High-redshift obscured quasars

Alejo Martínez Sansigre (MPIA),
Steve Rawlings (Ox), Mark Lacy (SSC),
Hans-Rainer Klöckner (Ox)
and many others (all over the place)

What do we mean by this?

- High-redshift: z~2 around peak in quasar activity

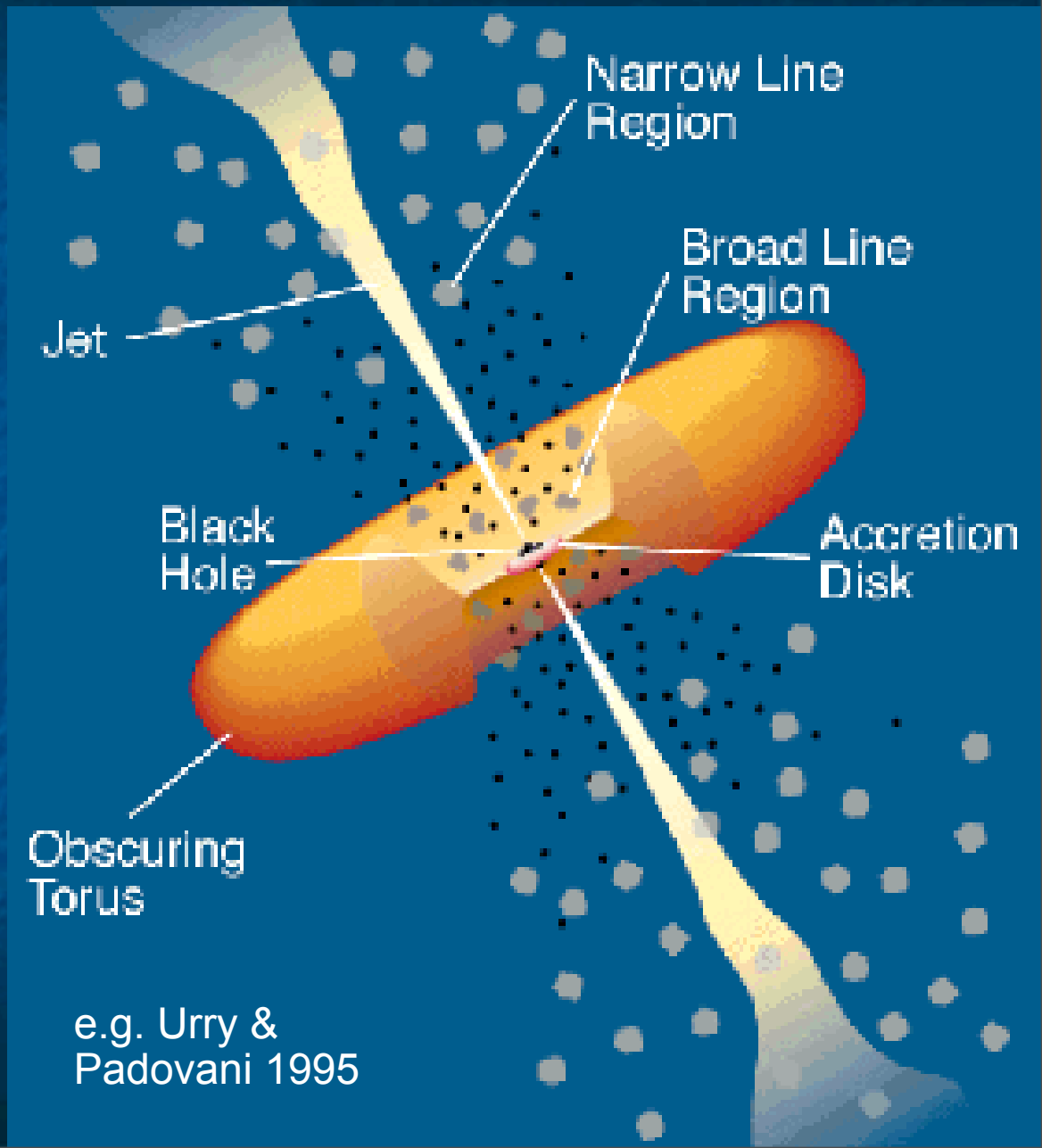
- Obscured (type-2): No broad lines (>2000 km s-1), large extinction, Av≥5.
- This definition might not be equivalent to X-ray def. ($N_H \geq 10^{26}$ m^{-2}) depending on gas-to-dust ratio.

- Quasars: Luminous, $L_{bol} \geq 10^{39}$ W ($M_B \leq -23.5$, $Lx \geq 2x10^{44}$ erg s^{-1}).
- but also radio-intermediate: $L_{1.4\ GHz} \sim 10^{24}$ W Hz^{-1} sr^{-1}.

