Radio-loud AGN through the eyes of 3XMM, WISE, and FIRST/NVSS

ARCHES

The X-Ray Universe 2014

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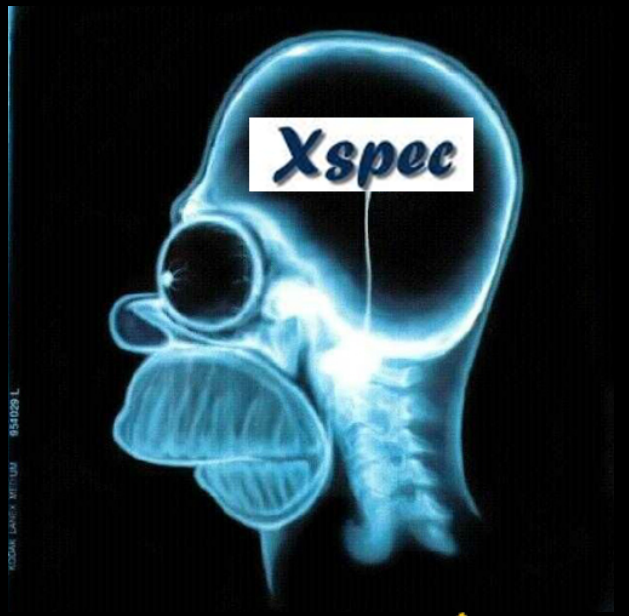
Outline

- ARCHES
- Why Radio-loud AGN are our friends :-)
- How to find and study them? The 3XMM, WISE, FIRST and NVSS science case
- Future & Summary



ARCHES

