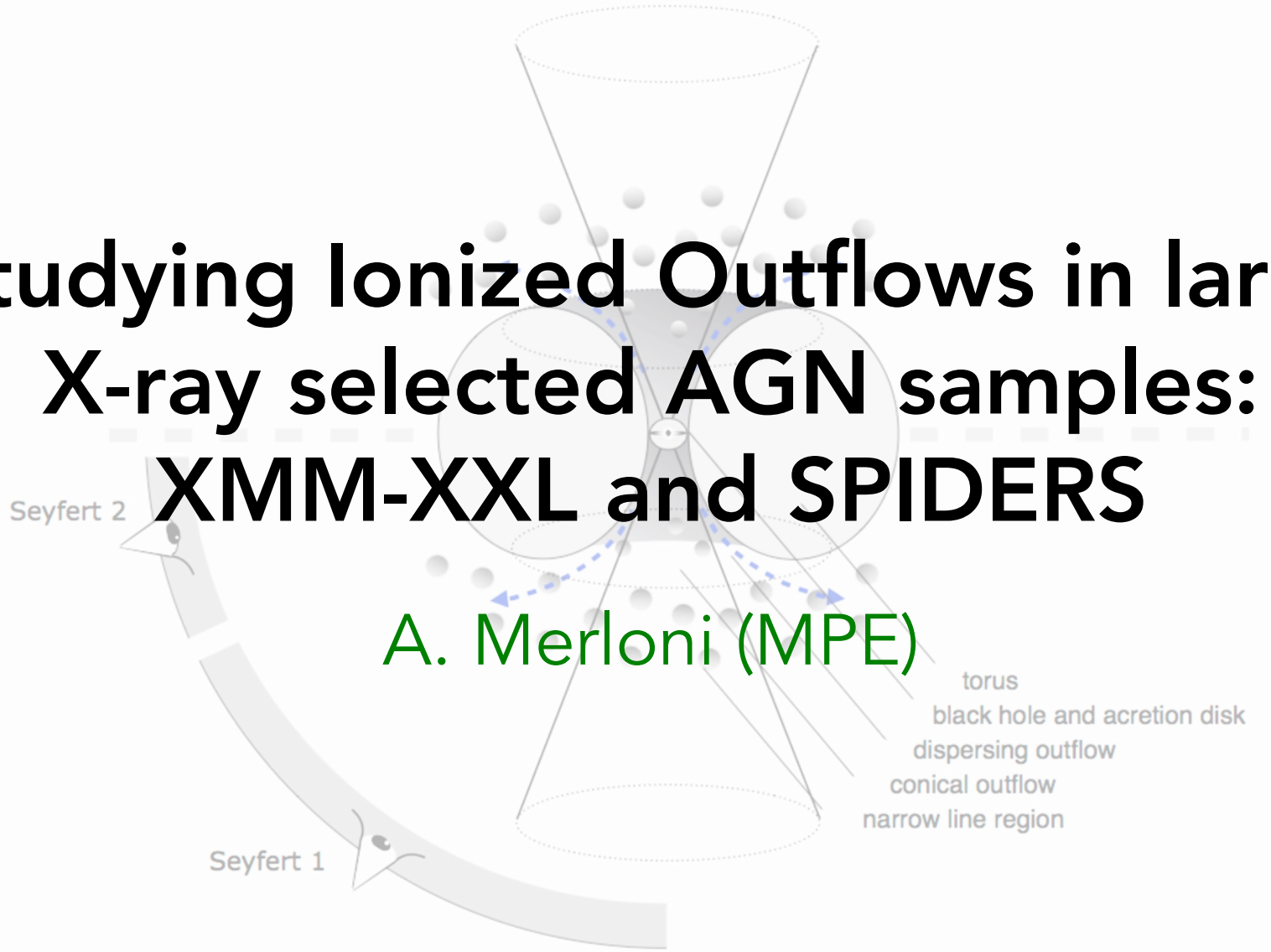
Studying Ionized Outflows in large X-ray selected AGN samples: XMM-XXL and SPIDERS

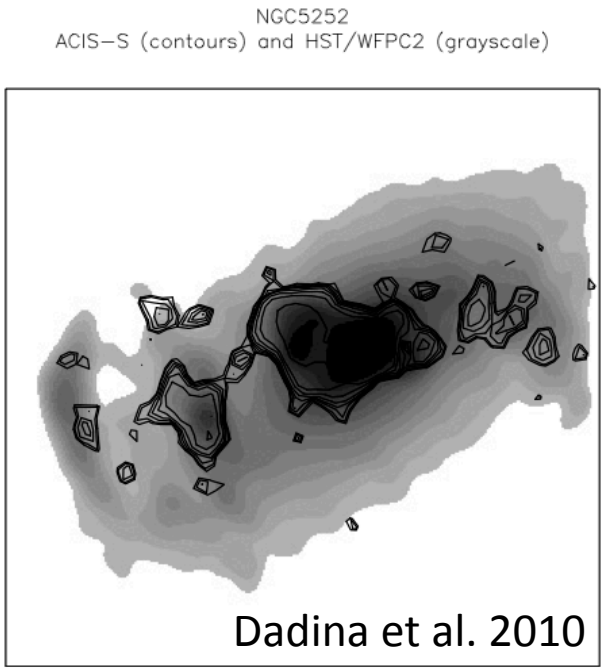
A. Merloni (MPE)

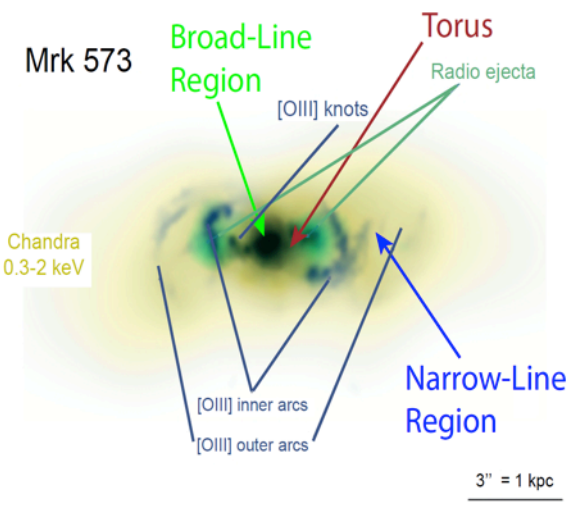


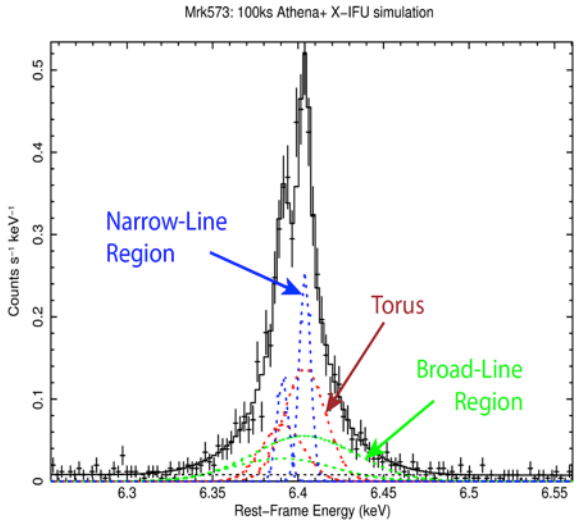
Introduction

- Feedback from powerful QSOs (radiative mode) is needed to:
  - Maintain the observed close connection between the growth of SMBH and the growth of galaxies
  - Ensure a tight relation between black hole mass and galaxy mass/velocity dispersion
  - Help establishing the color-bimodality of galaxies
- Massive outflows are expected/observed from luminous QSOs, and their effect on the Narrow Line Regions can be studied in detail
- Sample selection is critical to move from sporadic events to an assessment of the population
- Present a study of X-ray selected AGN in XMM-XXL, prospect for future (SDSS-IV/SPIDERS)

The narrow line region of AGN: a feedback calorimeter?