AGN unified scheme

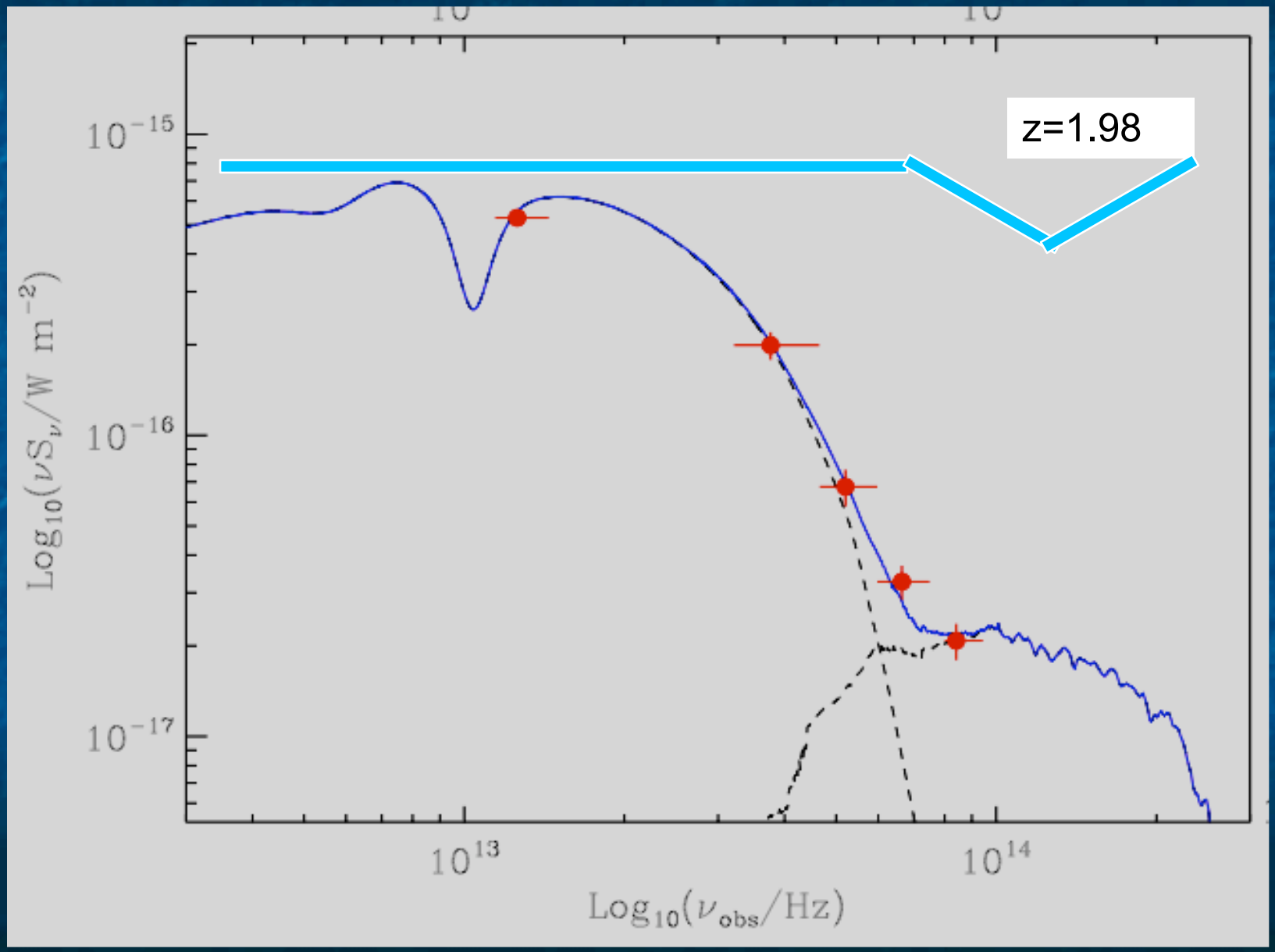
Obscuration is a pure orientation effect (torus)

