Characterizing the WISE AGN Population in the NDWFS Boötes Field

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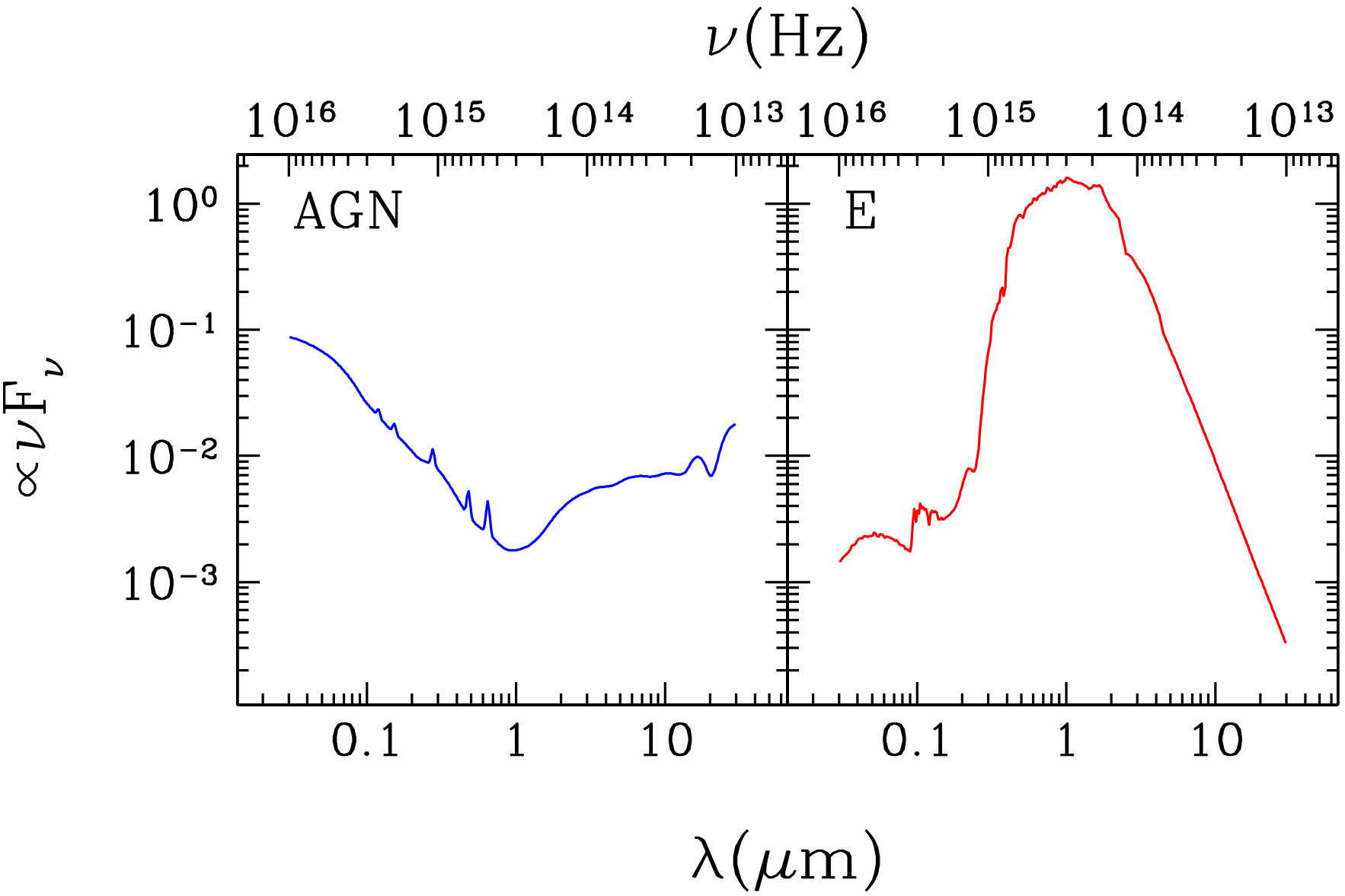
WISE ExGal Team, AGES, MAGES and NEWFIRM collaborations

Introduction

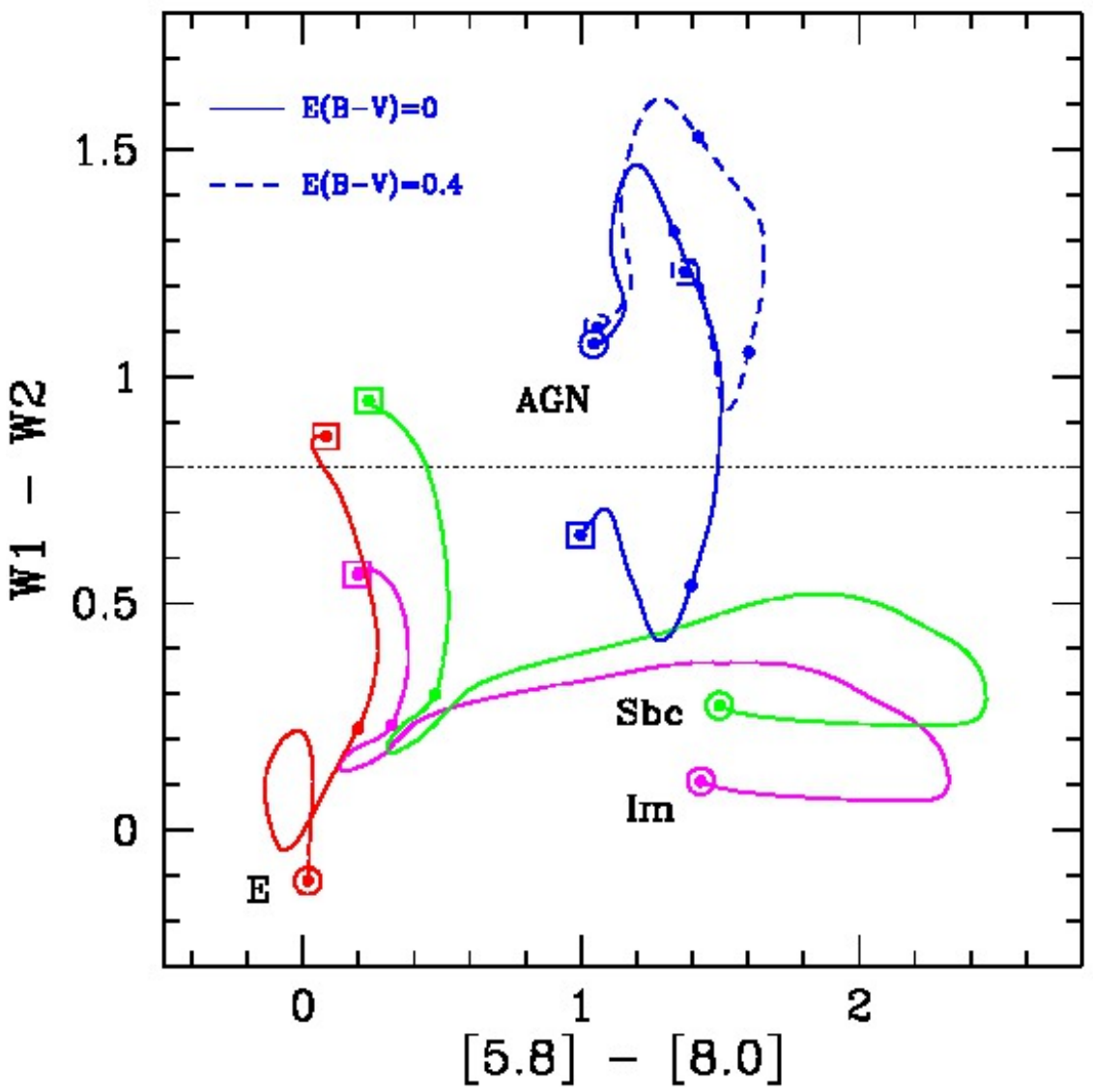
- AGN likely play a most important role in shaping galaxy evolution
  - Important details need to be understood/confirm observationally
- WISE will enable a incredible amount of such studies
  - All-sky nature
  - AGN identification is simpler in IR than in optical
  - X-rays are great too, but small/shallow areas only

