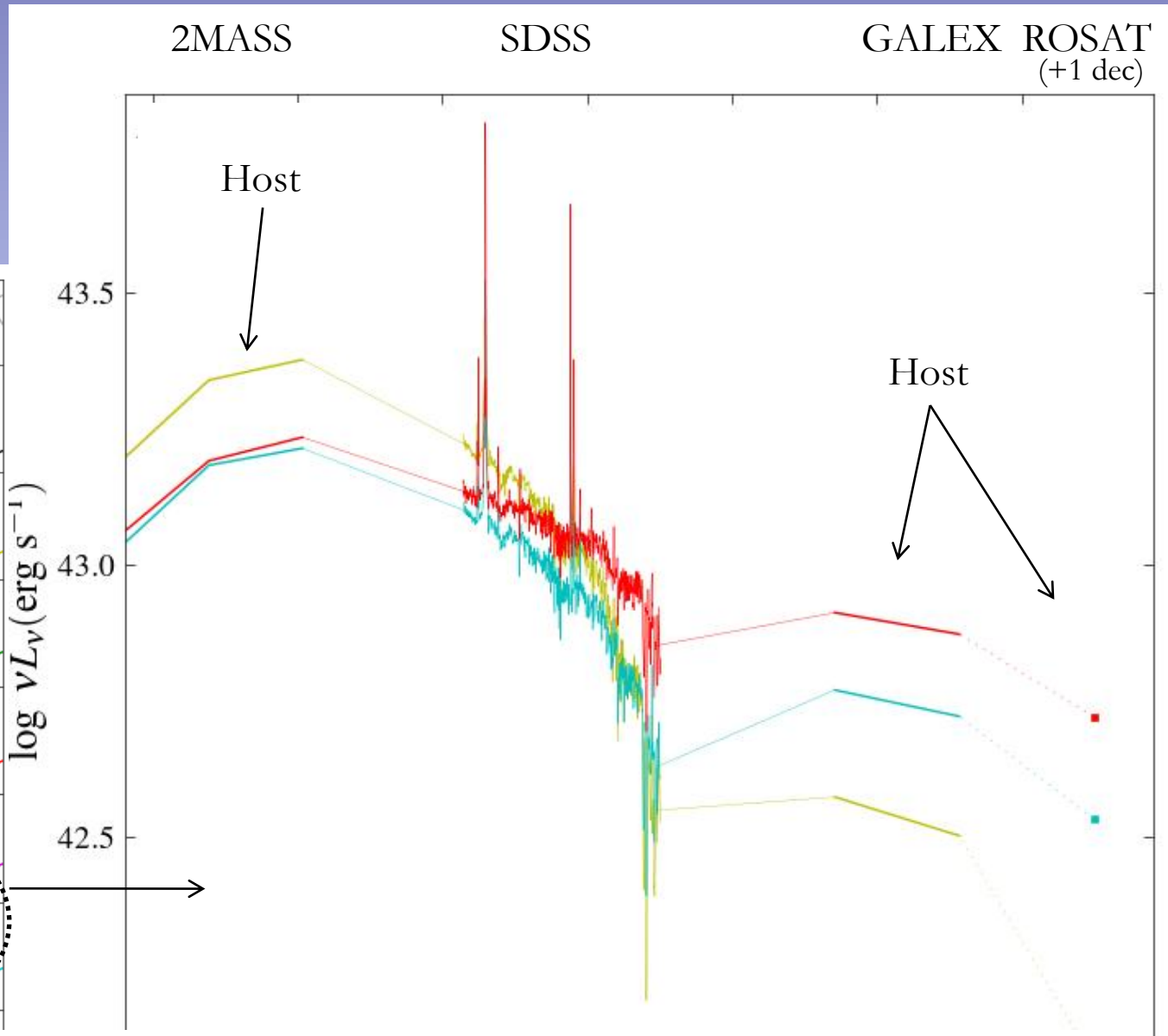