Radio jet can never be face-on for an obscured AGN



e.g. Urry & Padovani 1995

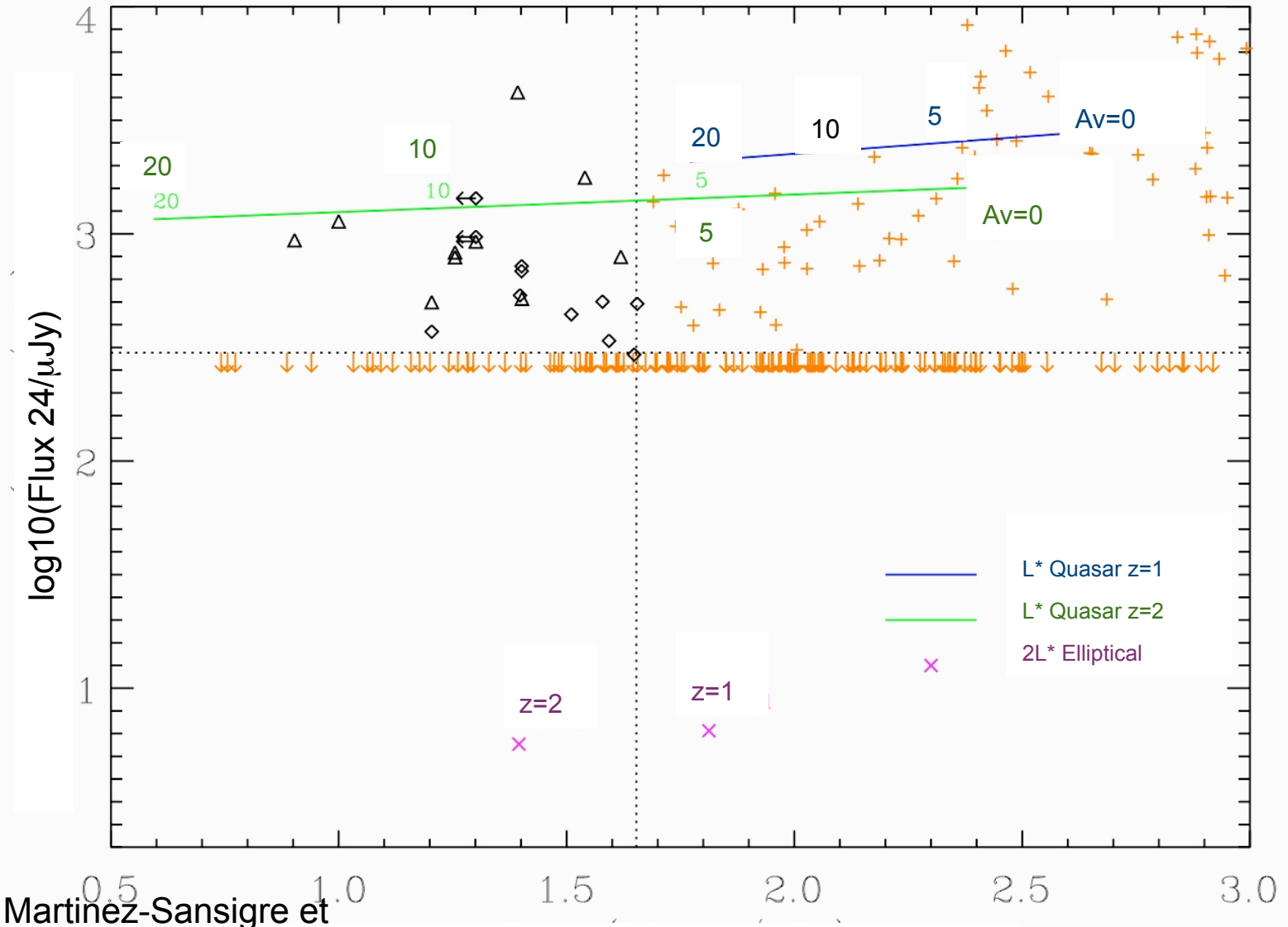
Spectral energy distribution



Selection criteria

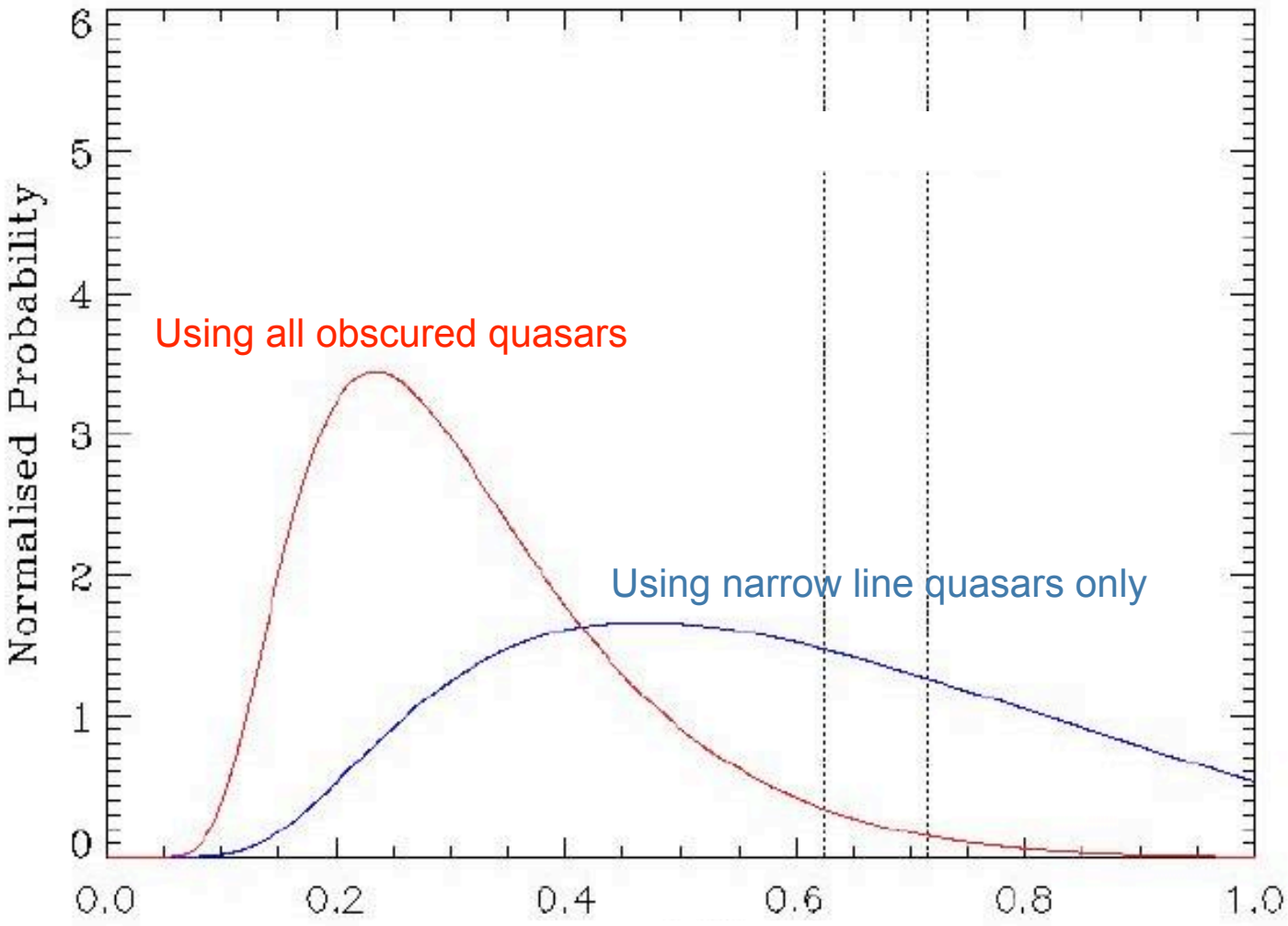
- S 24 μm > 300 μJy : Selects warm dust typical both of type-1s and type-2s (around break in LF)
- S 3.6 μm ≤ 45 μ Jy : rejects type-1s and low-z type-2s ($z_{phot} > 1.4$)
- 350 μ Jy ≤ S 1.4 GHz ≤ 2 mJy : selects radio-intermediate quasars, to minimise contamination from ULIRGs