However…

- We need to understand the nature of the selected objects
- We know Spitzer selection can be reliable and complete
  - Stern et al.(2005) – IRAC, highly reliable
  - Lacy et al.(2004) – IRAC, highly complete
  - Alonso-Herrero (2006) – IRAC + MIPS
- But reliable WISE criteria should mostly rely on W1 and W2
  - W3 and W4 sensitivity is too low



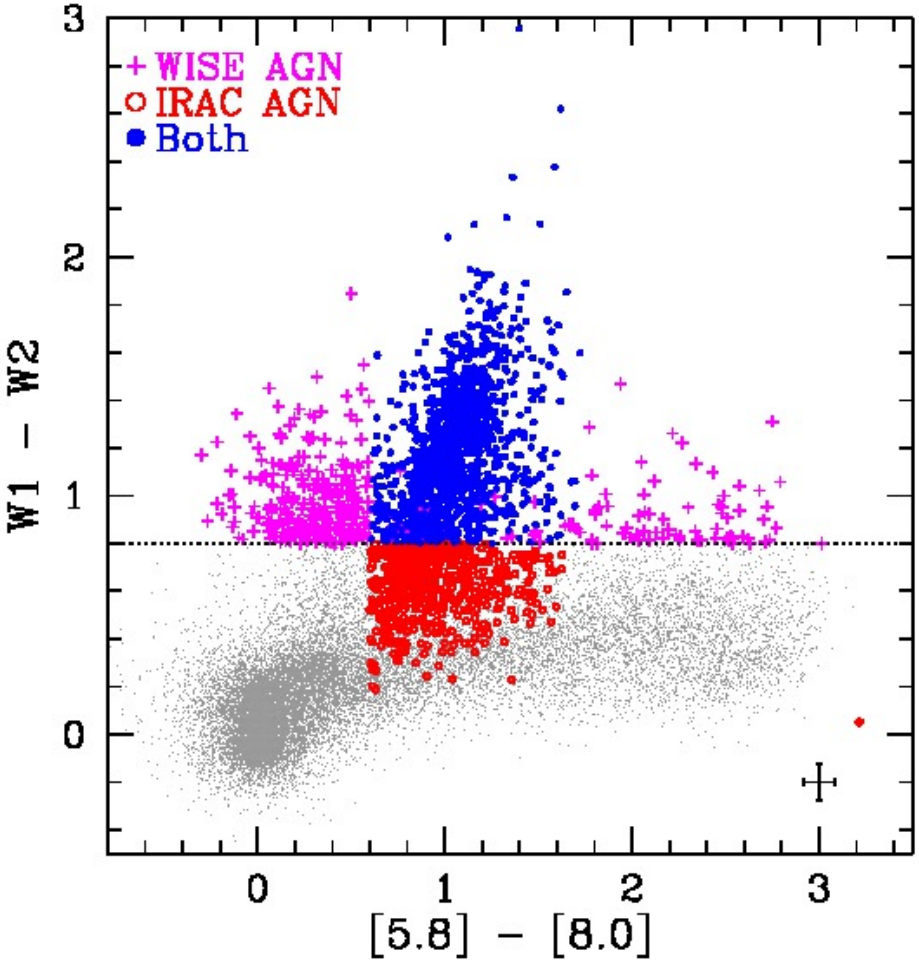
SED Templates from Assef et al. (2010, ApJ, 713, 970)



SED templates from Assef et al.(2010, ApJ, 713, 970)