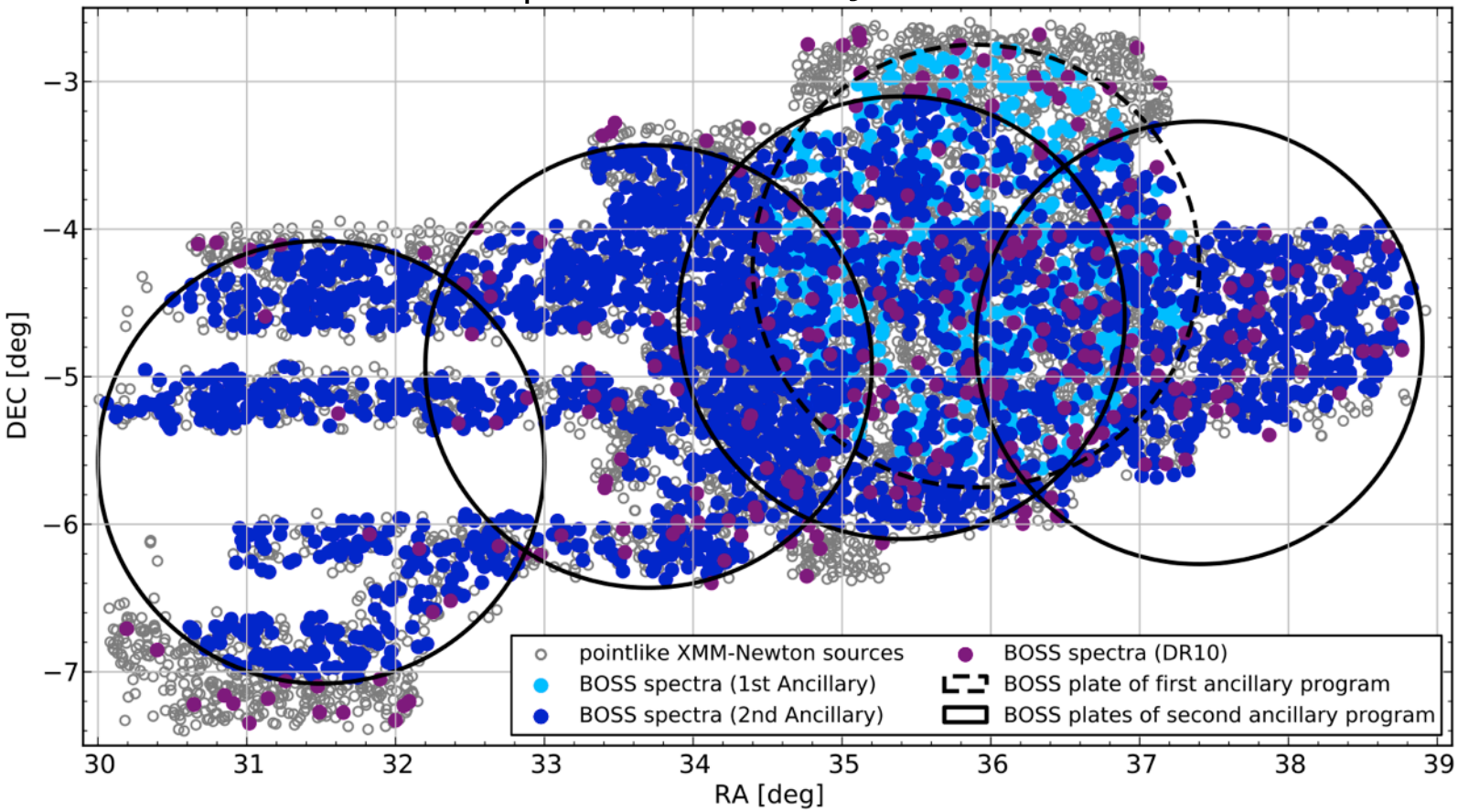




We use a highly complete X-ray selected sample to assess the energetics of Ionized outflows for AGN at z<1

X-ray AGN in XMM-XXL

~3000 SDSS/BOSS spectra of X-ray selected AGN in ~20 deg^2



Liu et al. 2016; Menzel et al. 2016; Georgakakis et al. 2016, 2017

X-ray AGN in XMM-XXL

Fig. 1

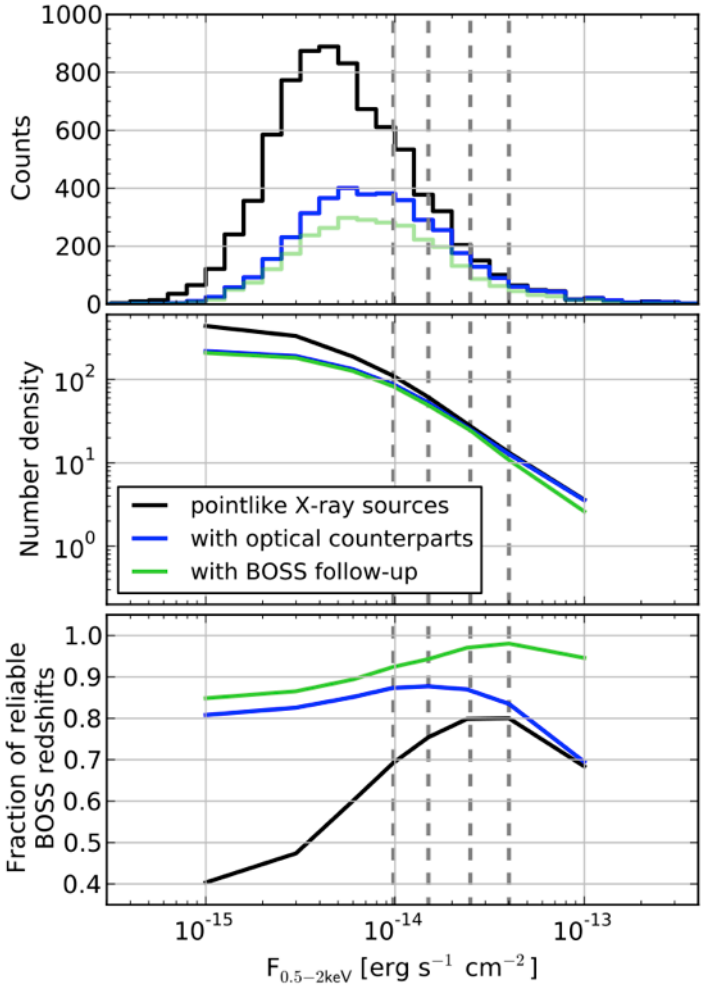
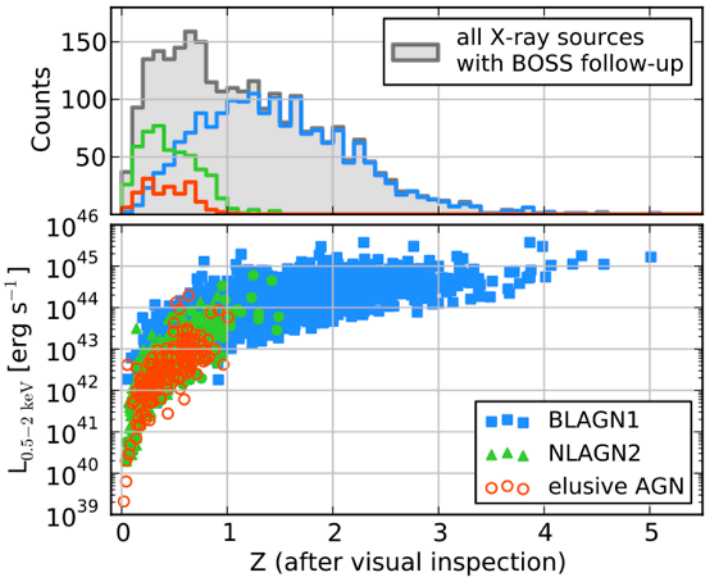
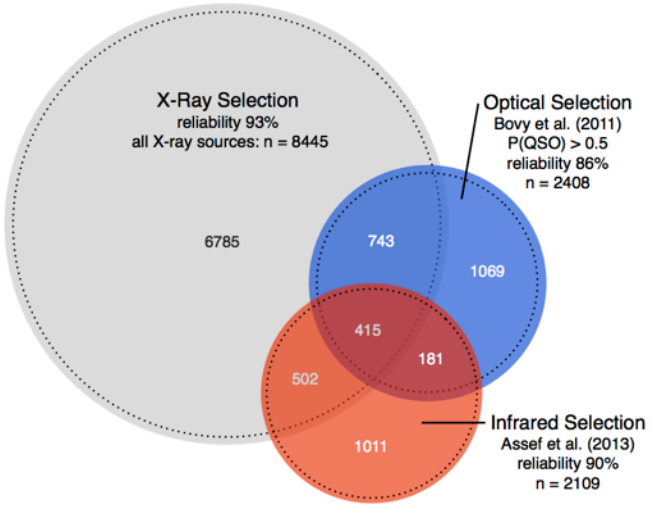