Another way of looking at it …



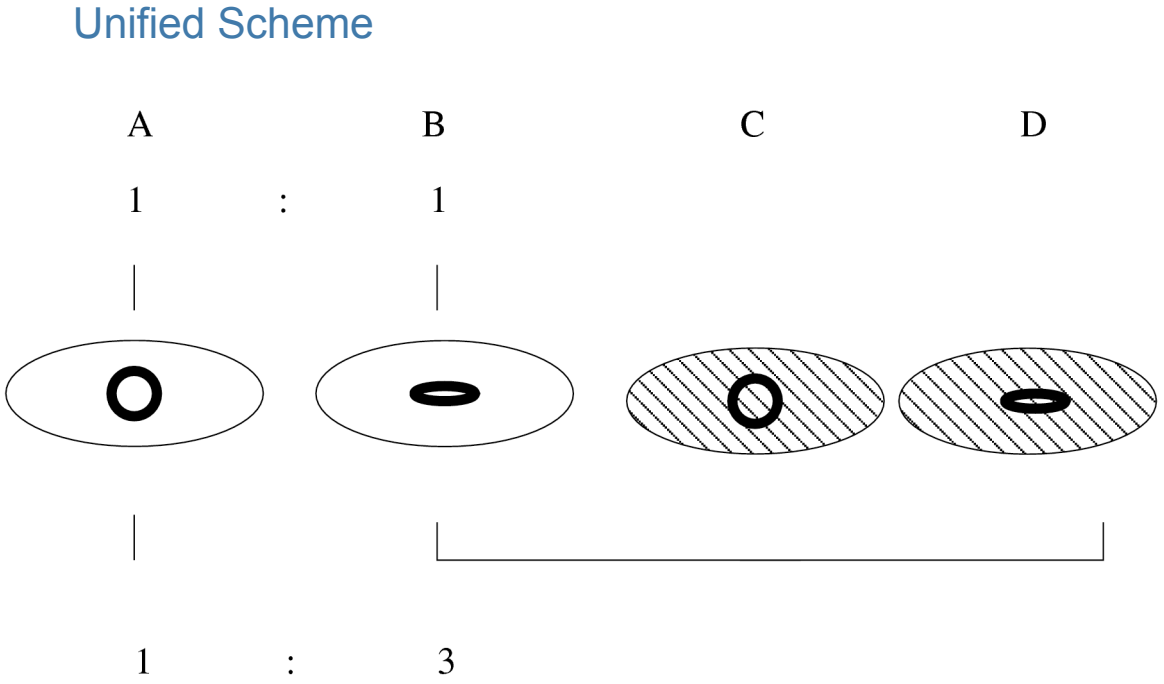
Martinez-Sansigre et al., 2005, Nat

The quasar fraction



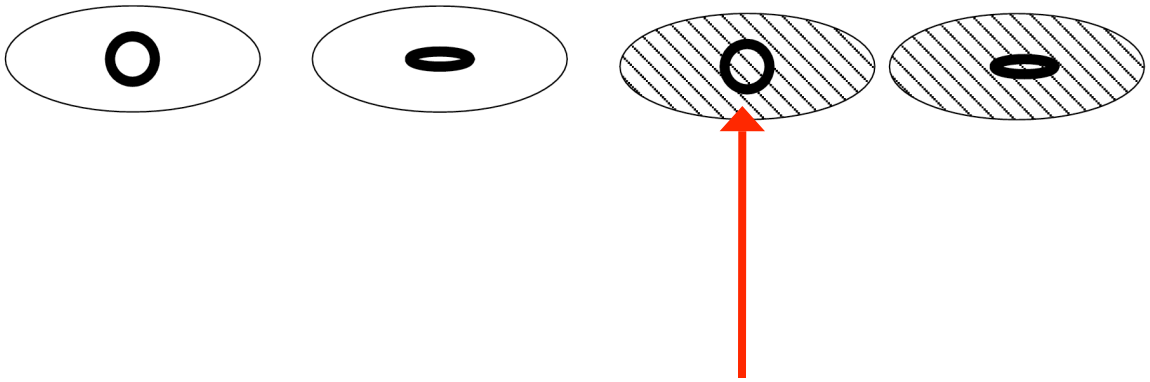
Martinez-Sansigre et al., 2005, Nat

Possible scheme?