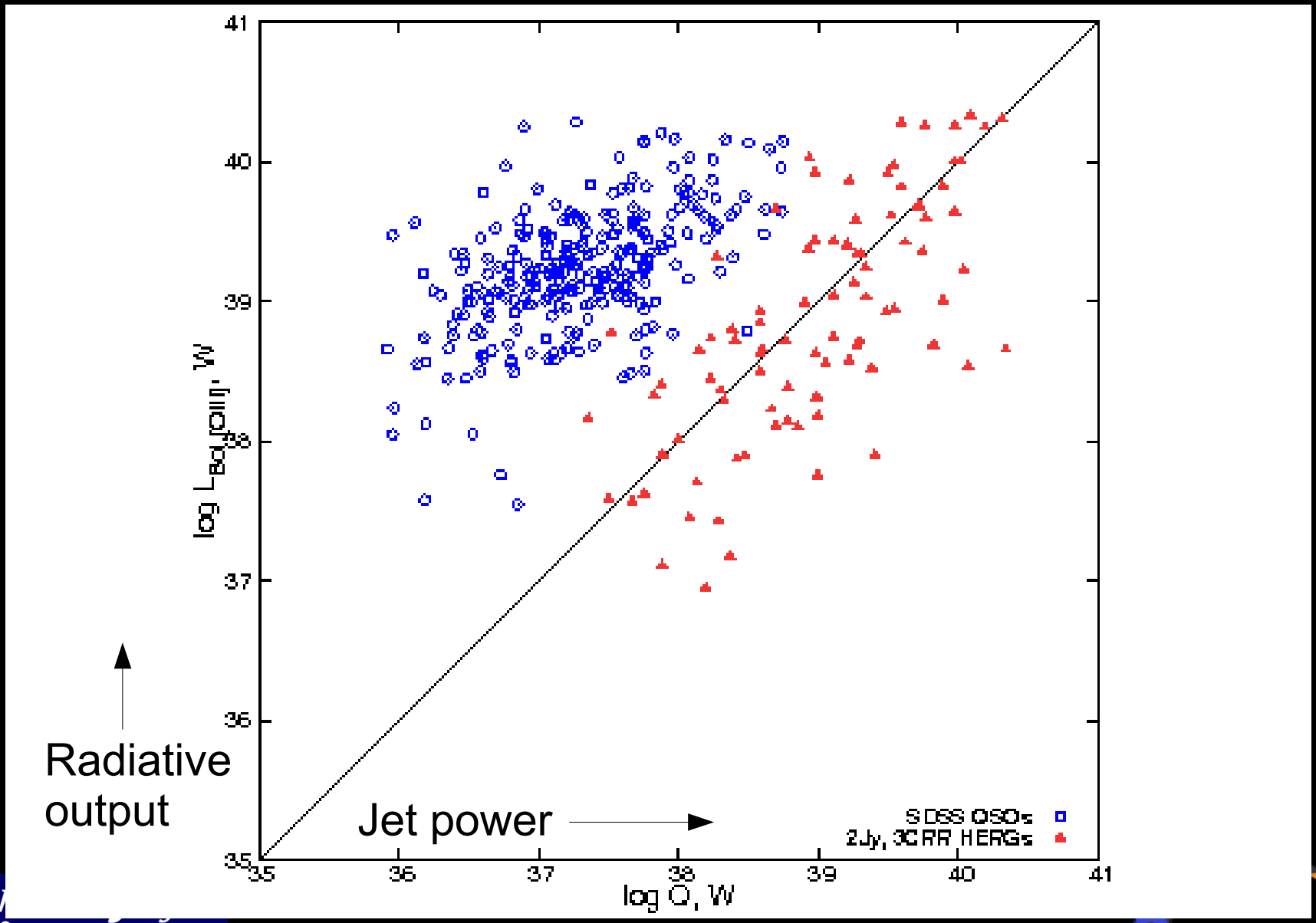
- ARCHES (Astronomical Resource Cross-matching for High Energy Studies)
  - EU/FP7 Collaboration
  - Leicester, Santander, Strasbourg, Potsdam, Madrid
    - Carrera, Mateos, Motch, Mints, Nebot, Rosen, Schwope
- Produce well-characterised multi-wavelength data for large samples of sources drawn from the 3XMM serendipitous source catalogue