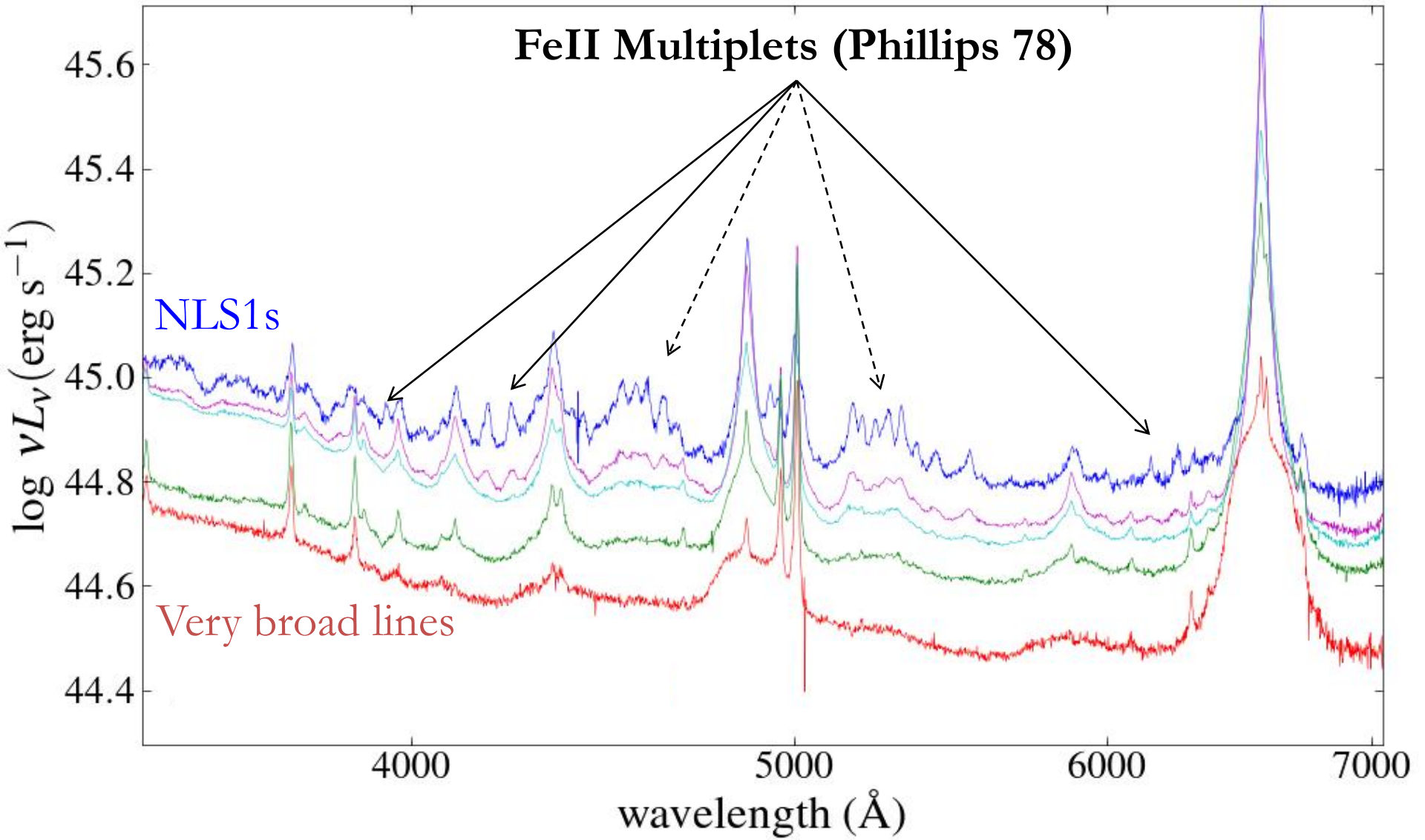