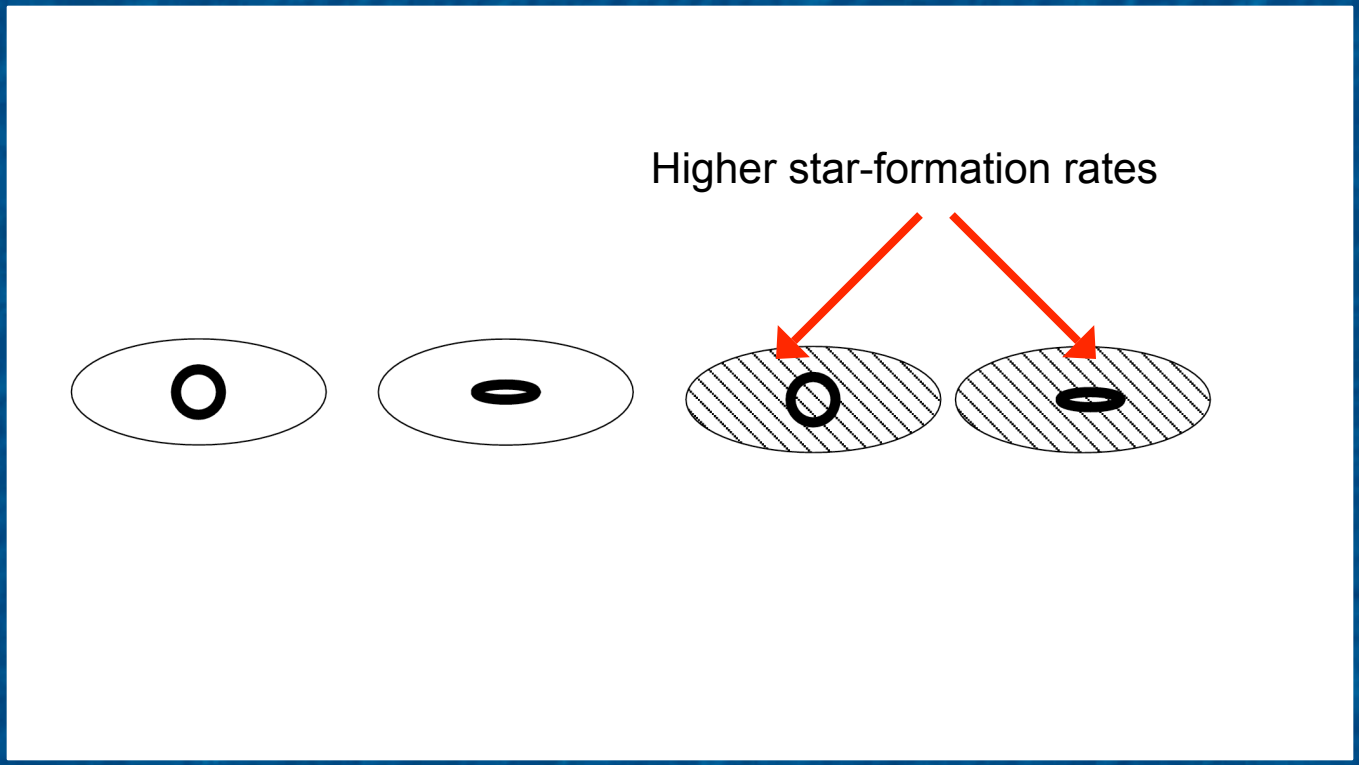


Expectations

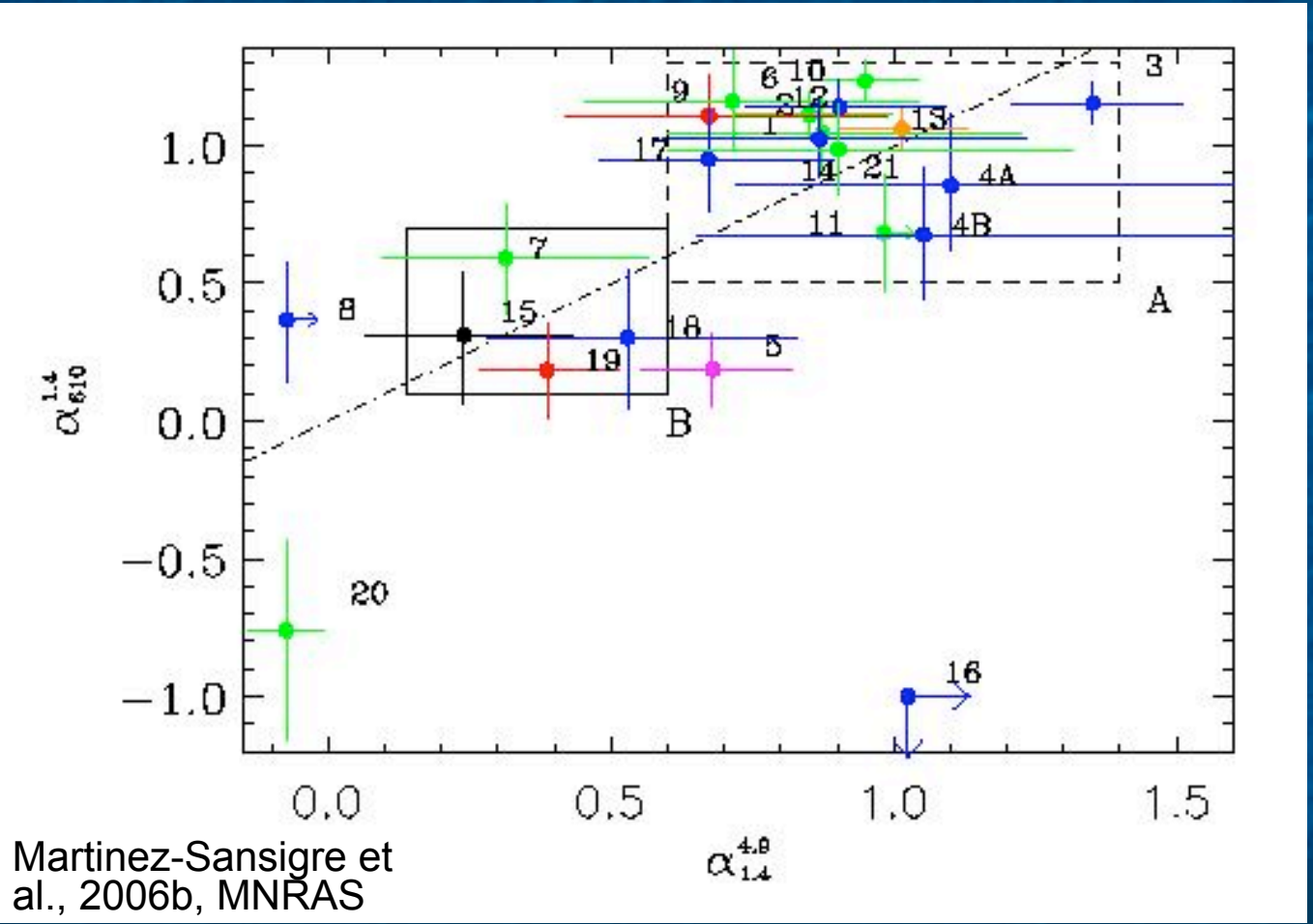
Obscured quasars with face-on jets



Expectations



Radio spectral indices

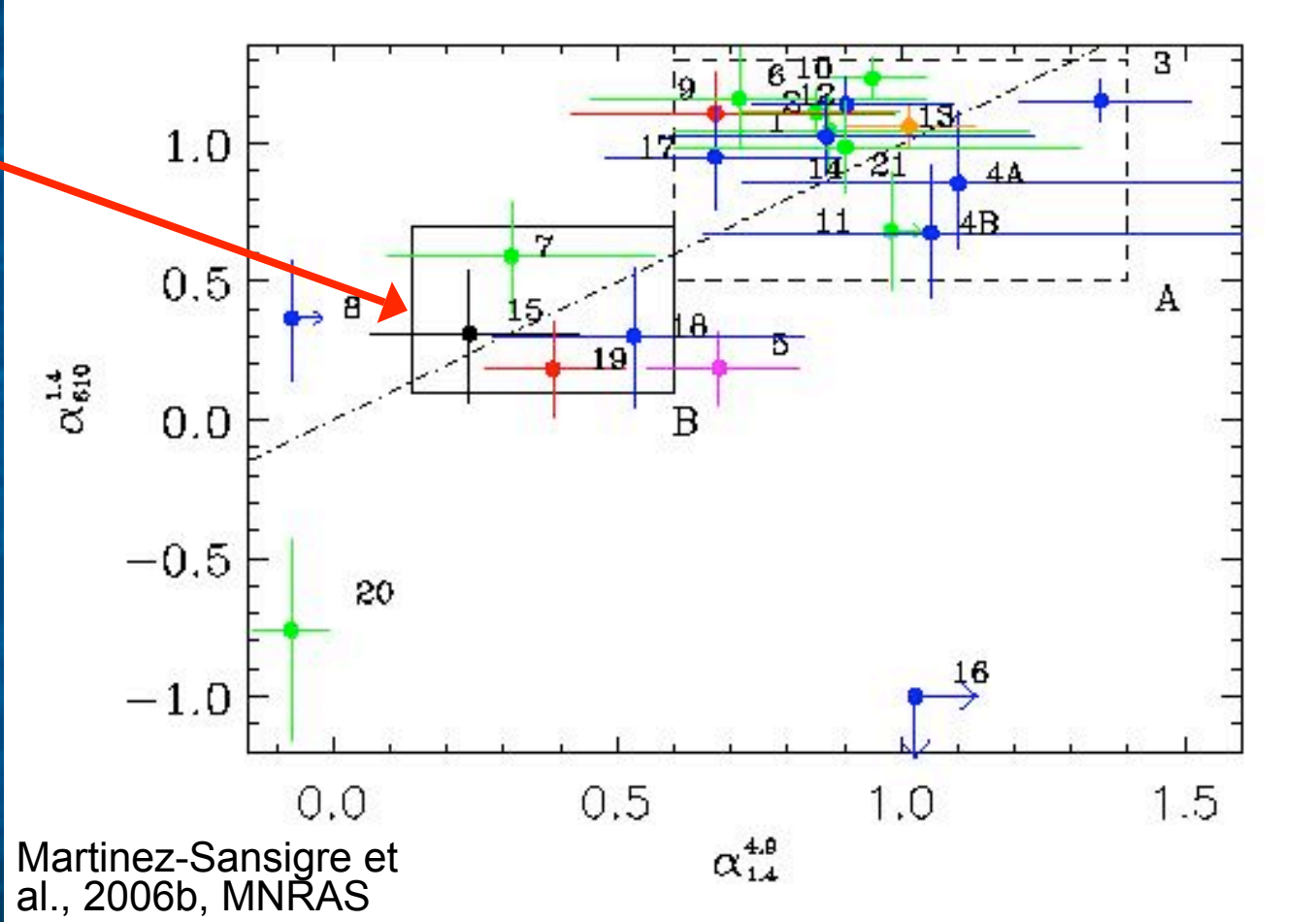


Martinez-Sansigre et al., 2006b, MNRAS