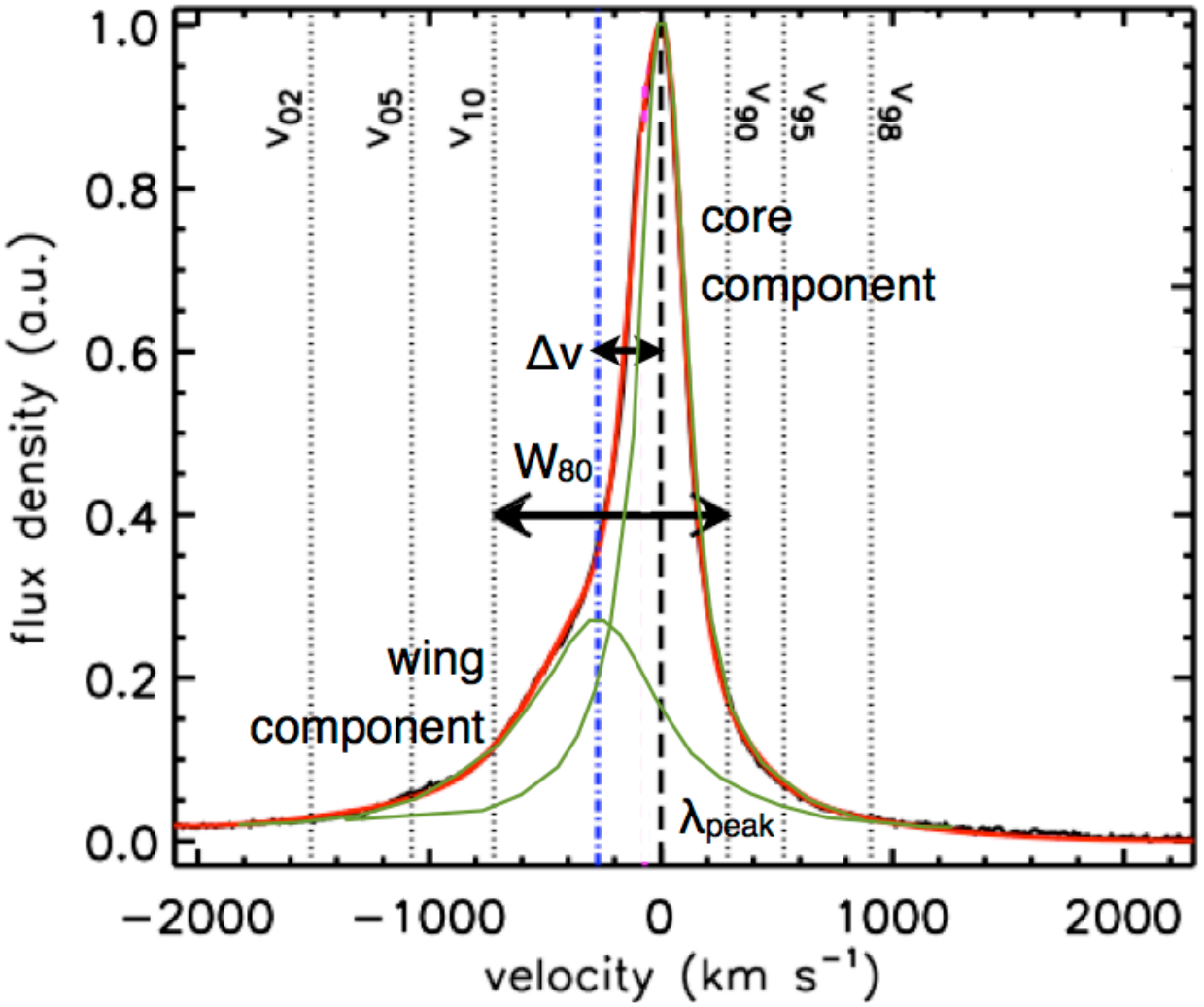
Fig. 2



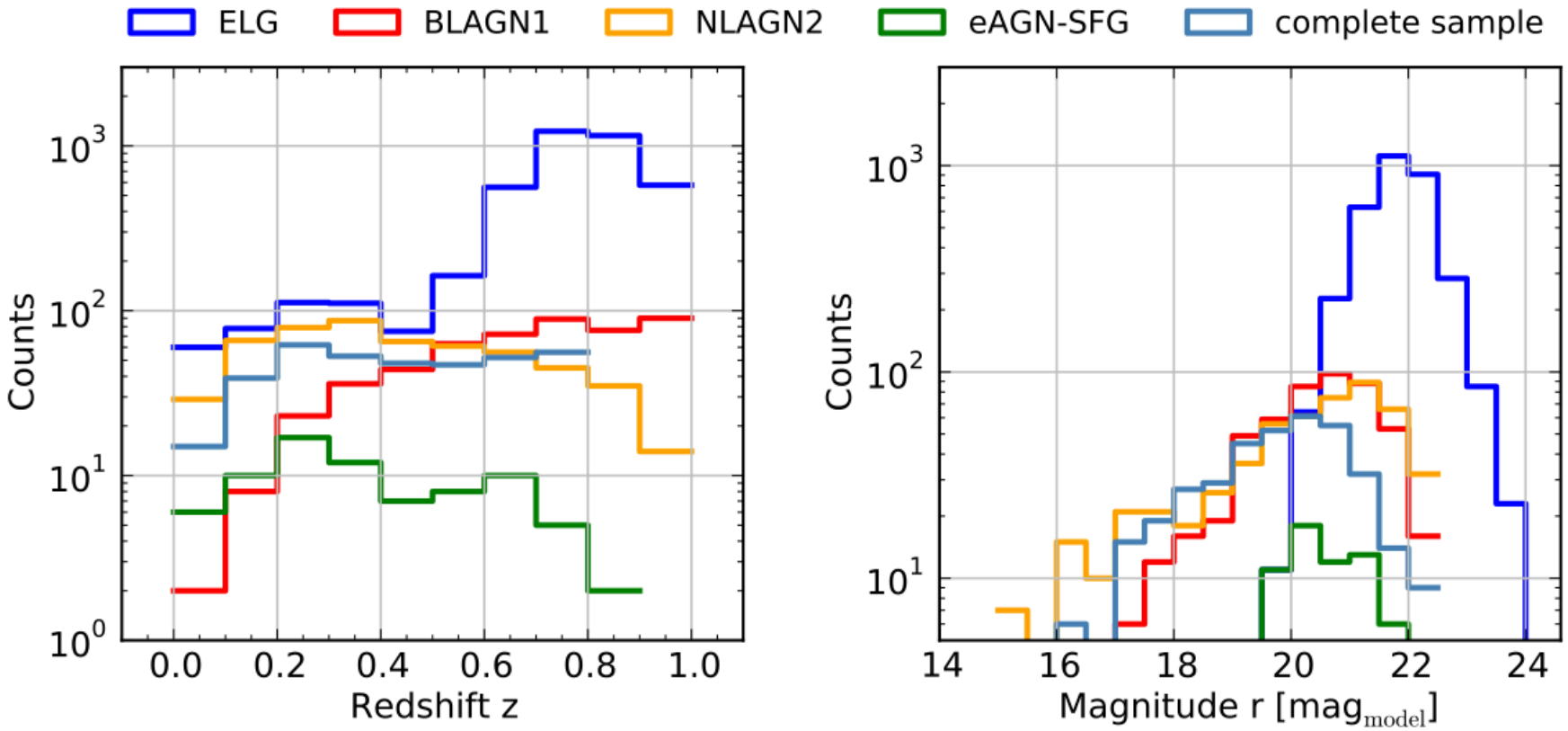


Menzel et al. 2016

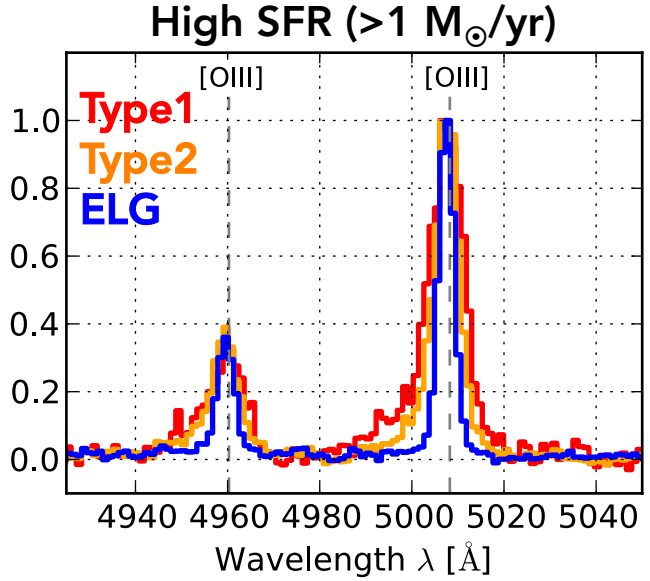
NLR kinematics: line diagnostics

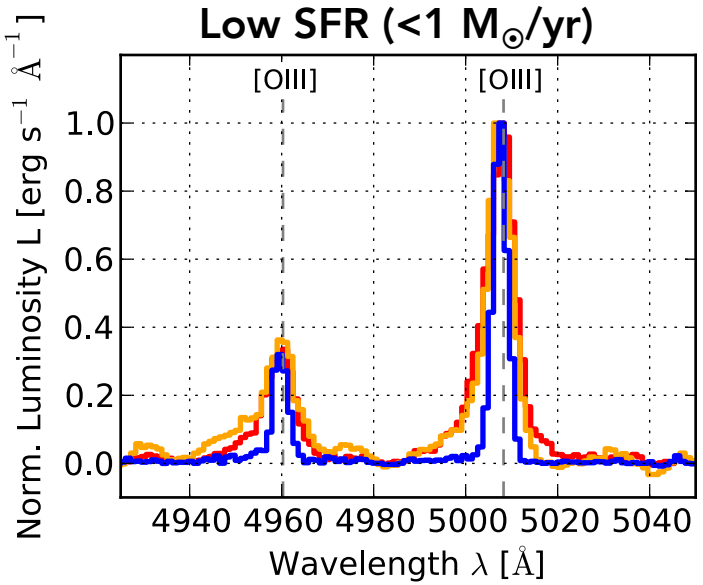


AGN vs. Emission Line Galaxies



NLR Kinematics: AGN impact





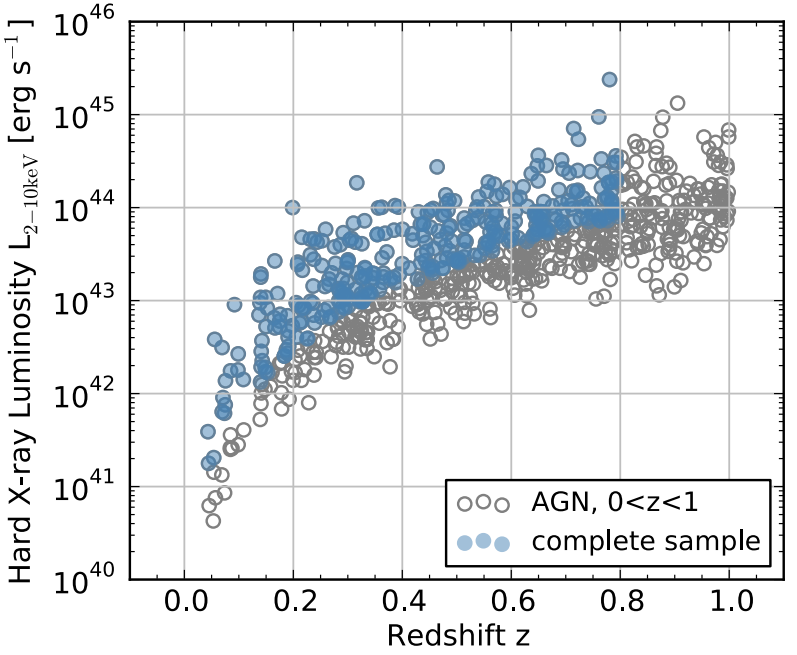
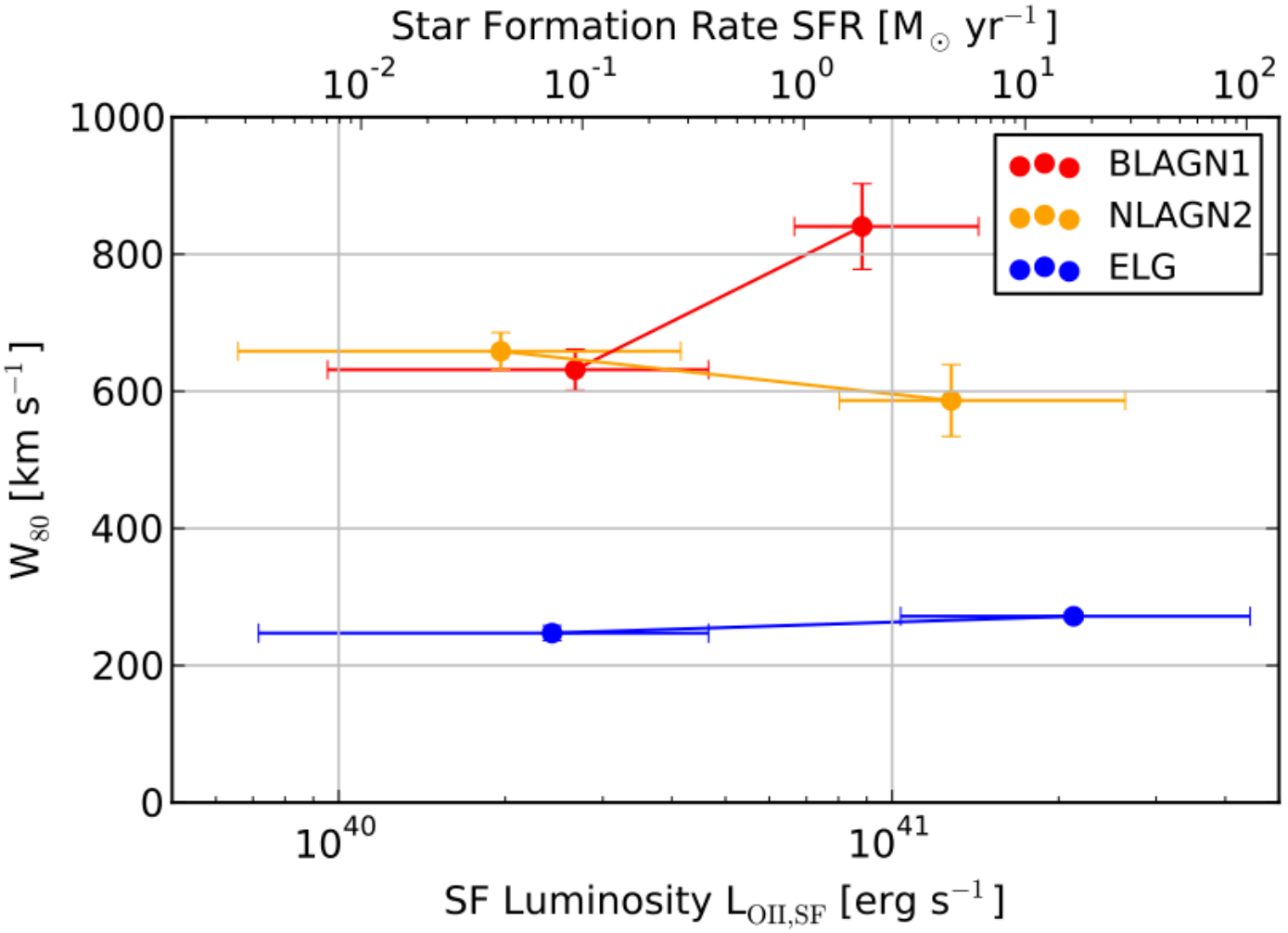


Table 4.2.: Fraction of ionized [OIII] outflows/inflows in BLAGN1 and NLAGN2.

	0<z<1			complete sample	
	ELG	BLAGN1	NLAGN2	BLAGN1	NLAGN2
	[per cent]	[per cent]	[per cent]	[per cent]	[per cent]
$SN_{\rm med} > 1$	1.0 ± 0.3	24 ± 3	16 ± 2	41 ± 6	28 ± 5
$SN_{\rm med} > 3$	1.8 ± 0.1	30 ± 3	19 ± 3	43 ± 6	31 ± 5
$SN_{\rm med} > 10$	-	55 ± 9	29 ± 6	60 ± 11	40 ± 10