http://www.arches-fp7.eu/

Radio-loud AGN

- Why?
  - RL ~10-20% of the total AGN population, but (presumably) all AGN have been RL
  - RL phase affects environment dramatically: cannot be ignored towards galaxy evolution
    - More so when low-power sources are considered! Many Seyferts with jets and lobes! (see e.g. Croston et al. 2008, Mingo et al. 2011, 2012)
  - Fundamental to understand accretion

Radio-loud AGN



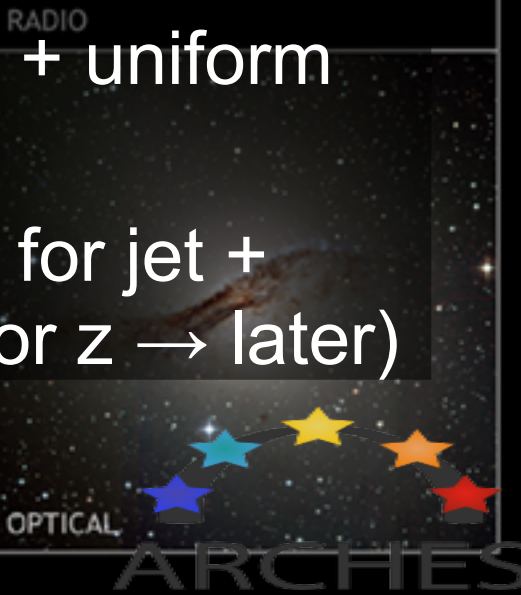
Mingo et al. 2014

Radio-loud AGN

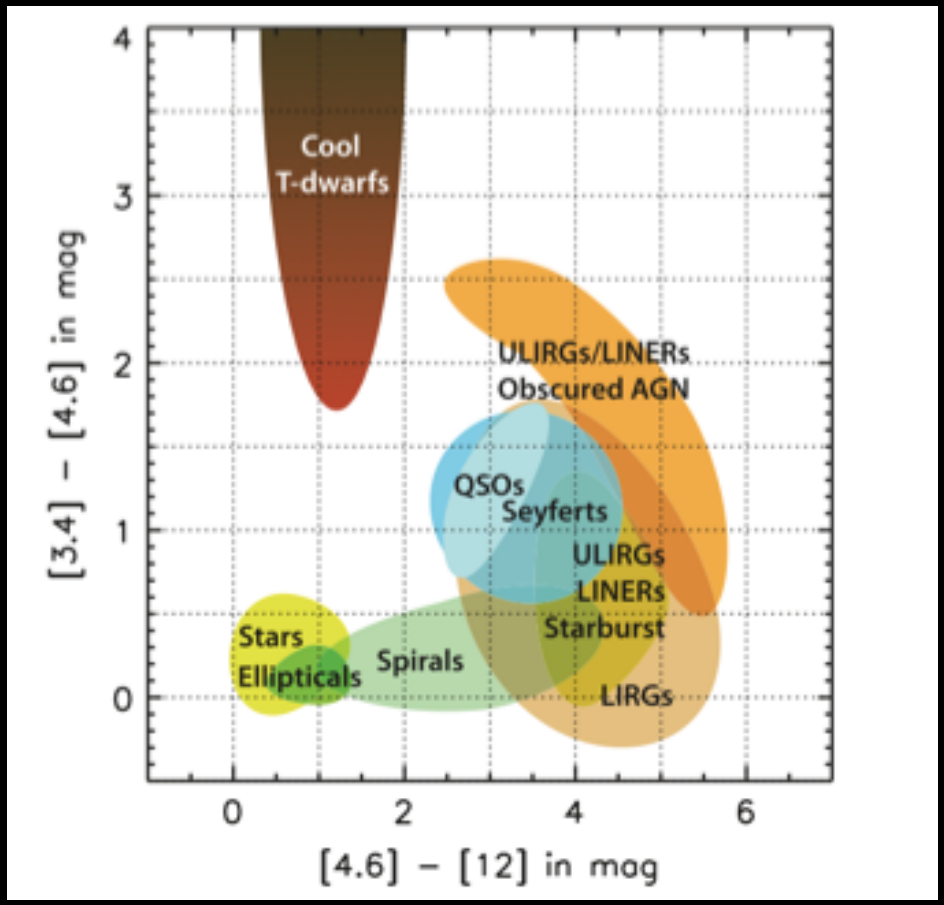
- Caveats:
  - Small statistics: mostly low z or high power sources, especially after cross-correlation → bias!
  - Extended sources! → positioning and cross-matching is challenging, even in the best circumstances
  - Spatial and time scales involved are larger than for other wavelengths

Radio-loud AGN

- Advantages:
  - (Mostly) unbiased with respect to orientation
  - Allow us to select dimmer AGN that don't pass the traditional optical/X-ray/IR cuts
  - Low sky density, clean selection
- Requirements:
  - Large sky area + deepest coverage + uniform data → large surveys
  - Radio for AGN/SF selection, X-rays for jet + core activity, IR for torus (optical for z → later)