Convention: $S_\nu \sim \nu^{-\alpha}$

Radio spectral indices

FLAT SPECTRUM obscured quasars: jet is face on

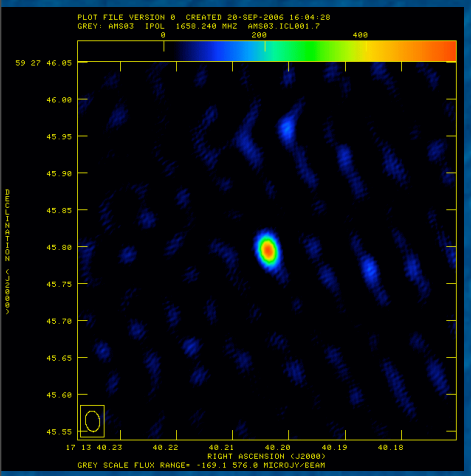


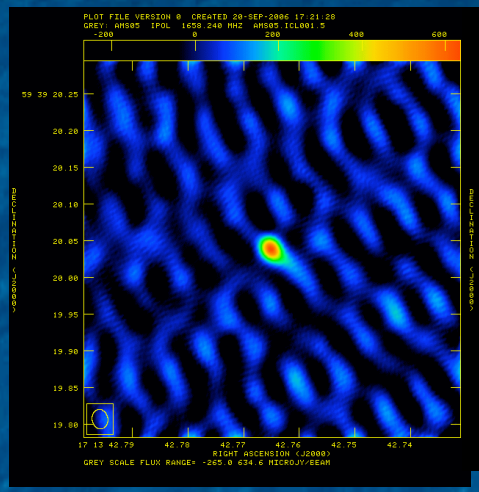
Martinez-Sansigre et al., 2006b, MNRAS

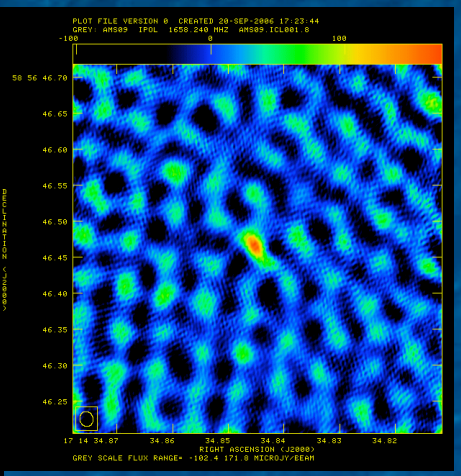