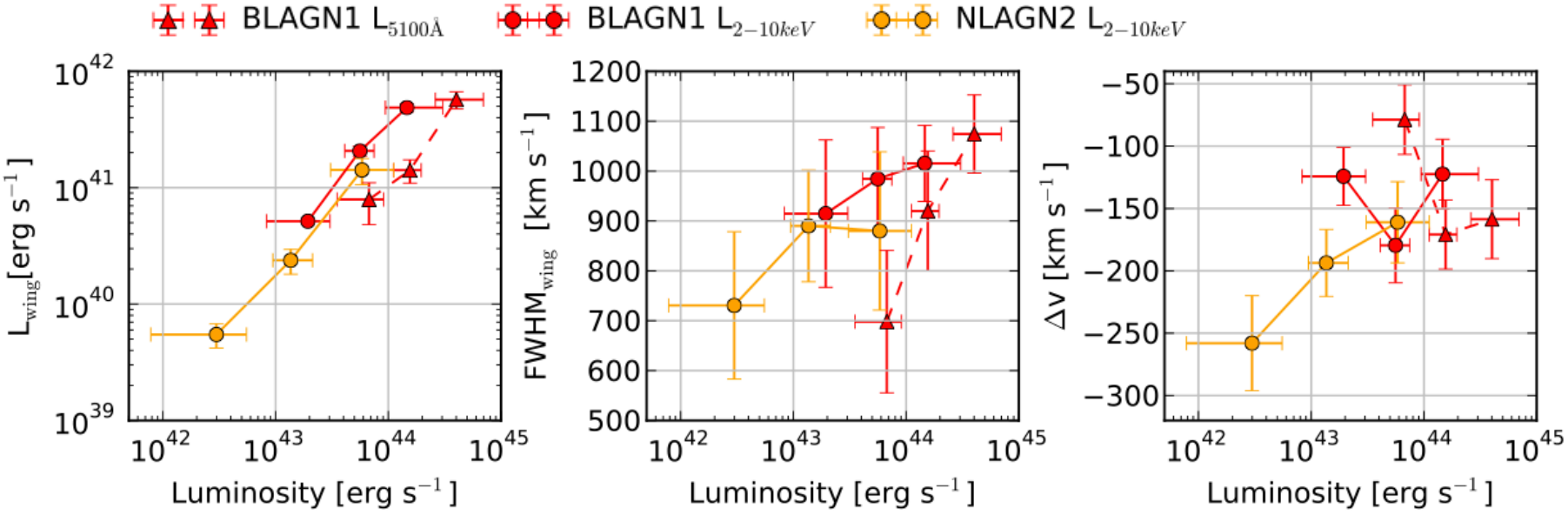
Menzel et al. 2016; PhD thesis

Ionized outflow are AGN driven



Menzel et al. 2016; PhD thesis

Ionized outflows energetics

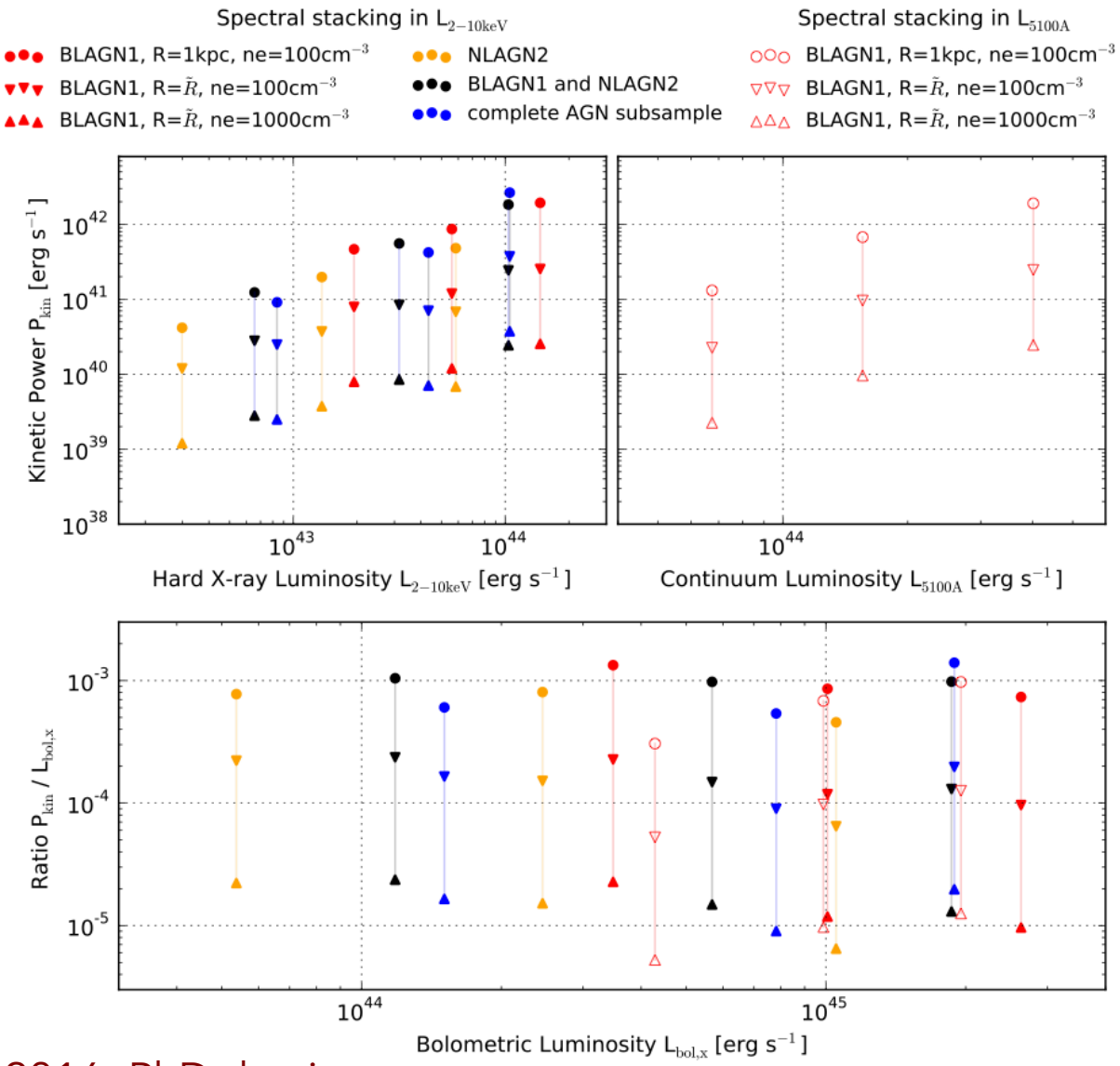


$$\dot{M}_{\rm out}^{\rm ion} = 164 \cdot \frac{C\, L_{44}^{\rm OIII,wing}\, v_3}{\langle n_{e3} \rangle\, 10^{[O/H]}\, R_{{\rm out},kpc}}\, {\rm M}_\odot\, {\rm yr}^{-1}$$

$$P_{\rm kin}^{\rm ion} = 5.17 \cdot 10^{43} \cdot \frac{C\, L_{44}^{\rm OIII,wing}\, v_3^3}{\langle n_{e3} \rangle\, 10^{[O/H]}\, R_{{\rm out},kpc}}\, {\rm erg\, s}^{-1}.$$

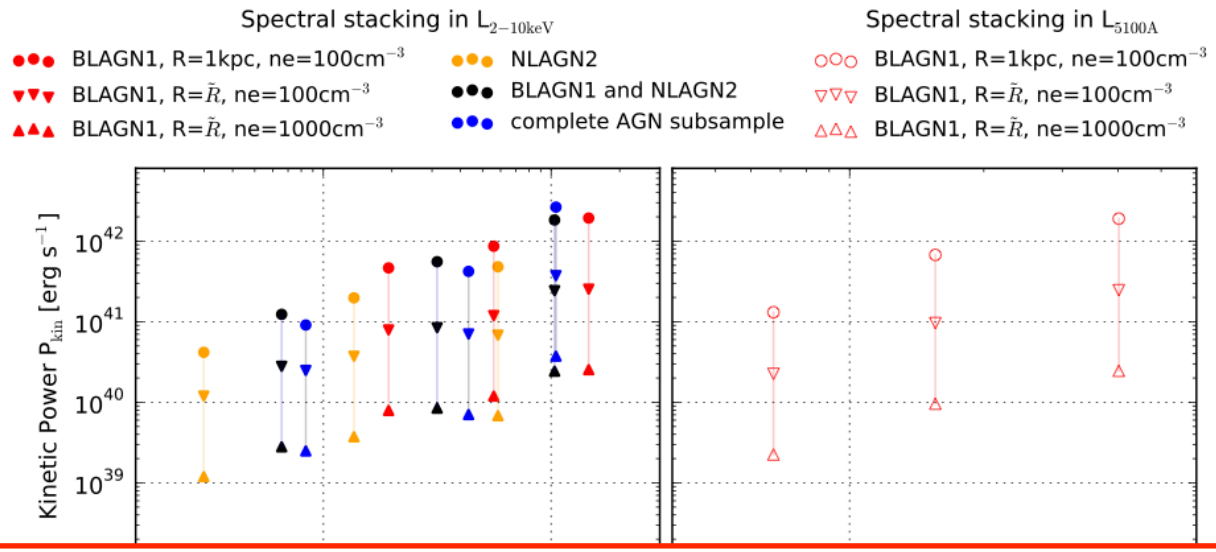
Menzel et al. 2016; PhD thesis; See also Perna et al. 2017