WISE AGNs in the Boötes Field

Stern et al.(2011) Selection

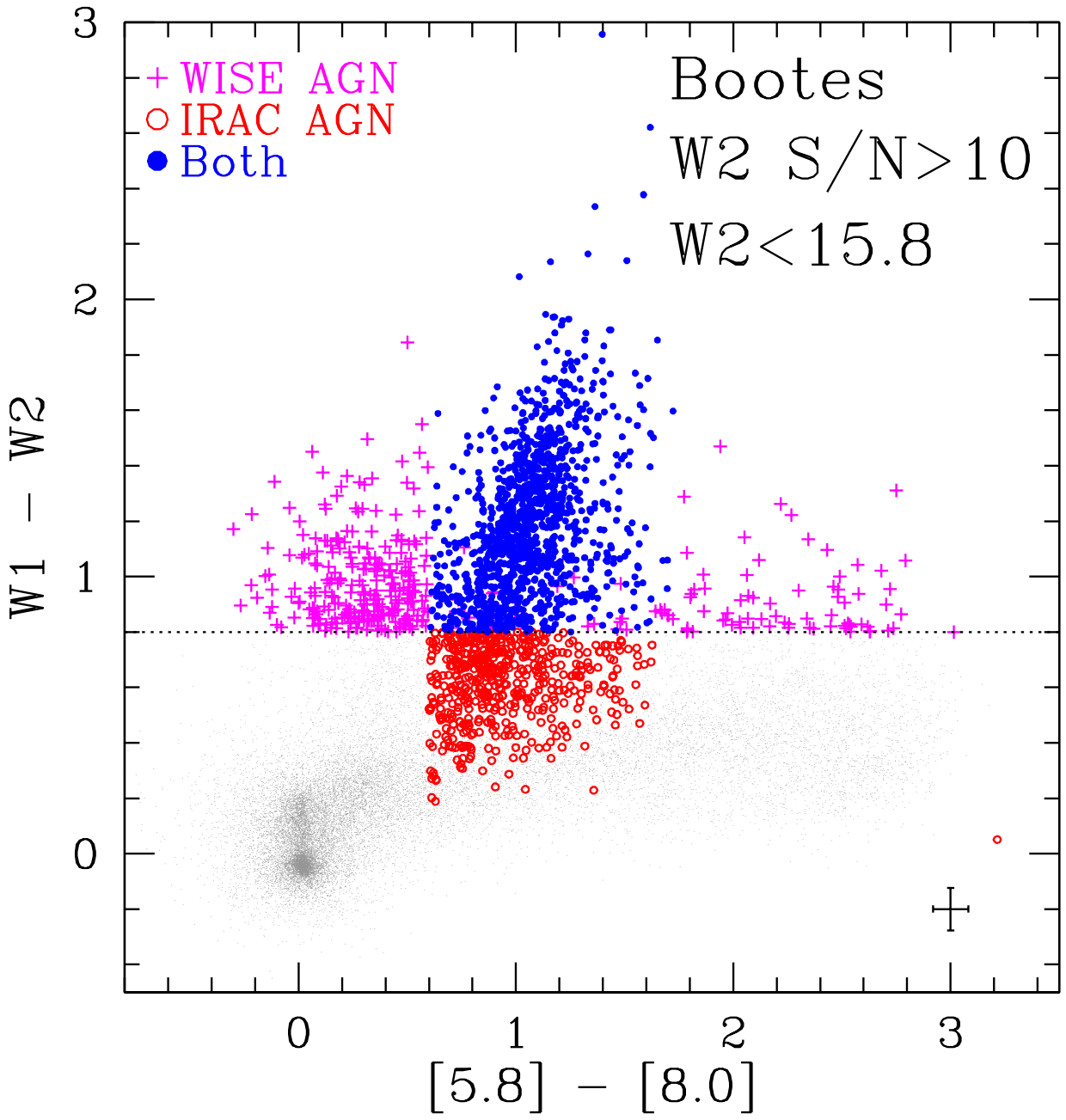


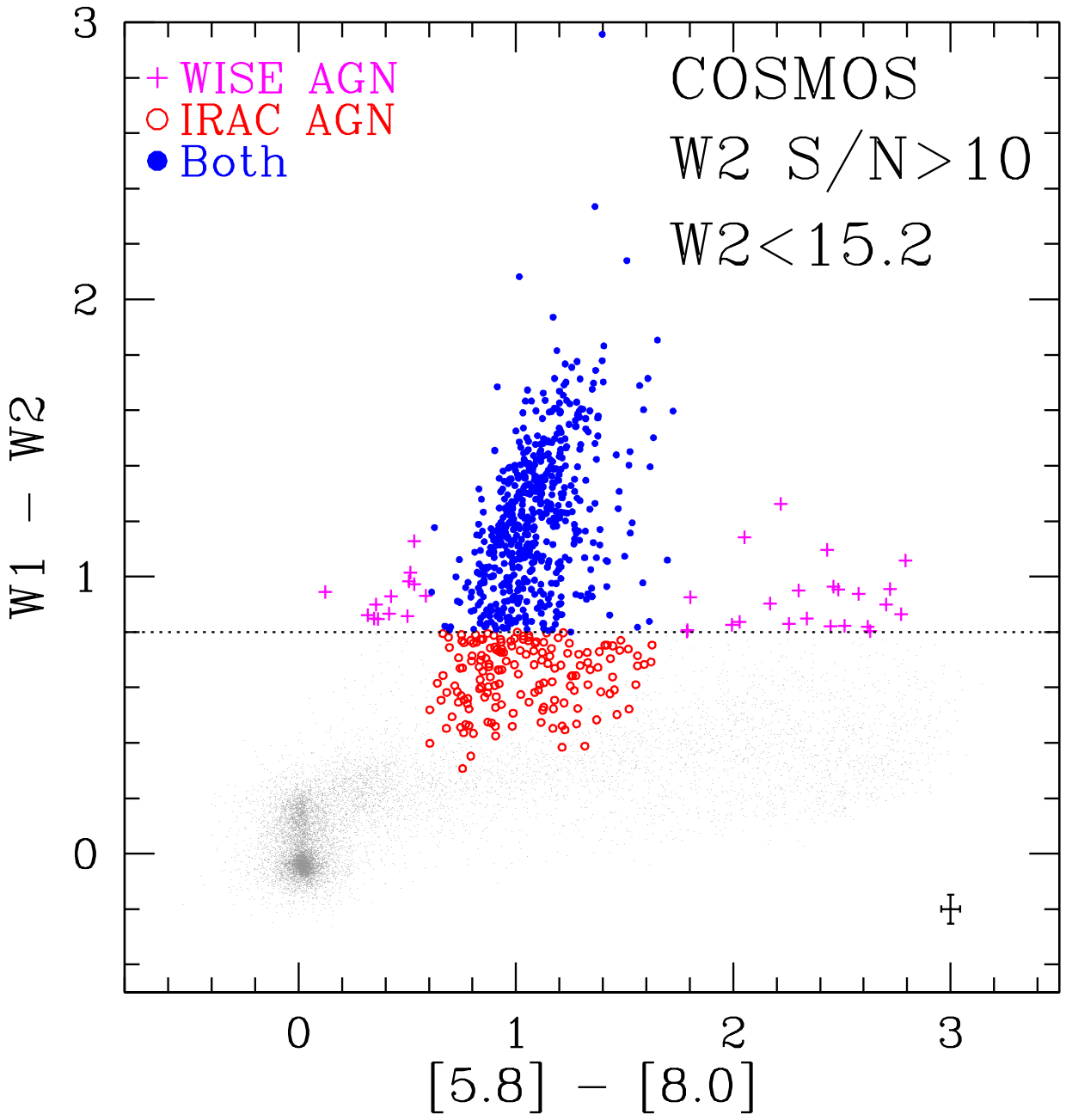
- AGN candidates have
  - W1 – W2 > 0.8
  - W2 S/N > 10