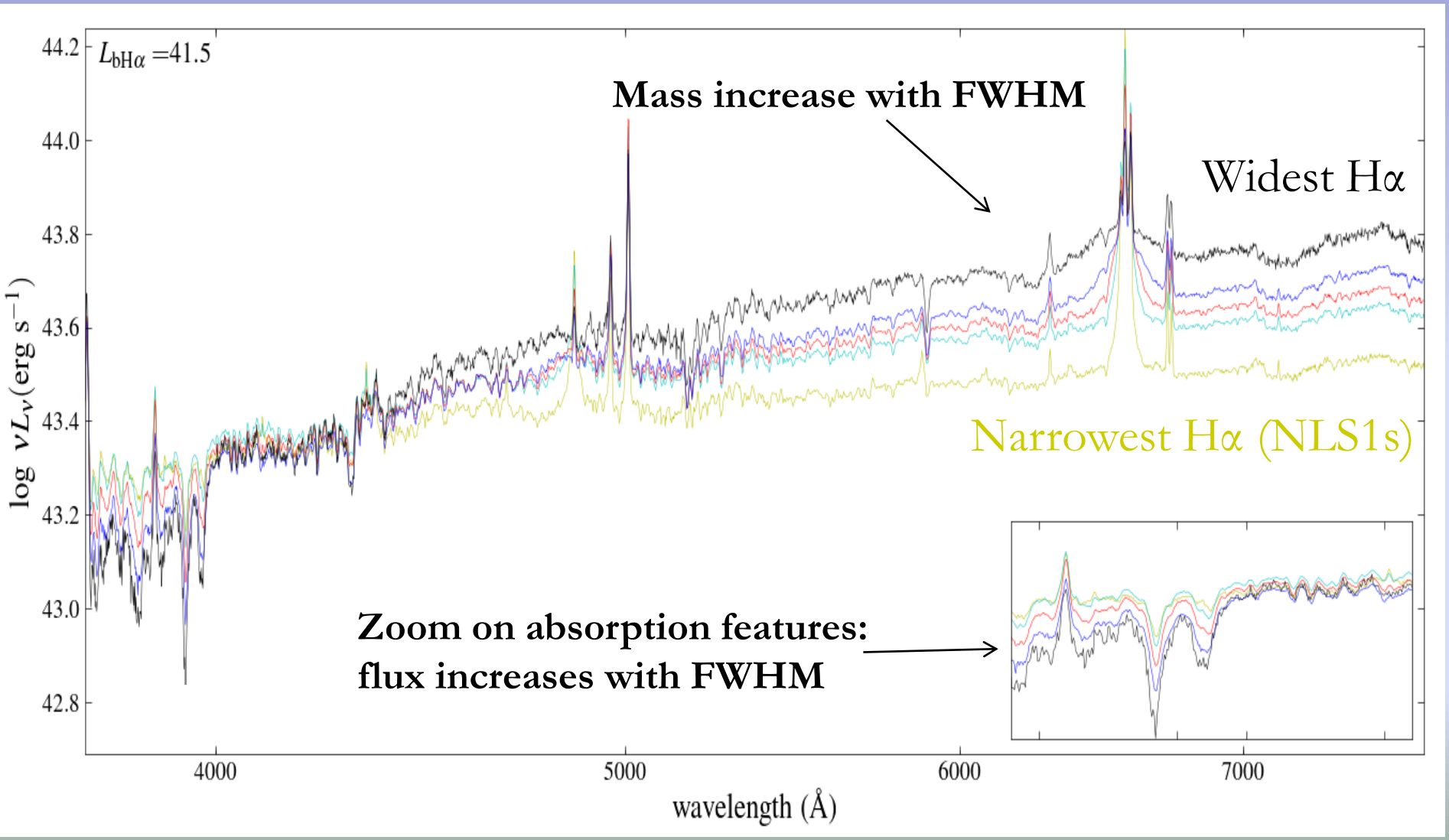


→ ***Main changes to optical slope are due to mechanisms external to the accretion disk.***