The Sample



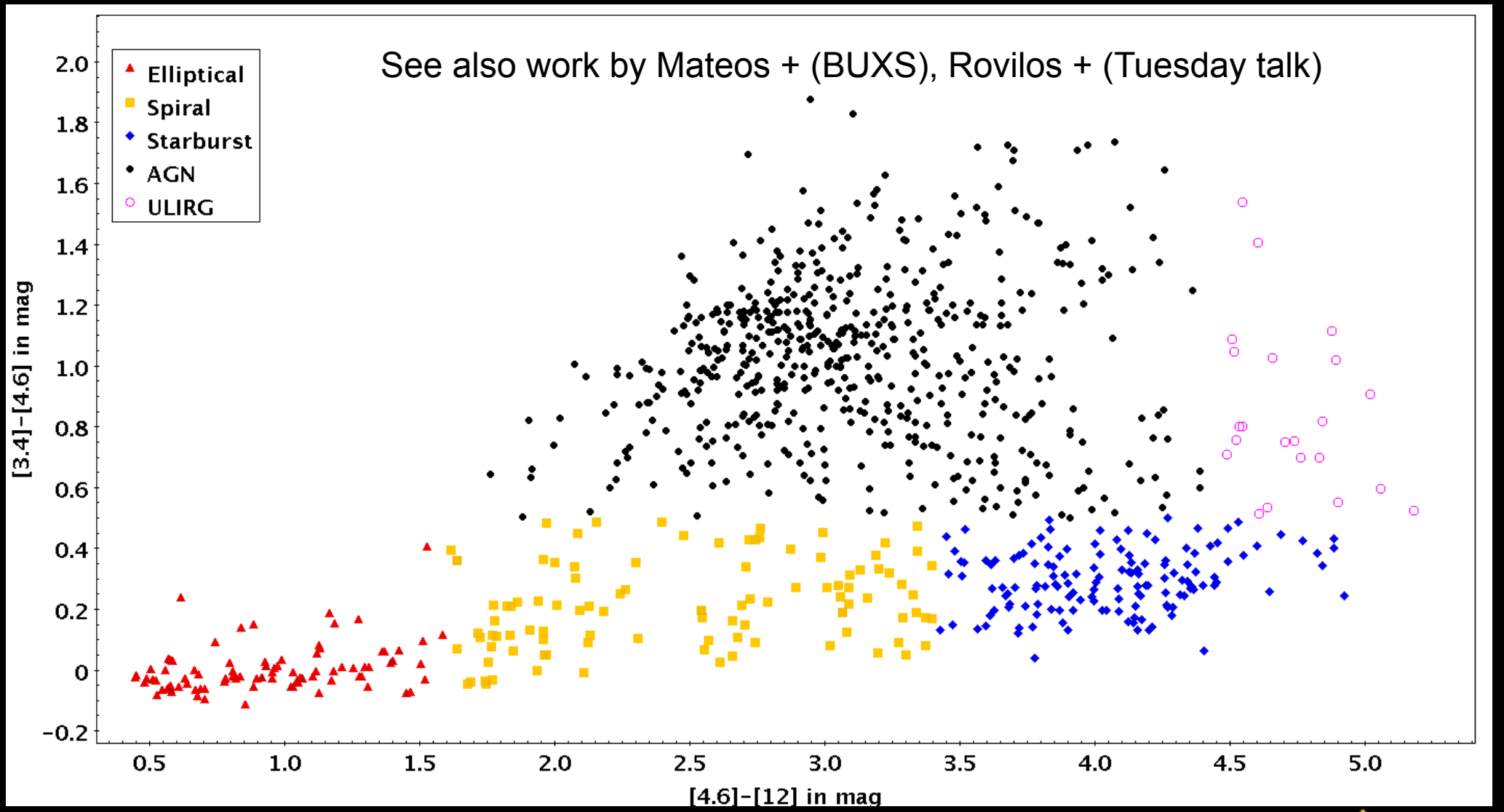
Lake+ 2012

- 3XMM + WISE + NVSS/FIRST
  - What does the WISE c/c plot look like?
- Data quality criteria:
  - S/N>5 in w1, w2, w3
  - No X-ray extended
  - "good" radio
- Cross-matching eliminates "false" sources