- 75% of IRAC AGNs found with Stern et al.(2005) criteria are recovered

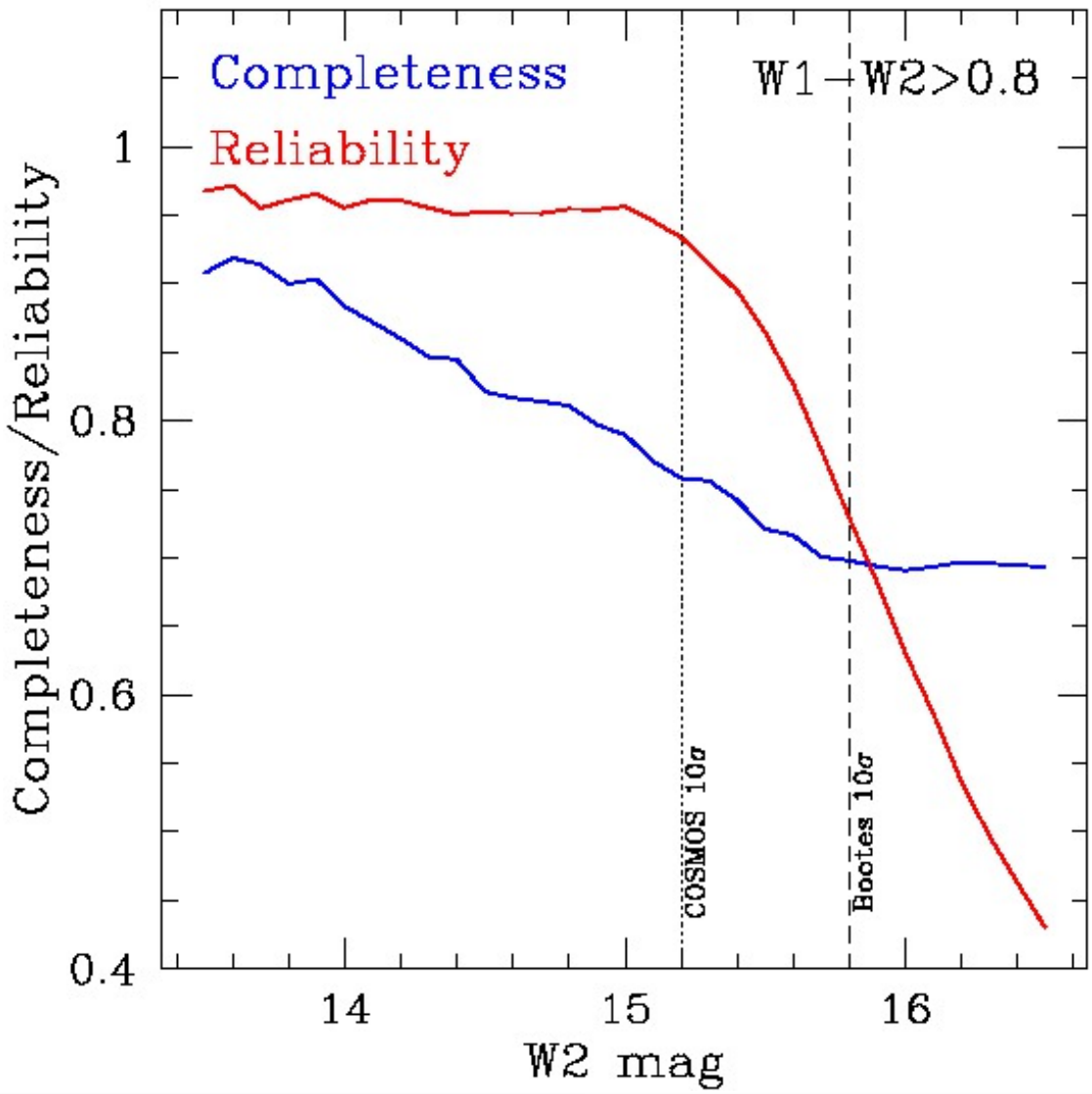
- 80% WISE candidates are IRAC candidates

- Why so different to COSMOS?


WISE AGN
IRAC AGN
Both
Bootes
W2 S/N>10
W2<15.8
W1 − W2
[5.8] − [8.0]
0
1
2
3


+ WISE AGN
○ IRAC AGN
● Both
COSMOS
W2 S/N>10
W2<15.2
W1 − W2
[5.8] − [8.0]
0
1
2
3

Magnitude Dependent Selection?