Ionized outflows energetics

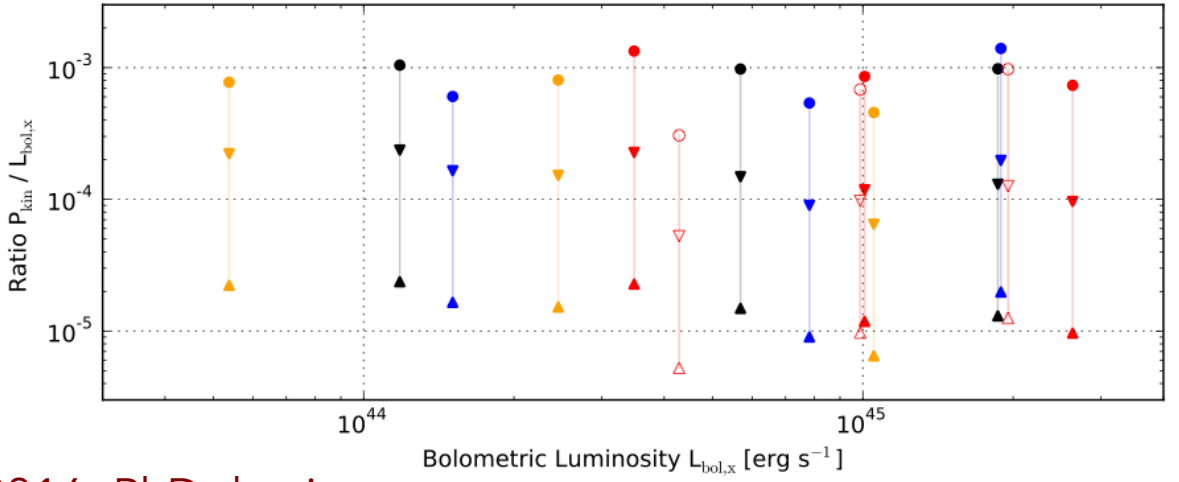


Menzel et al. 2016; PhD thesis

Ionized outflows energetics

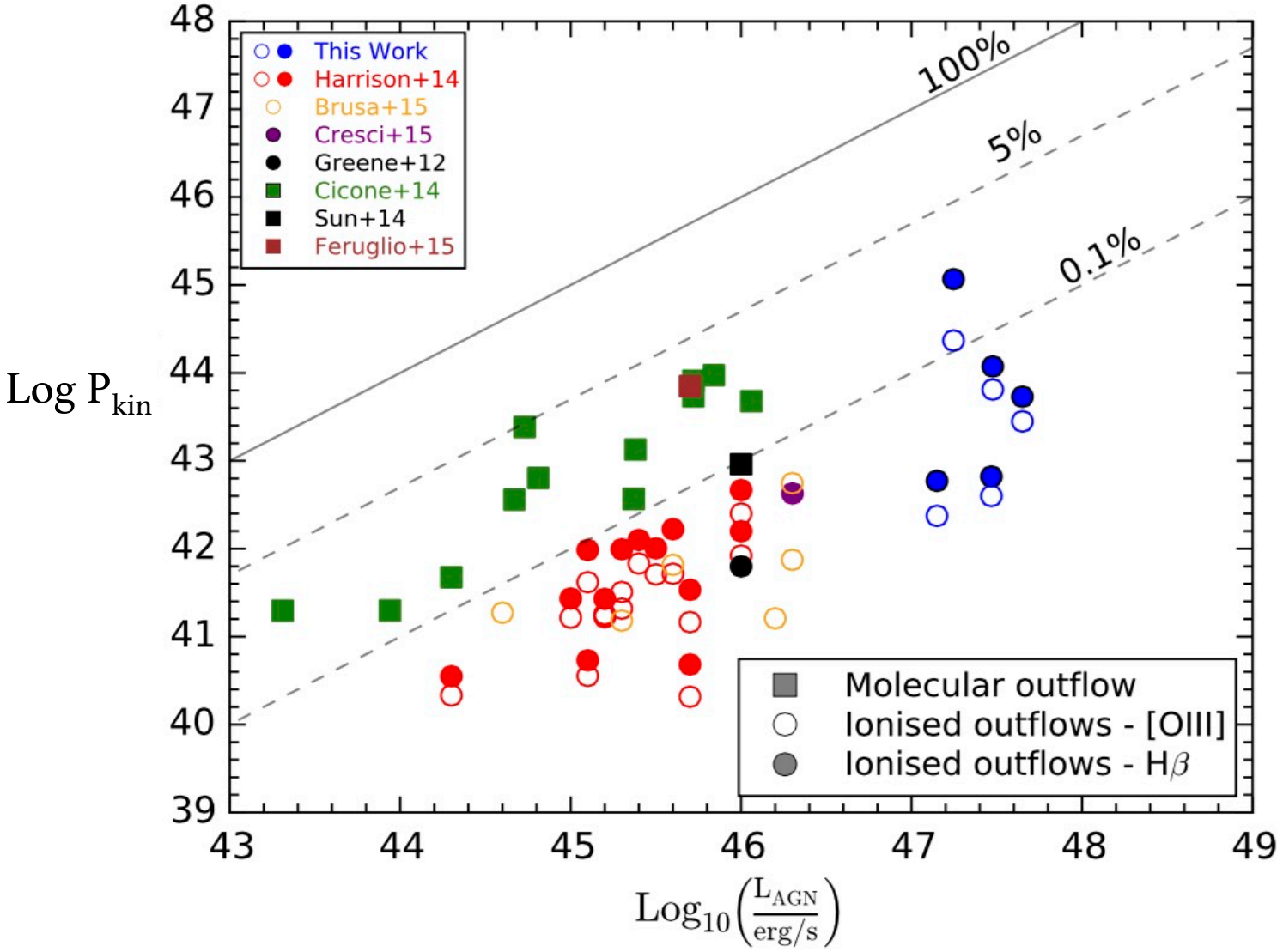


Average ratio of Kinetic/Bolometric luminosity ~10^{-4}!