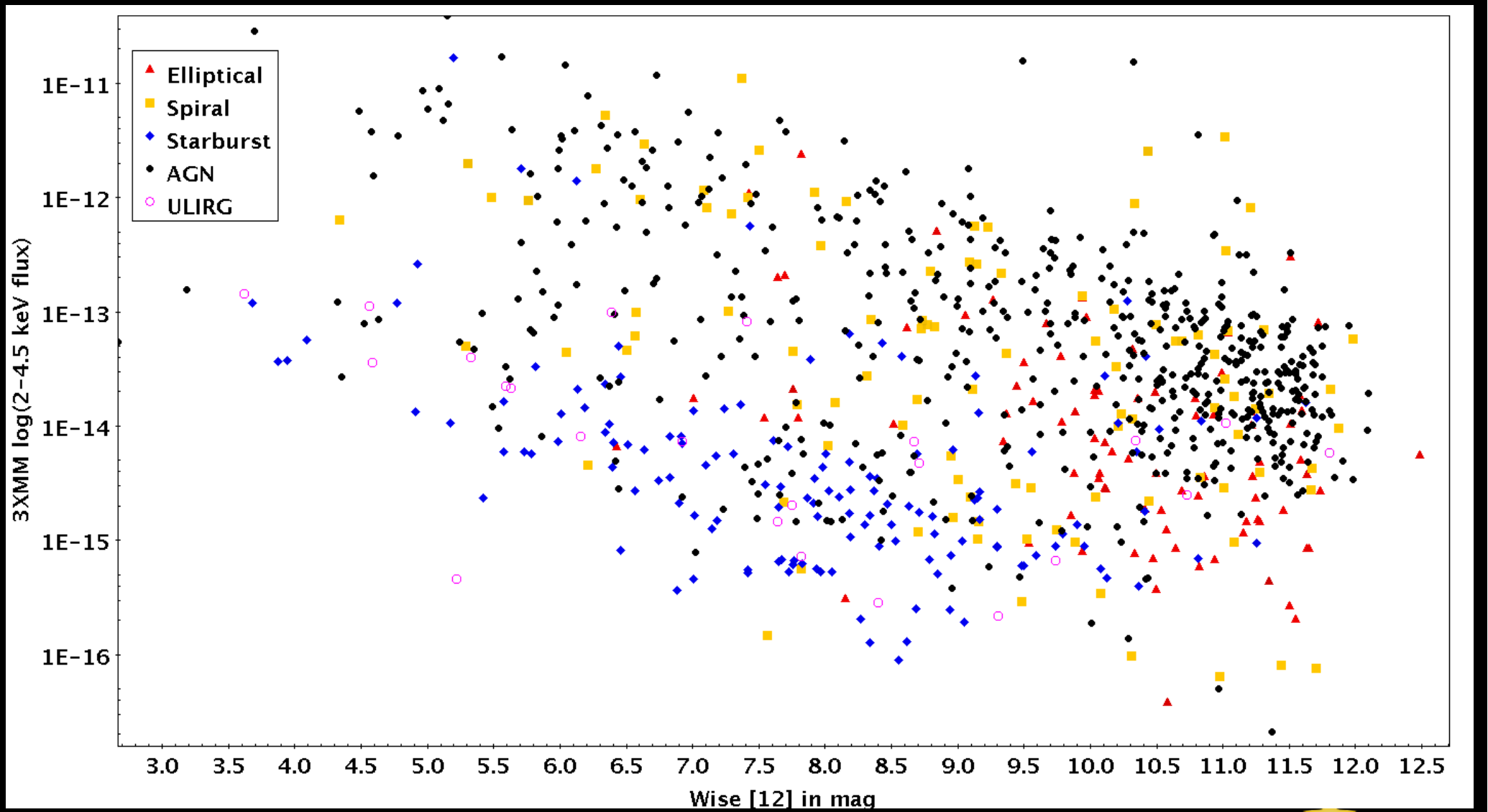
The Science Case

- 3XMM+WISE+FIRST
  - NVSS being added (cross-corr with FIRST, then the rest, see Kimball & Ivezic 2008), SDSS next
- Multiple matches eliminated
  - 10-20% are multiple matches, implementing statistics to establish reliability cut
- Total expected: ~1000 sources
  - Number will decrease with SDSS match, but we will have z, L_bol, M_BH