SED analysis - Data

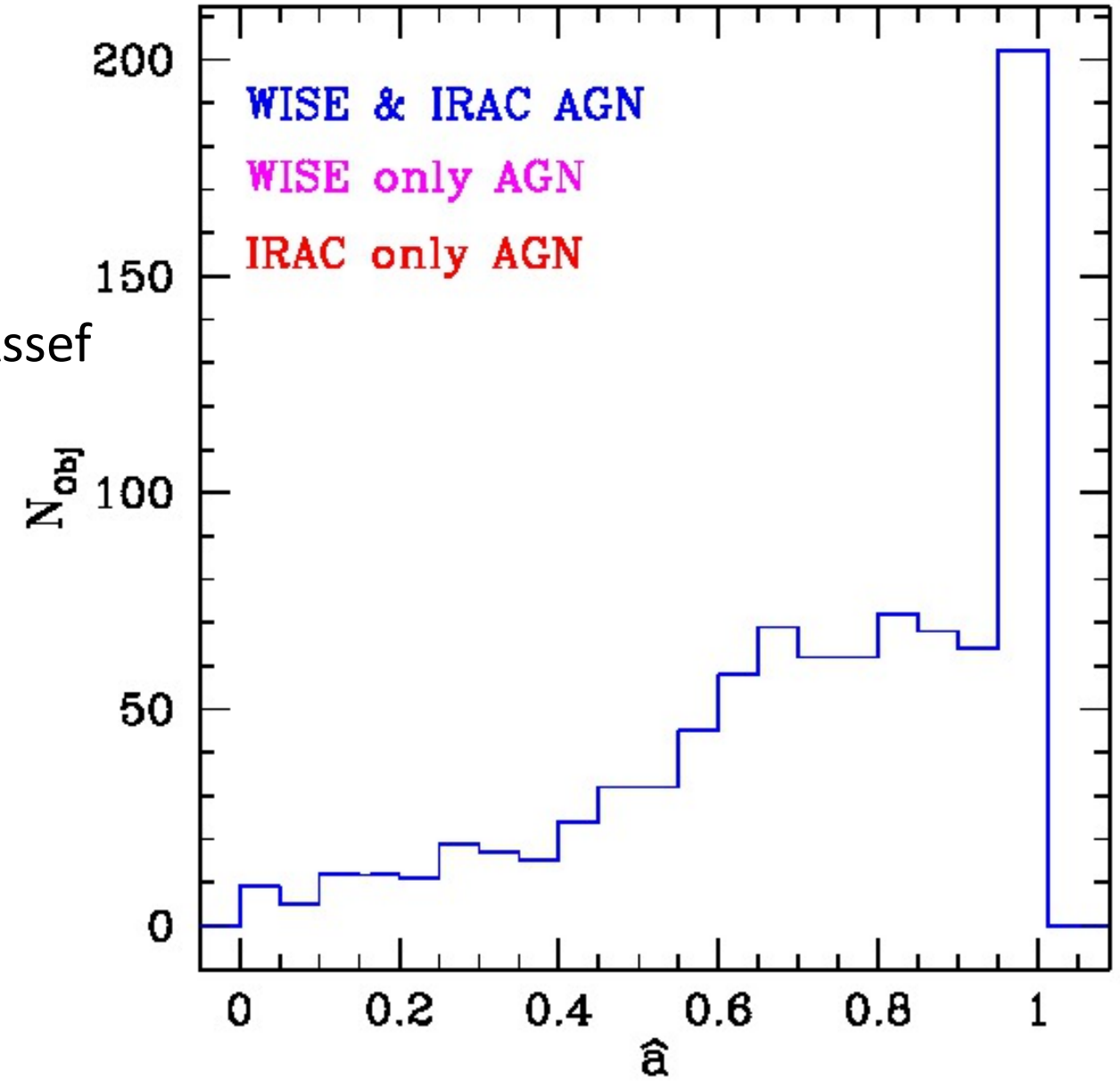
- **Bw, R, I and K (NDWFS)**
- **J, H and Ks (NEWFIRM)**
- **All IRAC channels (SDWFS)**
- **z-band (zBoötes)**
- **FUV and NUV (GALEX)**
- **MIPS 24μm,** 70, 160 **(MAGES)**
- U and Y (LBT)
- X-ray (XBoötes)
- Radio (FIRST, NVSS, WENSS)
- **AGES Spectroscopic Survey**

  Complemented with photo-zs

SED Properties

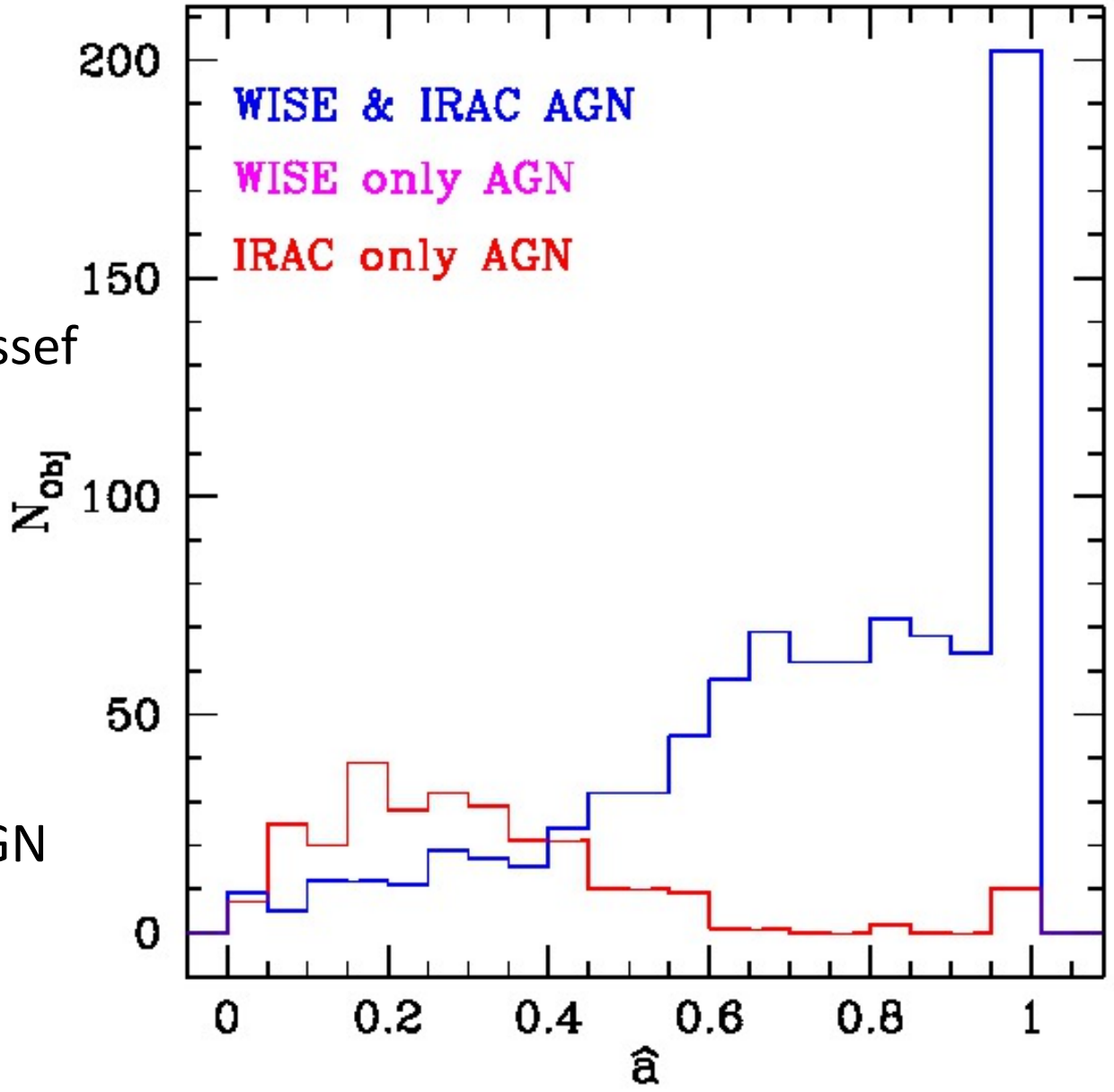
- Fits obtained with Assef et al.(2010) SED templates