Spectrum by FWHM – Highest $L_{bH\alpha}$ bin



SED by $L_{bH\alpha}$ and FWHM



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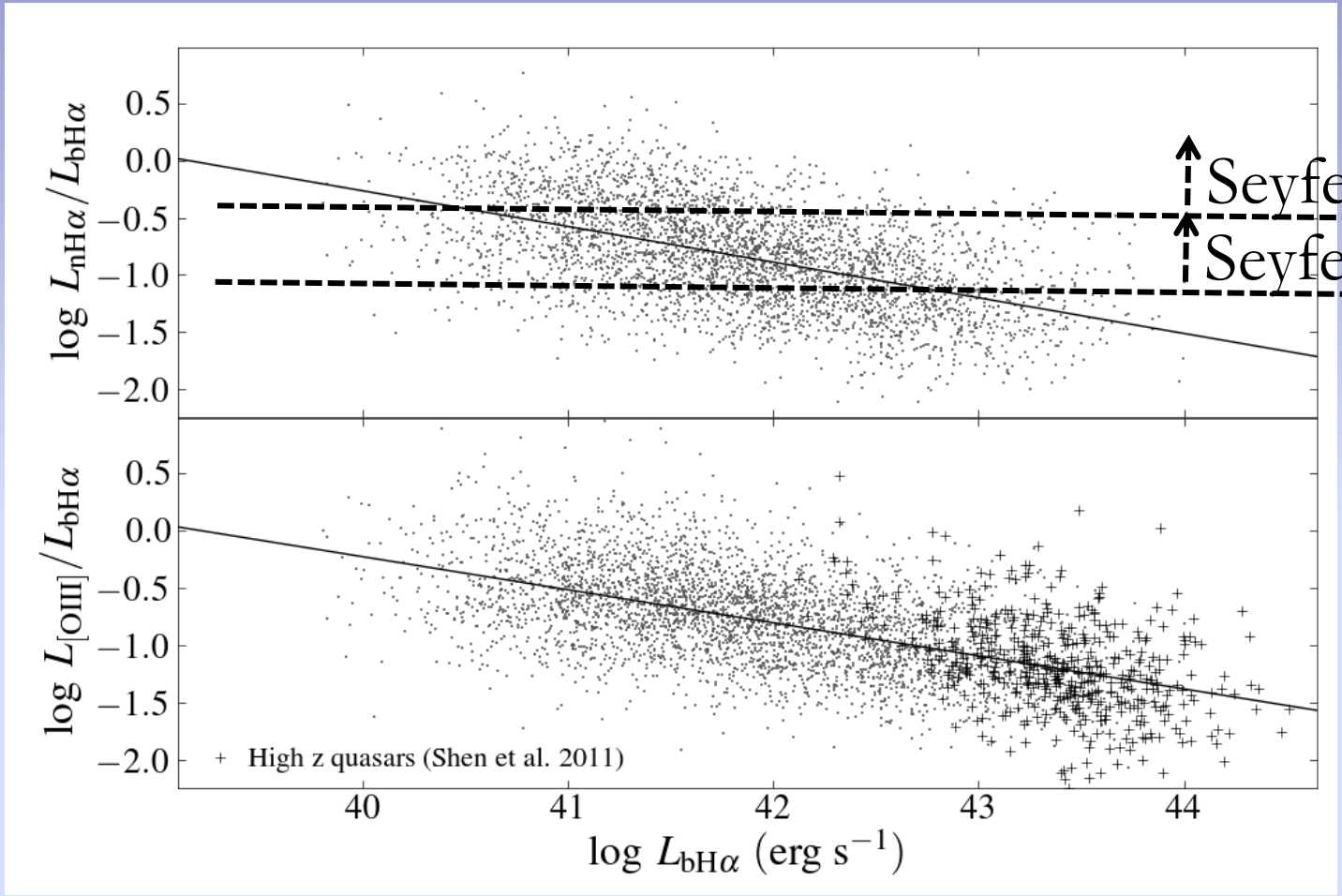
Narrow-Line Strength



→ ***Most low luminosity Type 1 Seyferts are 1.5-1.9***

Are all partially obscured, or is it the NLR covering factor?