The Science Case



The Science Case



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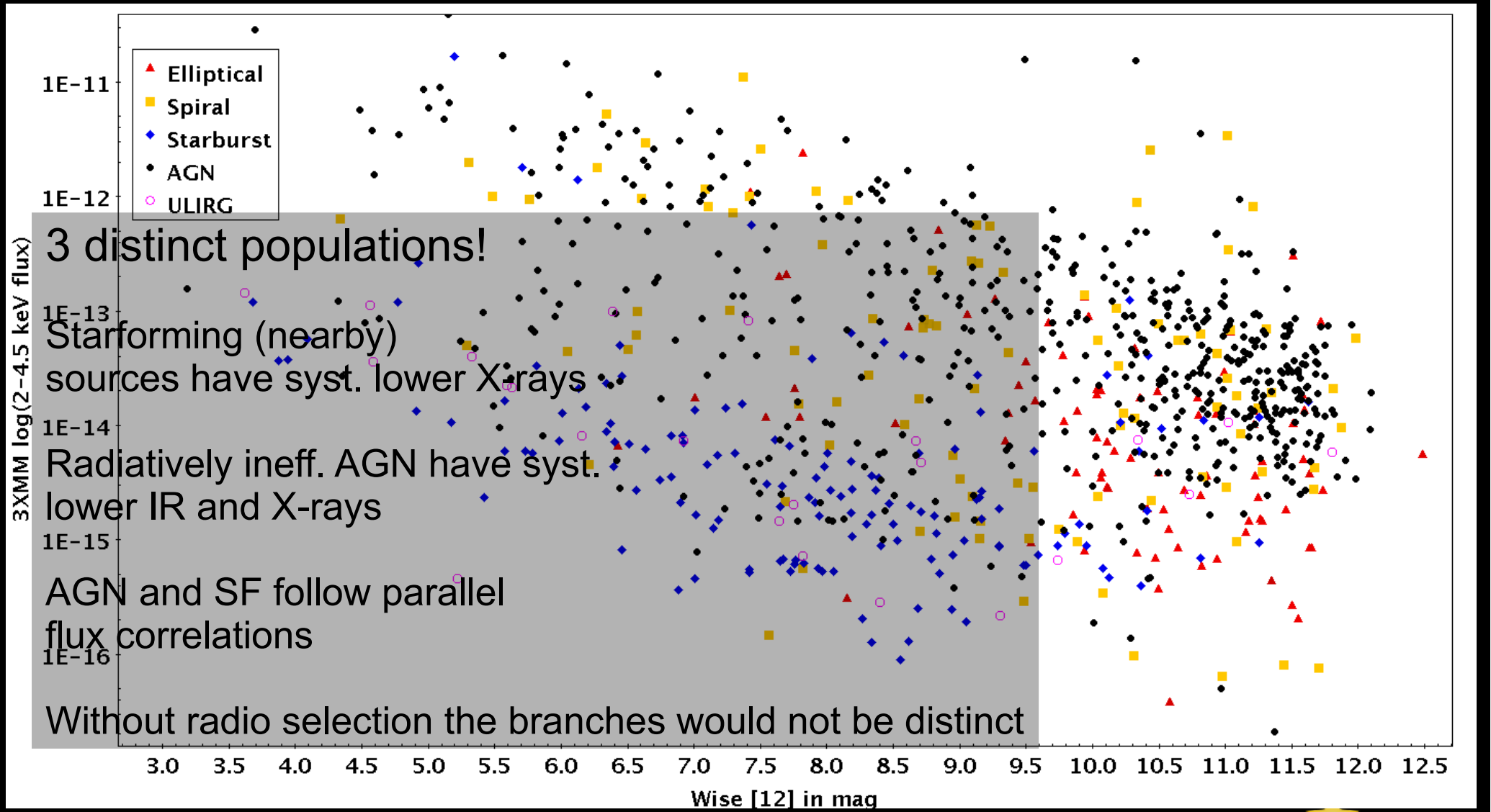