- W1 – W2 > 0.8
- W2 S/N > 10



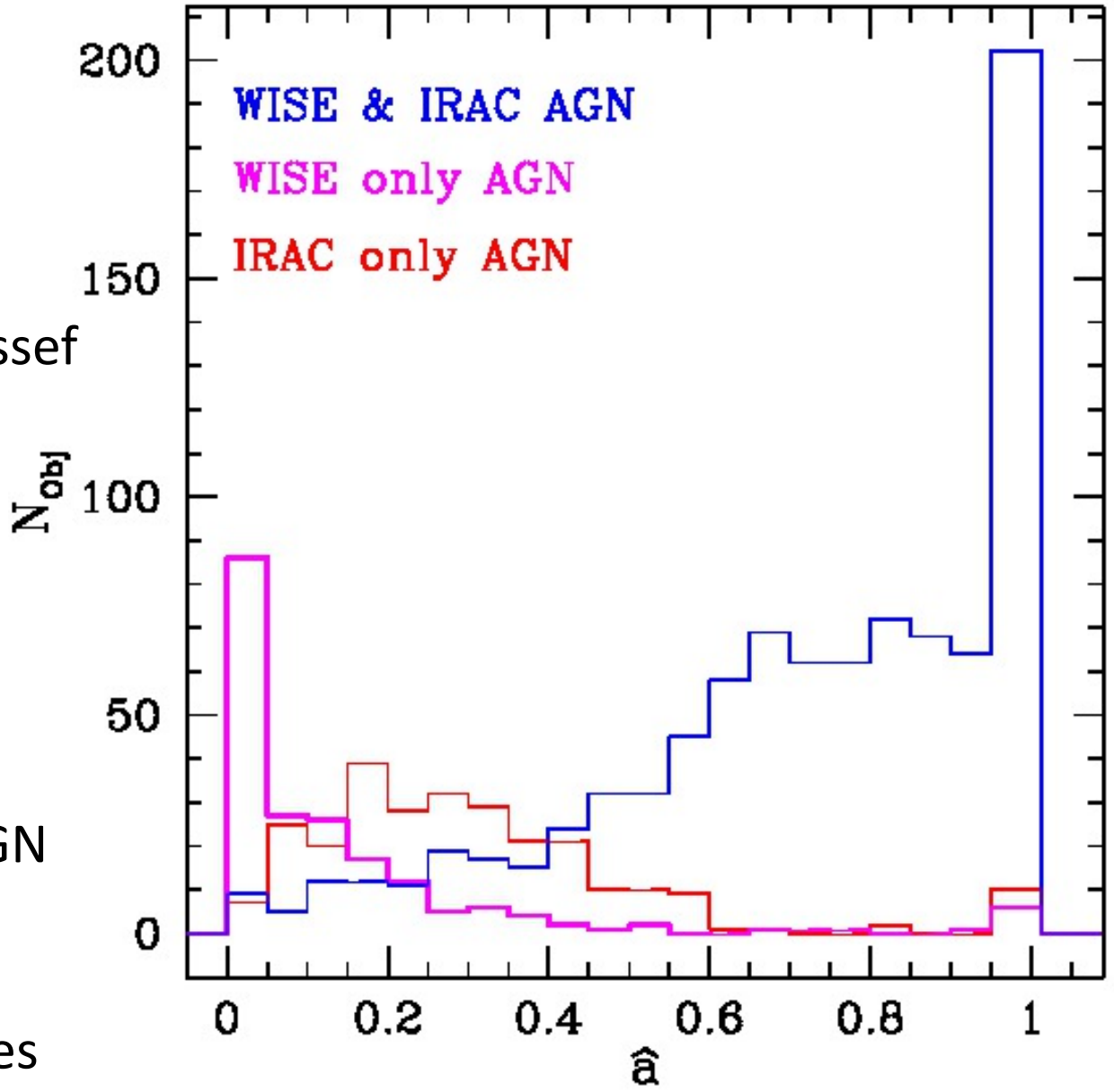
SED Properties

- Fits obtained with Assef et al.(2010) SED templates
- W1 – W2 > 0.8
- W2 S/N > 10
- WISE misses faint AGN in bright host