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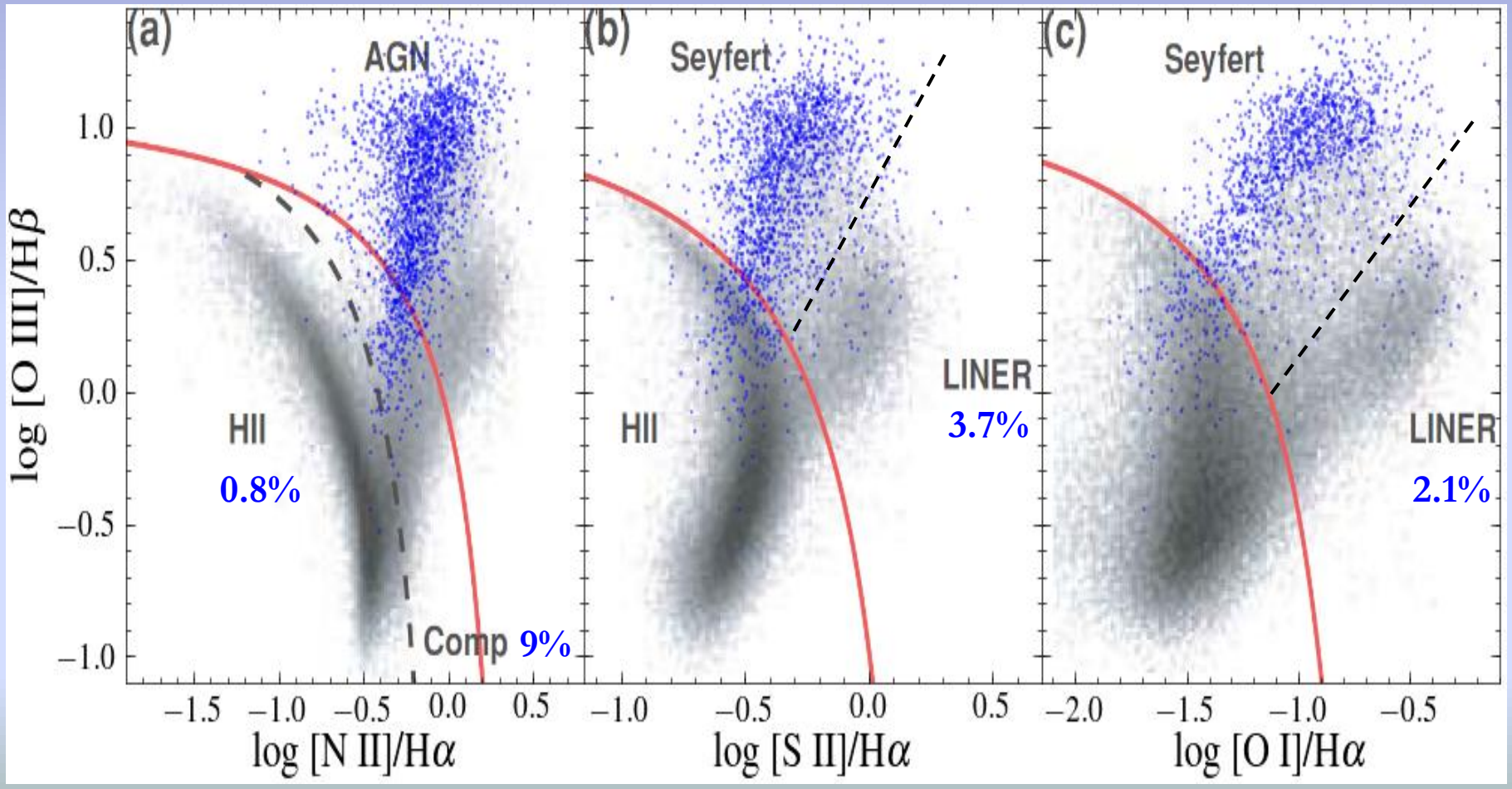