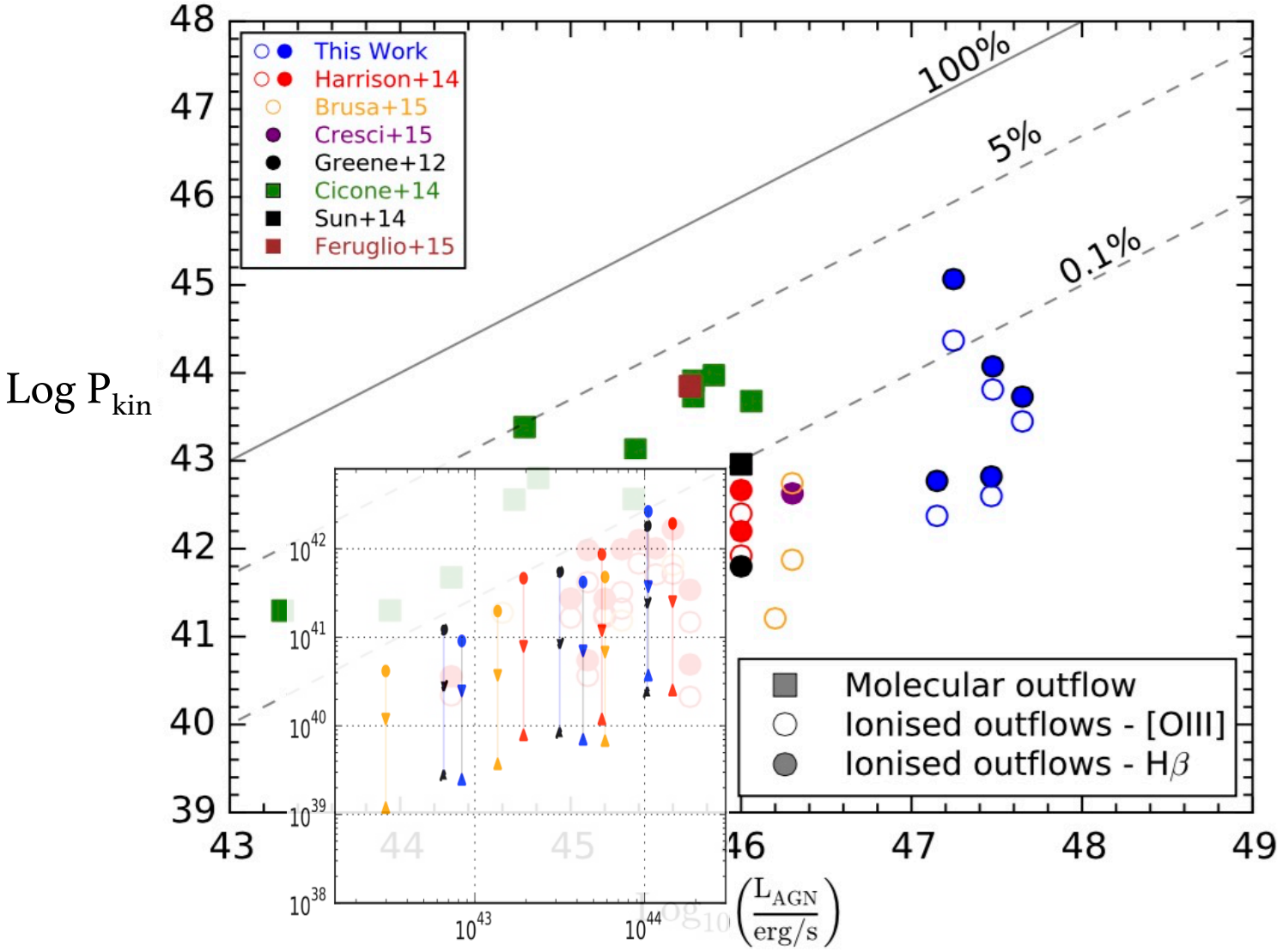
Menzel et al. 2016; PhD thesis

Ionized outflows energetics



Carniani et al. 2015

Ionized outflows energetics



Carniani et al. 2015

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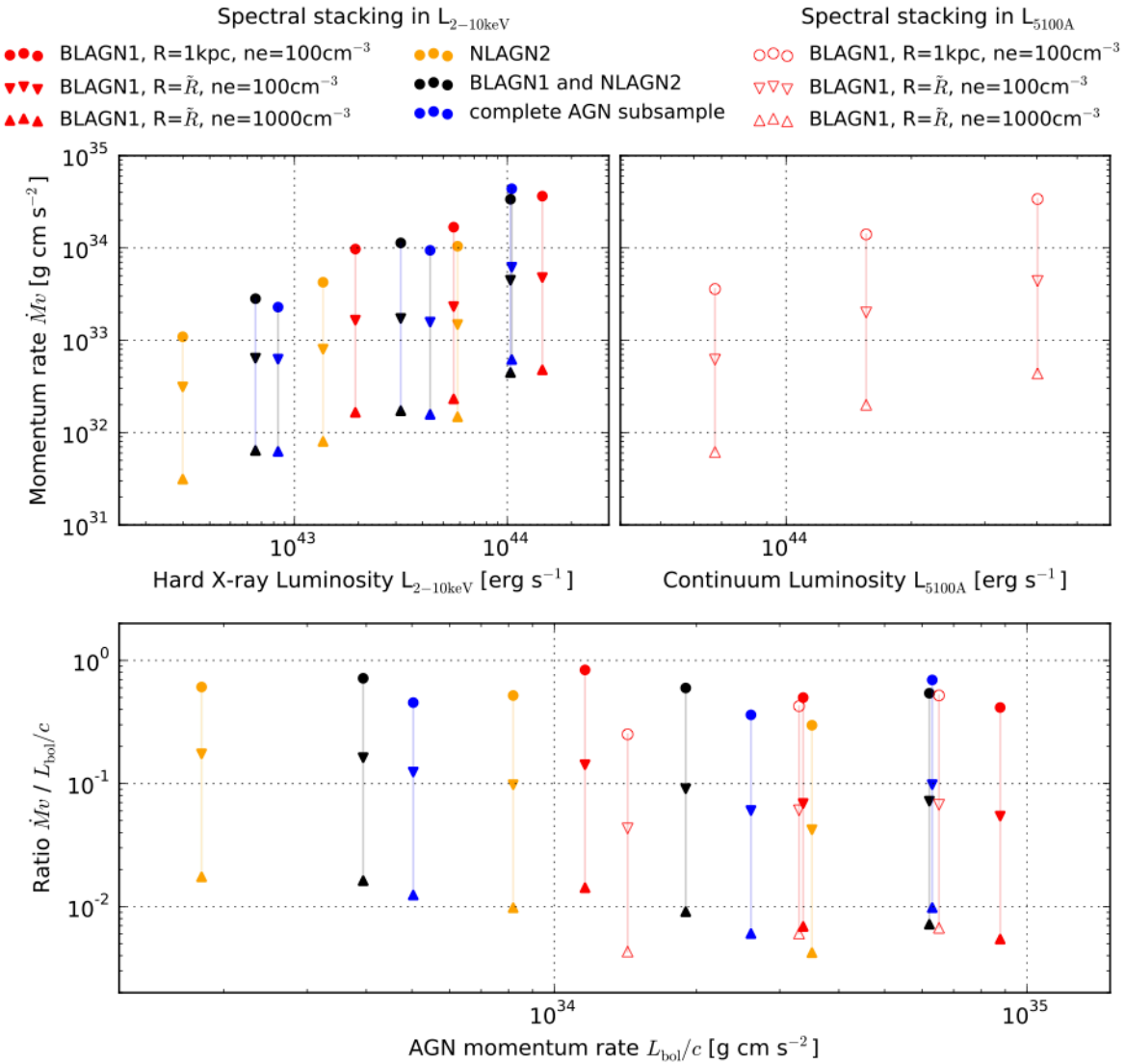
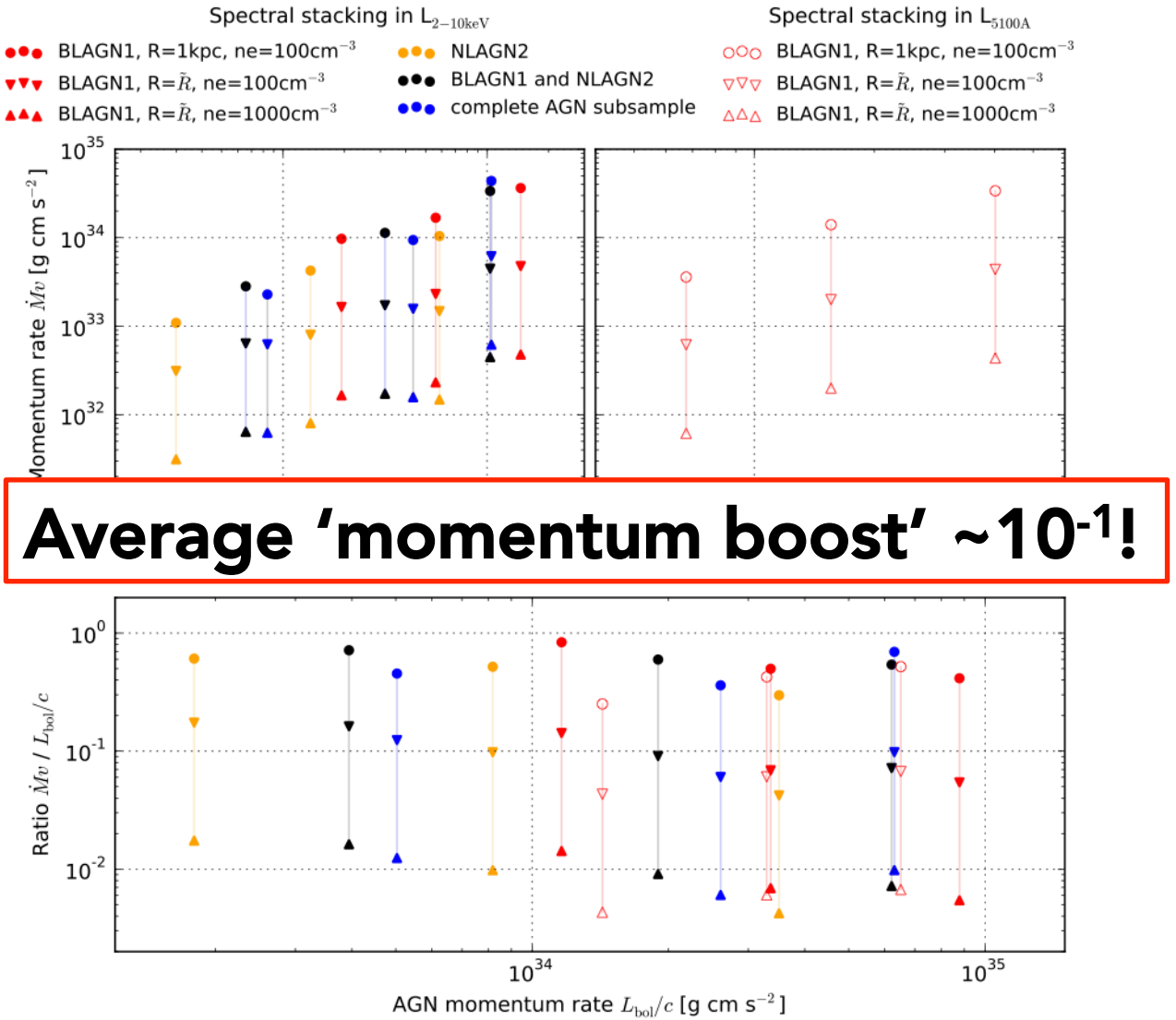