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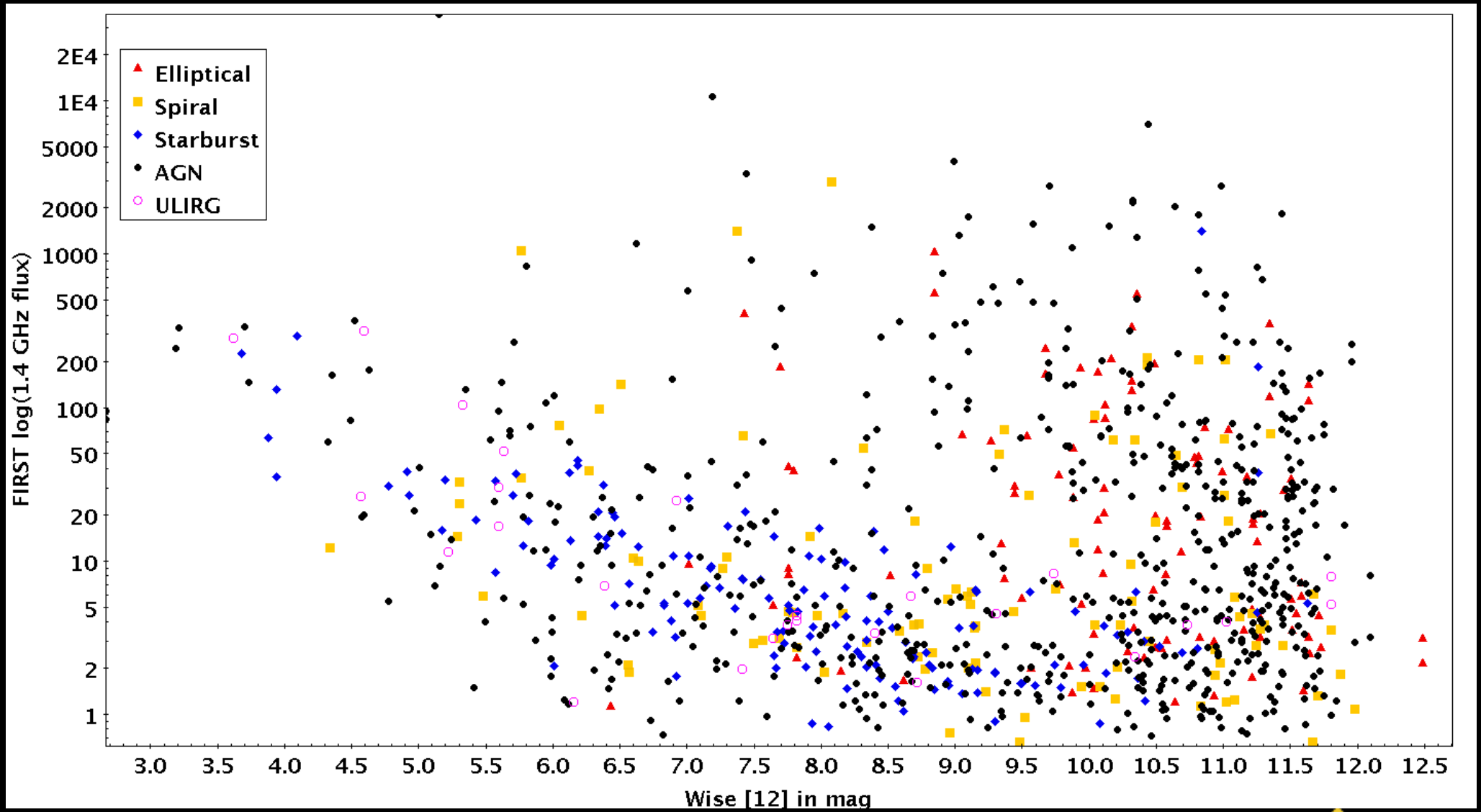