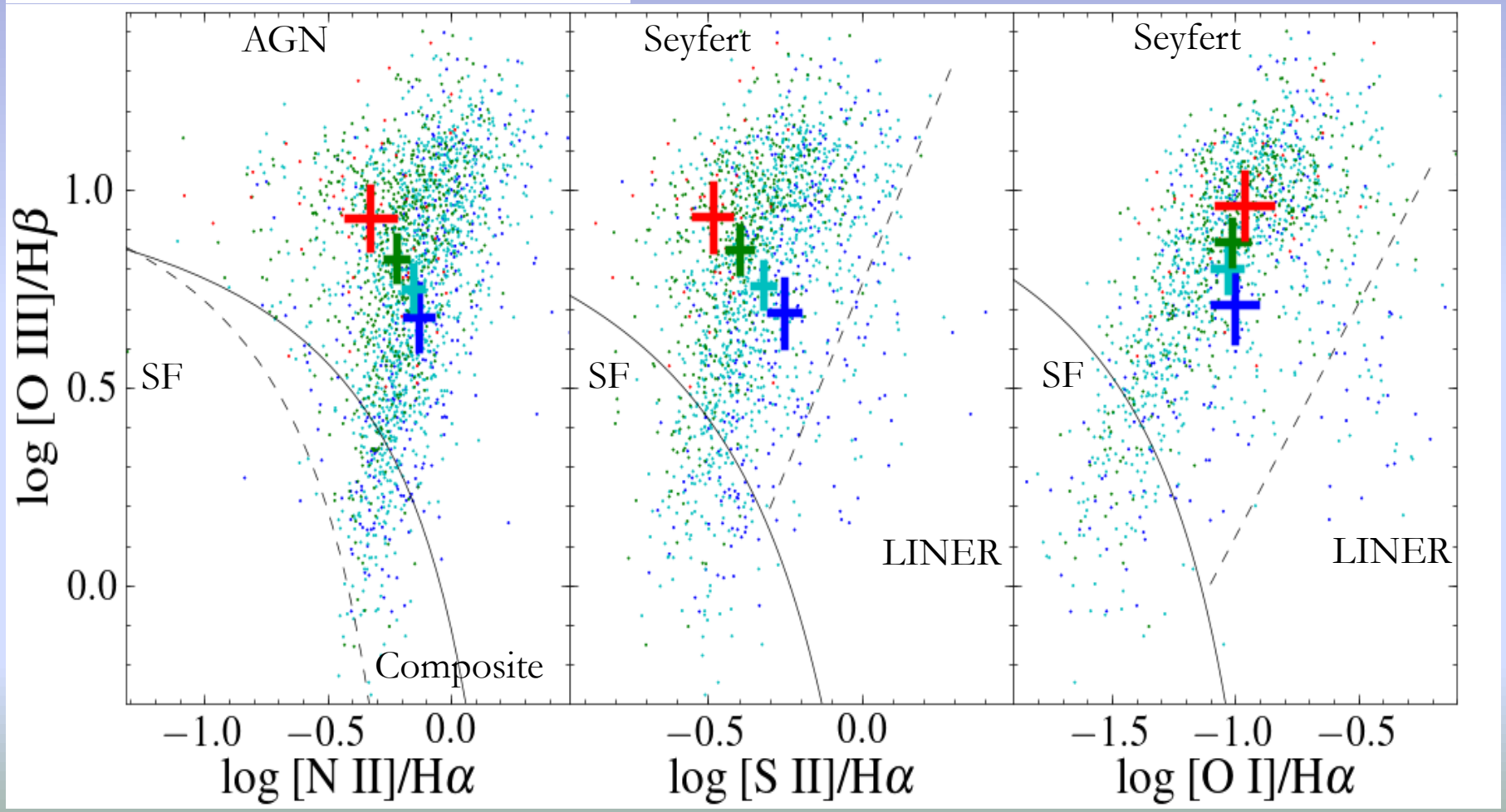
BPT Position of BLR selected AGN