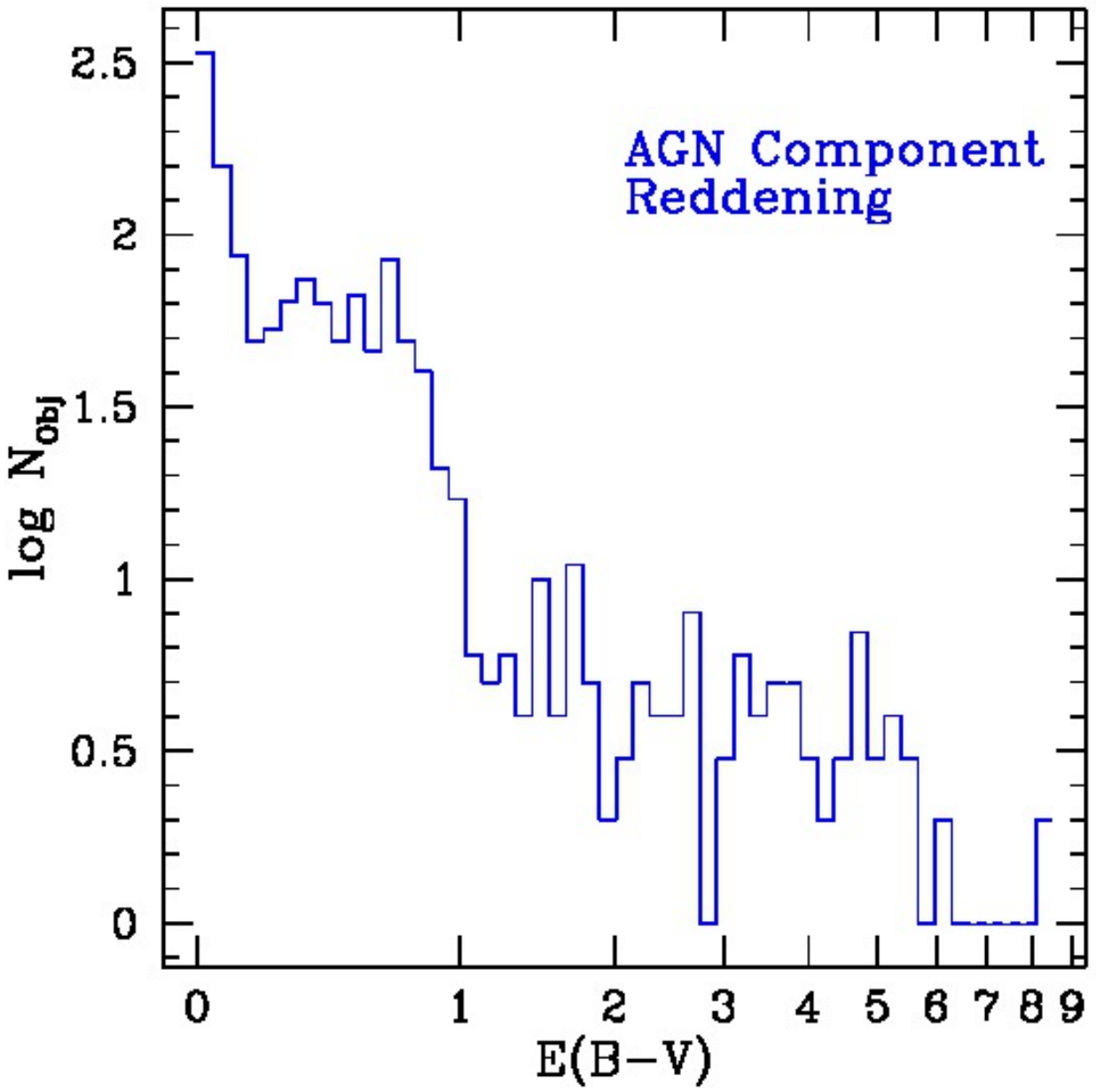
SED Properties

- Fits obtained with Assef et al.(2010) SED templates
- W1 – W2 > 0.8
- W2 S/N > 10
- WISE misses faint AGN in bright host
- WISE only are galaxies



SED Properties

- Type 1 AGN are preferentially selected
- But there is sensitivity to Type 2 AGN
- High z contaminants can be Type 2 AGN



Luminosity Function of WISE AGN

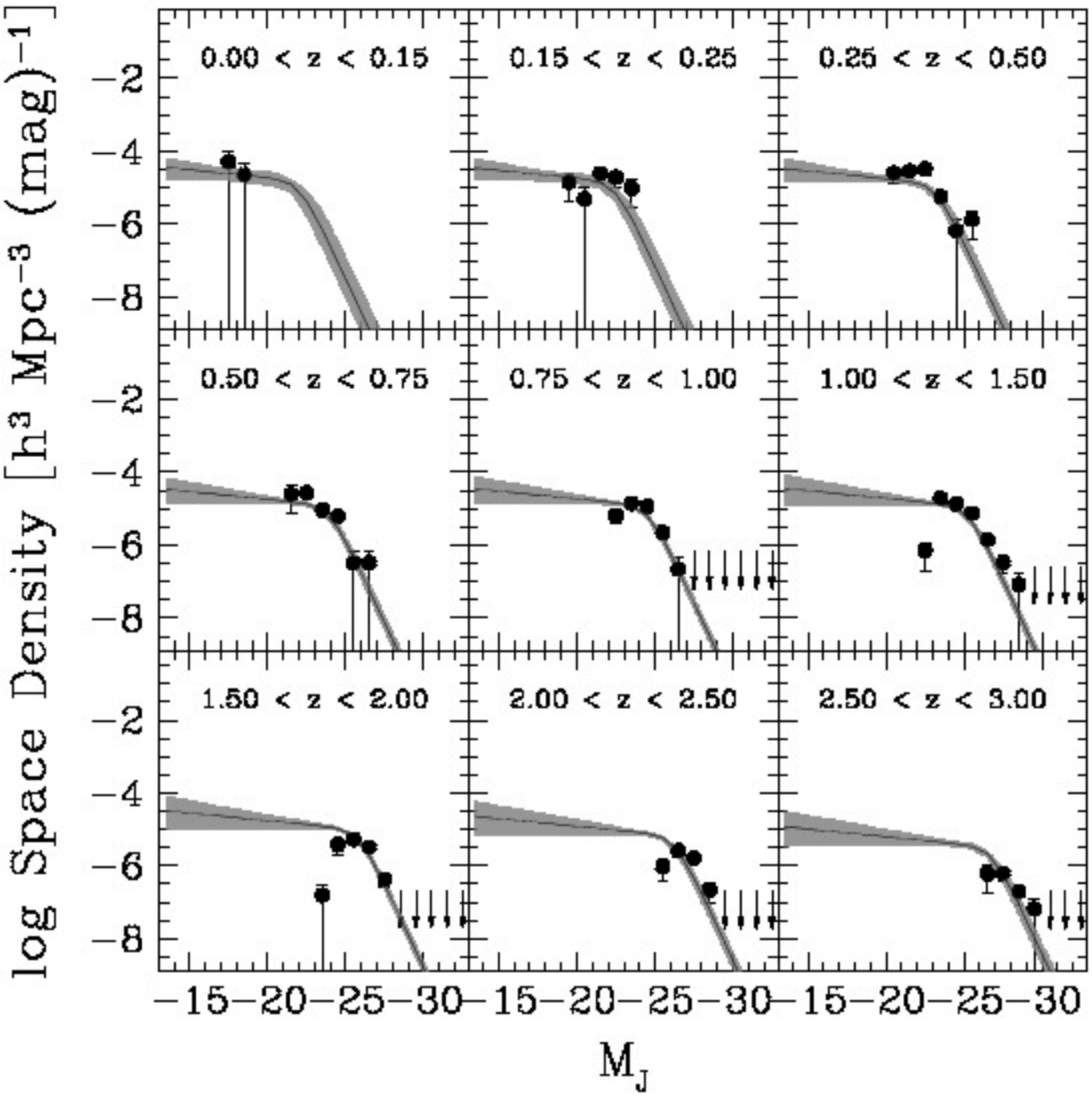
- Luminosity functions are a necessary characterization of the AGN population
- Particular interest on Type 2 AGNs