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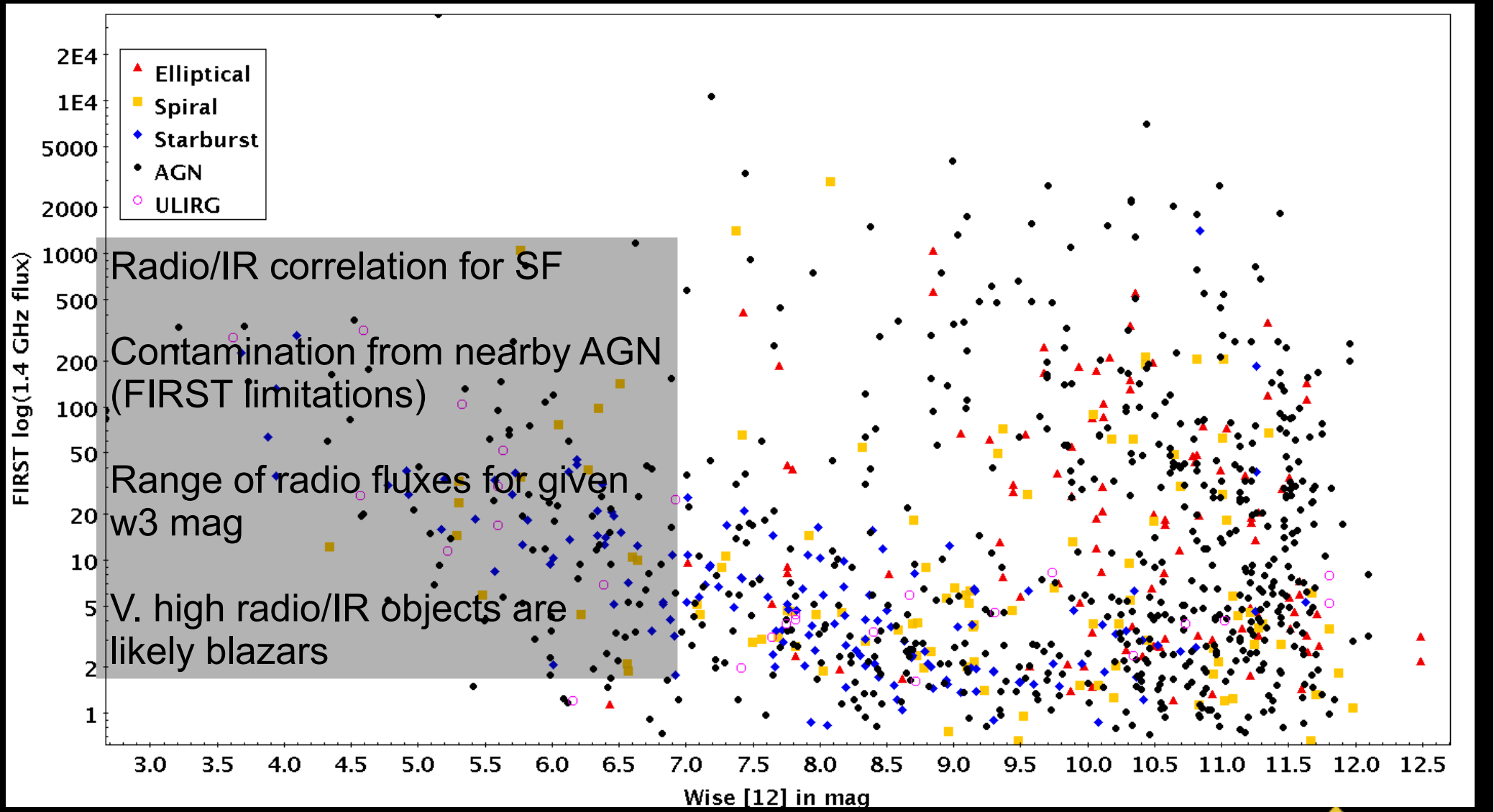

Future

- Hope NVSS match stops resisting me :-/
- Fun science! :)
  - radiative output vs jet, SF/AGN correlations, compare with RQ sample, study environments (Clustering)
- Add SDSS
  - z, L_bol, M_BH...
- Study outliers
  - E.G. mergers in the ULIRG/obscured area
- Southern hemisphere → SUMSS

Summary

- Radio loud AGN are our friends!
  - Complex, but fundamental to understand AGN feedback, accretion, host galaxy dynamics...
- Large statistics → 3XMM+WISE+FIRST/NVSS (+SDSS, later SUMSS)
  - Probe low L, where host dominates, and soft X
  - Test radio/IR/X-ray correlations for SF and AGN
  - Look for systematics in radio loud vs radio quiet
  - Explore the regulating mechanisms for the jet
- The fun is just beginning! Mingo et al. 2014b, in prep.