Type-2 AGN: Kewley et al. 06, Kauffmann et al. 03 (Background)



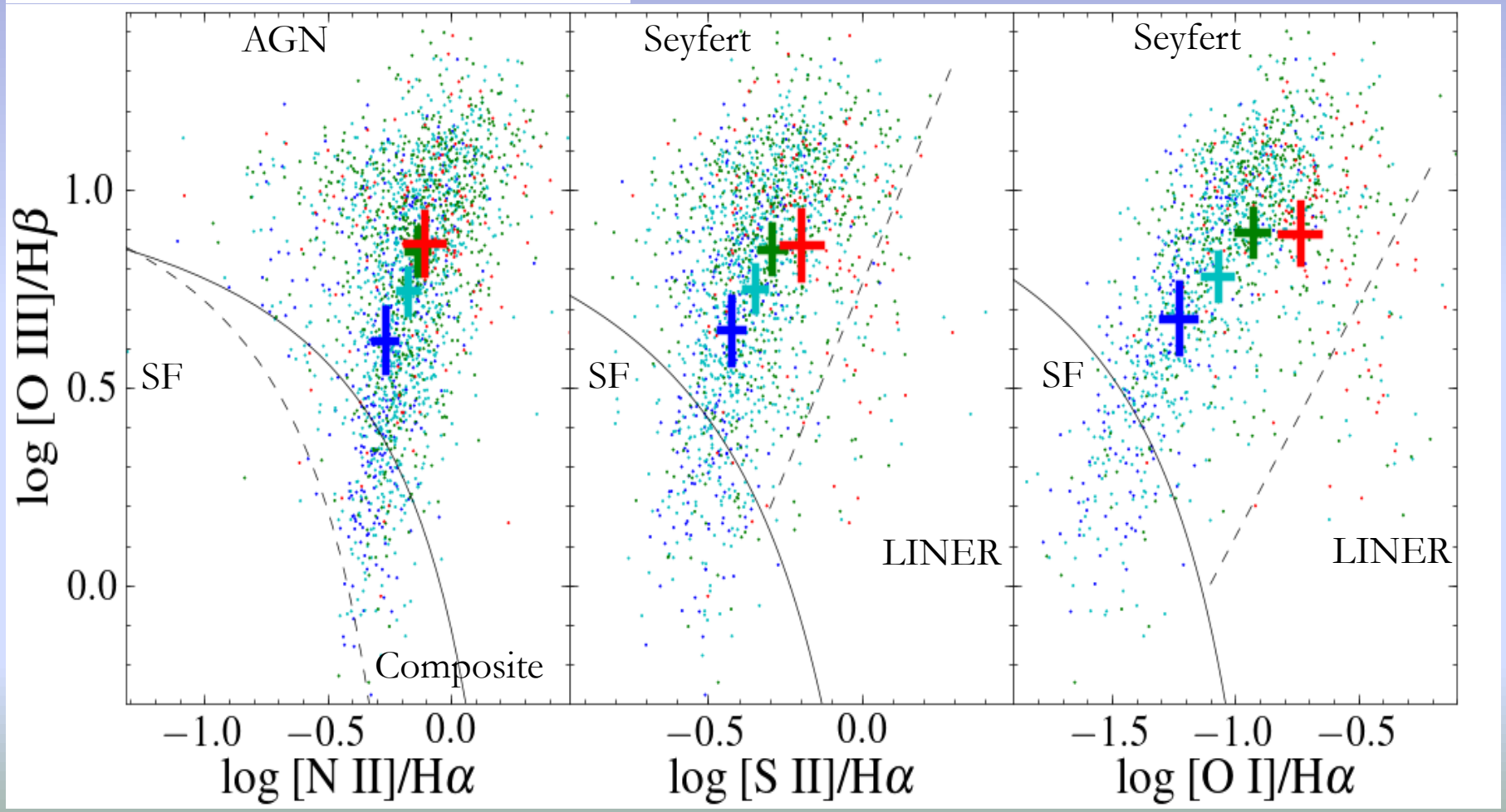
BPT Position of BLR selected AGN Luminosity Dependence