  But need photo-zs
- Derived using SED fitting for

  Correct host contamination and reddening

  Built with V/Vmax of Page & Carrera (2000)

  Same procedure as in Assef et al.(2011, ApJ, 728, 56)


0.00 < z < 0.15
0.15 < z < 0.25
0.25 < z < 0.50
0.50 < z < 0.75
0.75 < z < 1.00
1.00 < z < 1.50
1.50 < z < 2.00
2.00 < z < 2.50
2.50 < z < 3.00
log Space Density [h³ Mpc⁻³ (mag)⁻¹]
M_J
−2
−4
−6
−8
−15
−20
−25
−30

Luminosity Function of WISE AGN

- Fit is to IRAC Type 1 AGN luminosity function from Assef et al.(2011)

- As expected, shape is consistent

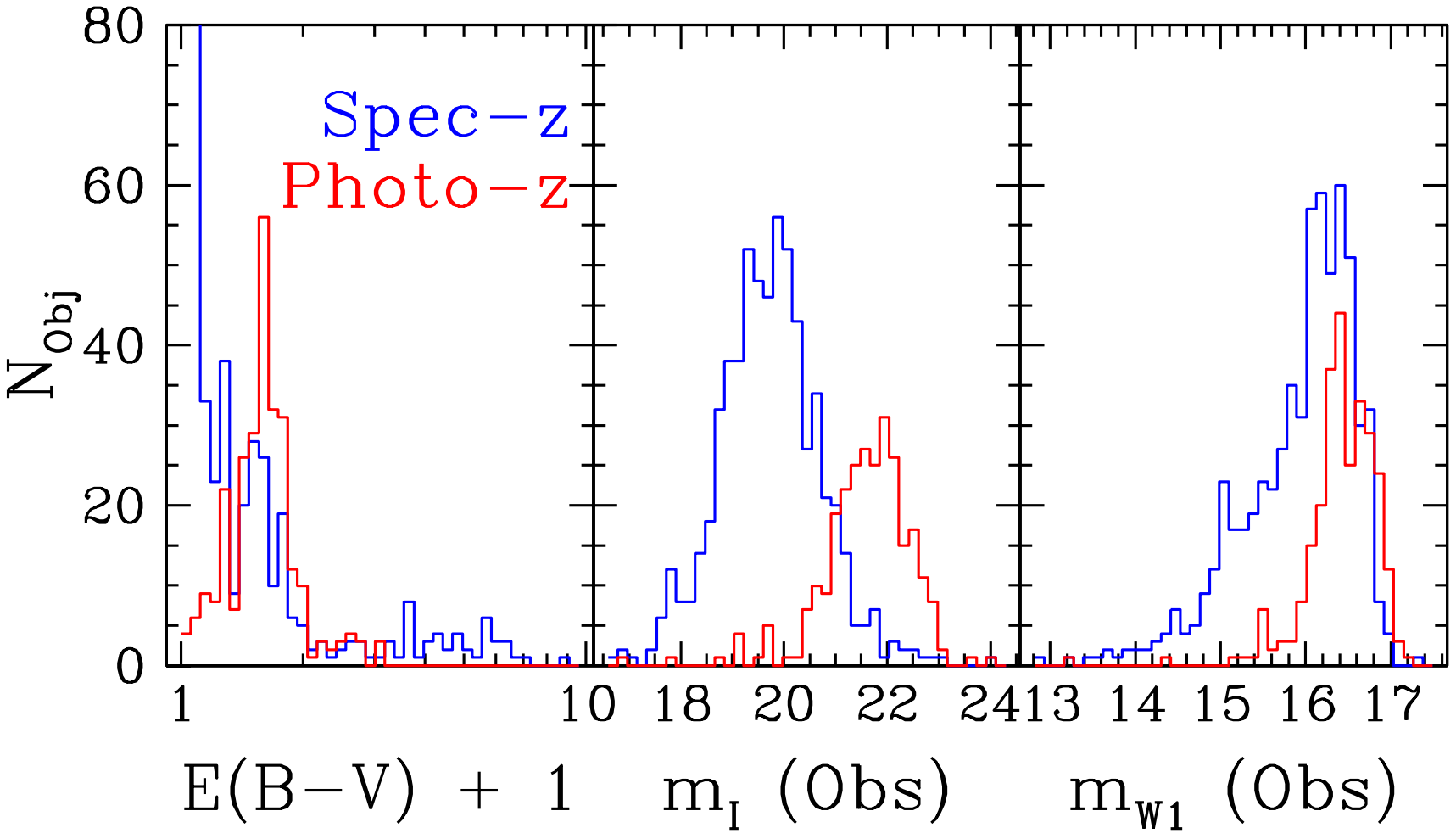
  We loose many low-luminosity AGN which are likely more easily diluted by the host

- Difference in normalization at intermediate z

  Type 2 AGN?

Conclusions

- WISE is very efficient at finding Type 1 AGN
  - Selection may need to depend on magnitude
- WISE is also sensitive to obscured AGN
  - Highest sensitivity below redshift 1
- Nature of contamination depends on depth
  - Star forming galaxies at bright magnitude
  - High redshift quiescent galaxies at fainter magnitudes

Backup Slides

SED Properties