Menzel et al. 2016; PhD thesis

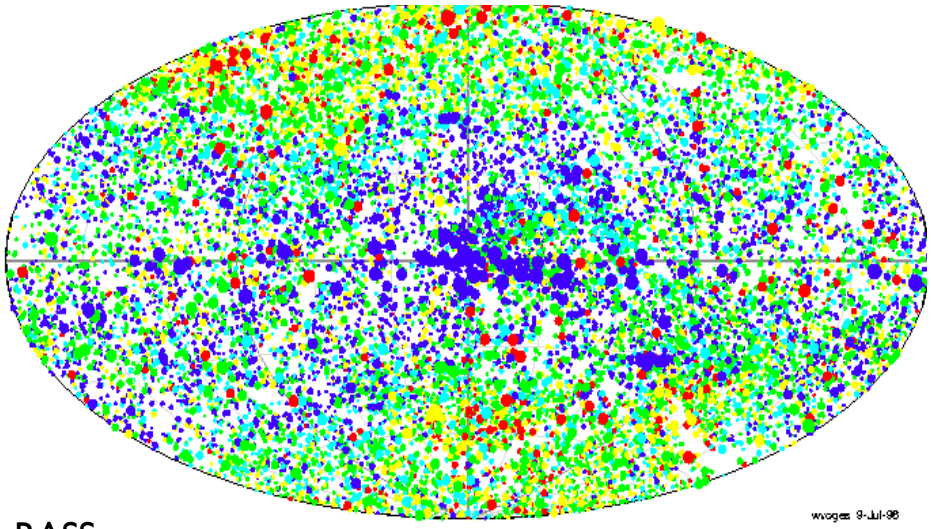
Ionized outflows energetics



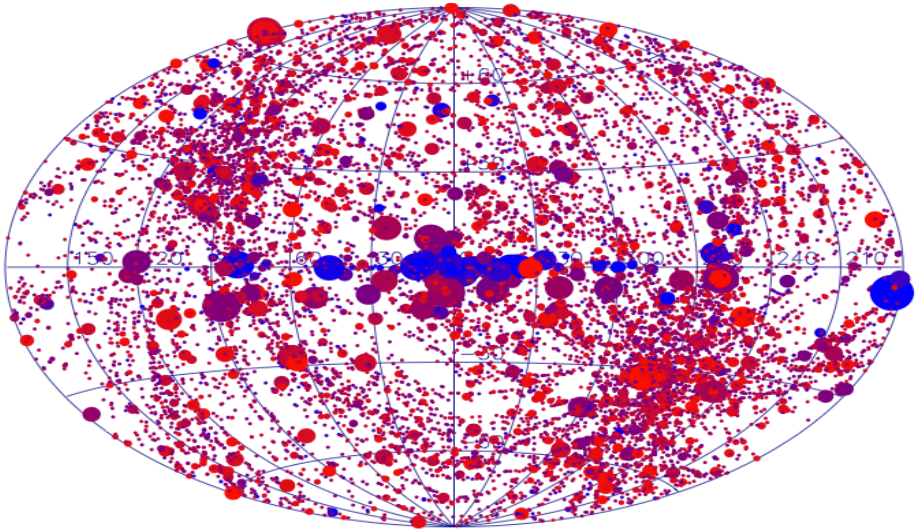
Average 'momentum boost' ~10^{-1}!

Menzel et al. 2016; PhD thesis

SDSS-IV/SPIDERS



RASS



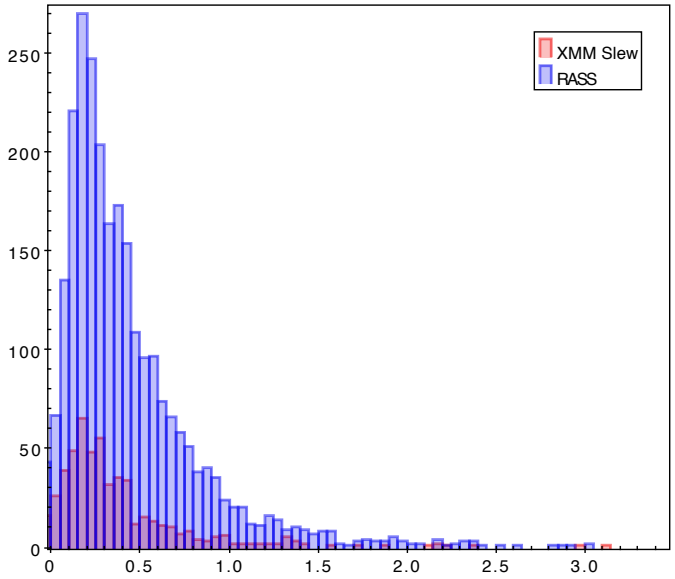
XMM SLEW

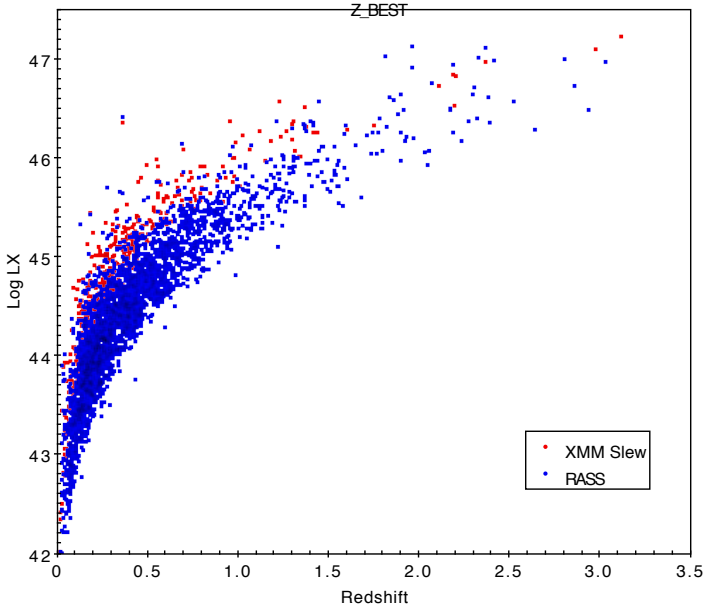
Selected from RASS and XMM-Newton; Two main source classes:

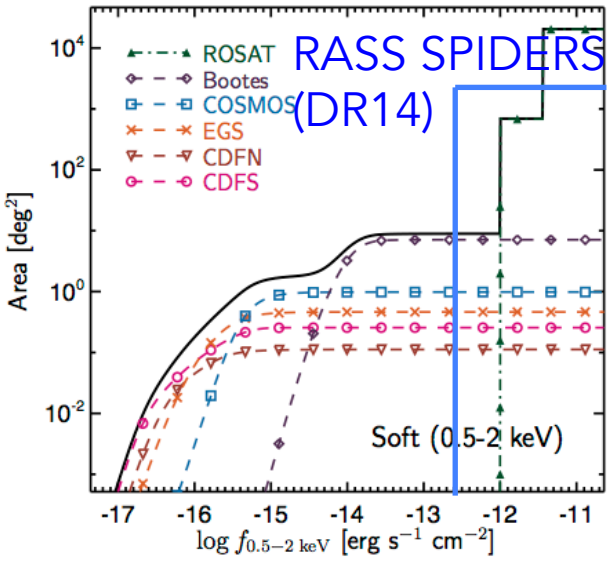
- Extended – **Clusters of Galaxies:** using ROSAT+XMM+redMapper ~(0.8+0.08)/deg^2; ~10 targets per cluster

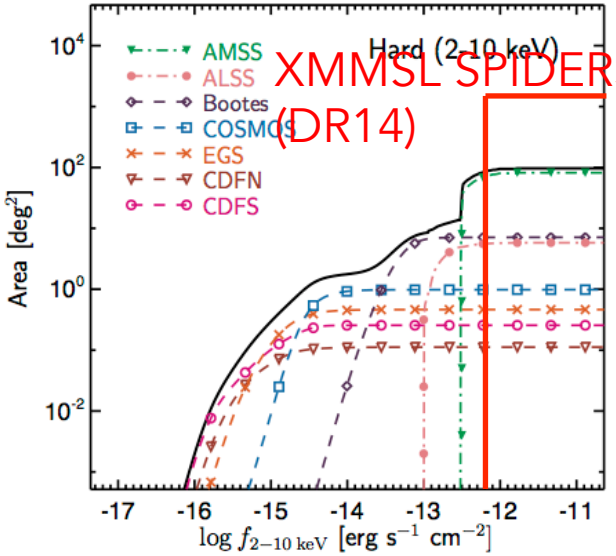
- Pointlike – Bright **AGN:** using ROSAT+XMM ~(1.8+0.2)/deg^2

L-z coverage, spectral classes









RASS:
- 77% QSO
- 19% GALAXY
- 3% STAR
- 1% BLAZAR

XMMSL:
- 77% QSO
- 18% GALAXY
- 4% STAR
- 1% BLAZAR

SPIDERS AGN: DR14 sample
publicly available from July 2017

- Multiple visual inspections (at least two) of all SPIDERS AGN, including DR12 X-ray sources
- "Validated" (and reconciled) redshift/spectra for 4628 RASS and 502 XMMSlew AGN over an area of ~2600 deg^2
- Considering only highly reliable **RASS** detections and WISE associations we reach about **89%** (2550/2850) completeness for r>17
- Including DR12, **87%** redshift complet. for XMMSL sources (**526/605** for r>17)

Good spectral quality, high completeness

Conclusions

- Ionized outflows, as traced by OIII emission lines, are clearly driven to the presence of AGN
- Complete spectroscopic follow-up of X-ray AGN reveals the 'average' energetics of such outflows
- OIII outflows kinetic power is too small to provide the theoretically expected QSO feedback: other (cold, molecular) tracers needed? How?
- SDSS-IV/SPIDERS survey of ROSAT and XMM-Newton AGN will provide a glimpse into the highest luminosity population