low $L_{bH\alpha}$ . . high $L_{bH\alpha}$



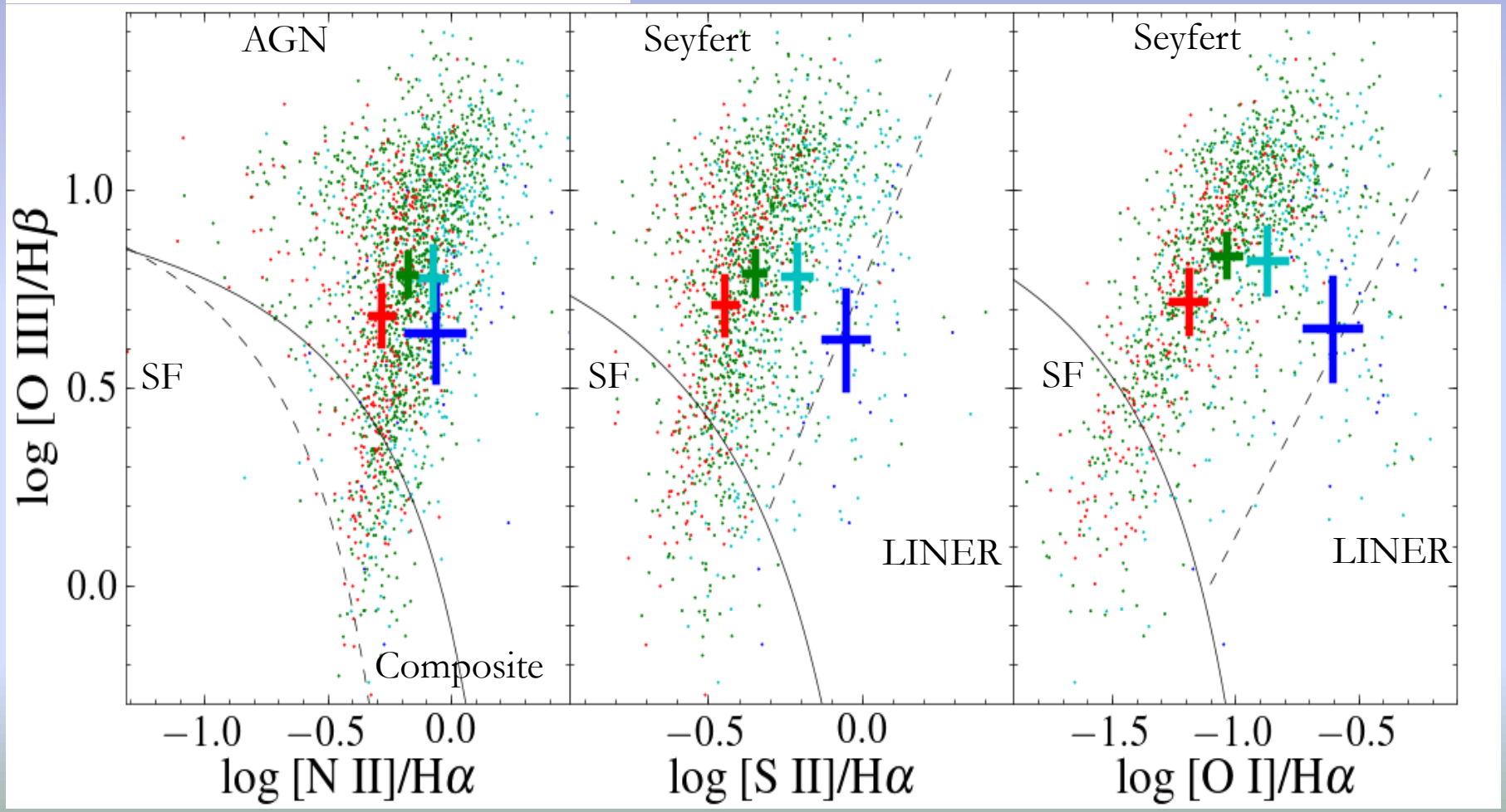
BPT Position of BLR selected AGN
Broad Hα FWHM Dependence

NLS1s . . Very broad lines



BPT Position of BLR selected AGN L/L_{Edd} Ratio Dependence

low L/L_{edd} . . high L/L_{Edd}



Main Results and Possible Implications

A new sample of low luminosity Type-1 AGN (publicly available soon).

1. AGN with 10^{44} erg s^{-1} < L_{Bol} < $10^{46.5}$ erg s^{-1} have:
   I. A fixed mean-SED shape, scales with $L_{bH\alpha}$.
      An optically thick accretion disk and constant BLR covering factor?
   II. Mean host galaxies similar to mean inactive galaxies.
2. EW (NLR) increases with decreasing luminosity.
   Most Seyferts 1.5-1.9 probably differ from Sey' 1.0 in NLR covering factor
3. BPT classification of T1-AGN:
   9% Composites, 1% SF, 3% LINERs
   I. Change in mean position with L. *Change in ionization parameter?*
   II. AGN at log $L/L_{Edd} \approx$ -2.5 are LINERs.
      Change in ionizing continuum?
   III. NLS1s have low [OIII]/narrow Hβ and low [NII],[SII],[OI]/narrow Hα. *Change in ?*