Convention: $S_\nu \sim \nu^{-\alpha}$

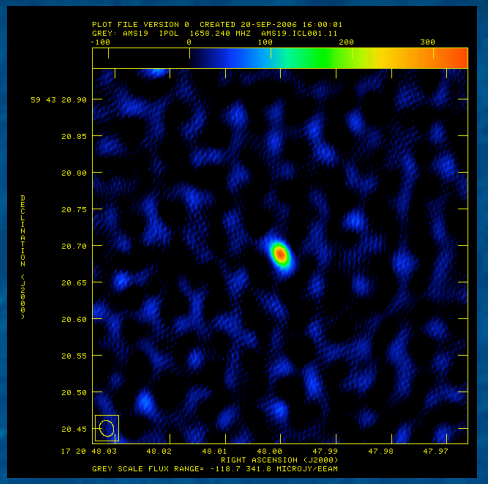
VLBI observations

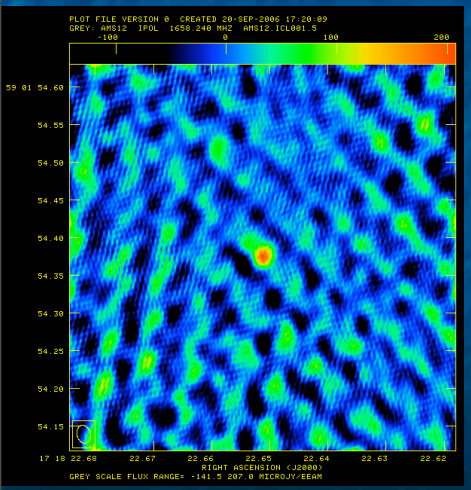
rms ~ 26 μJy

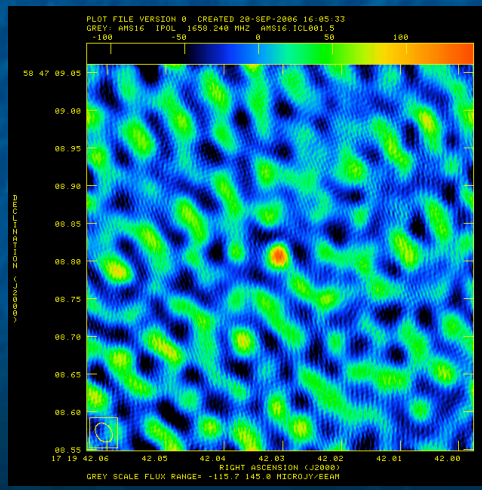


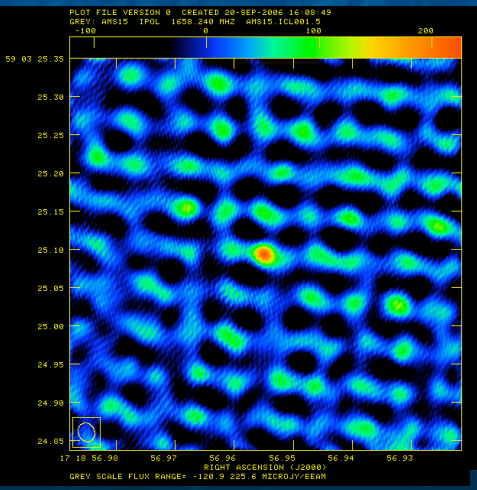


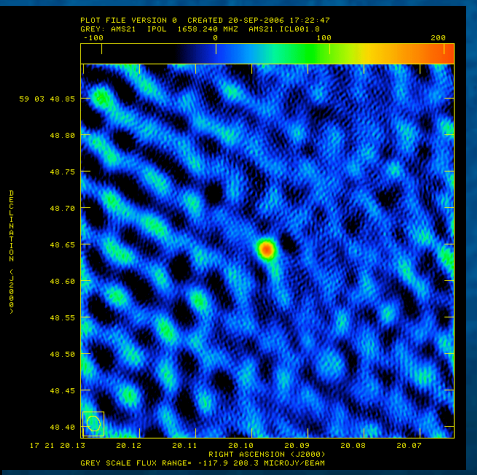






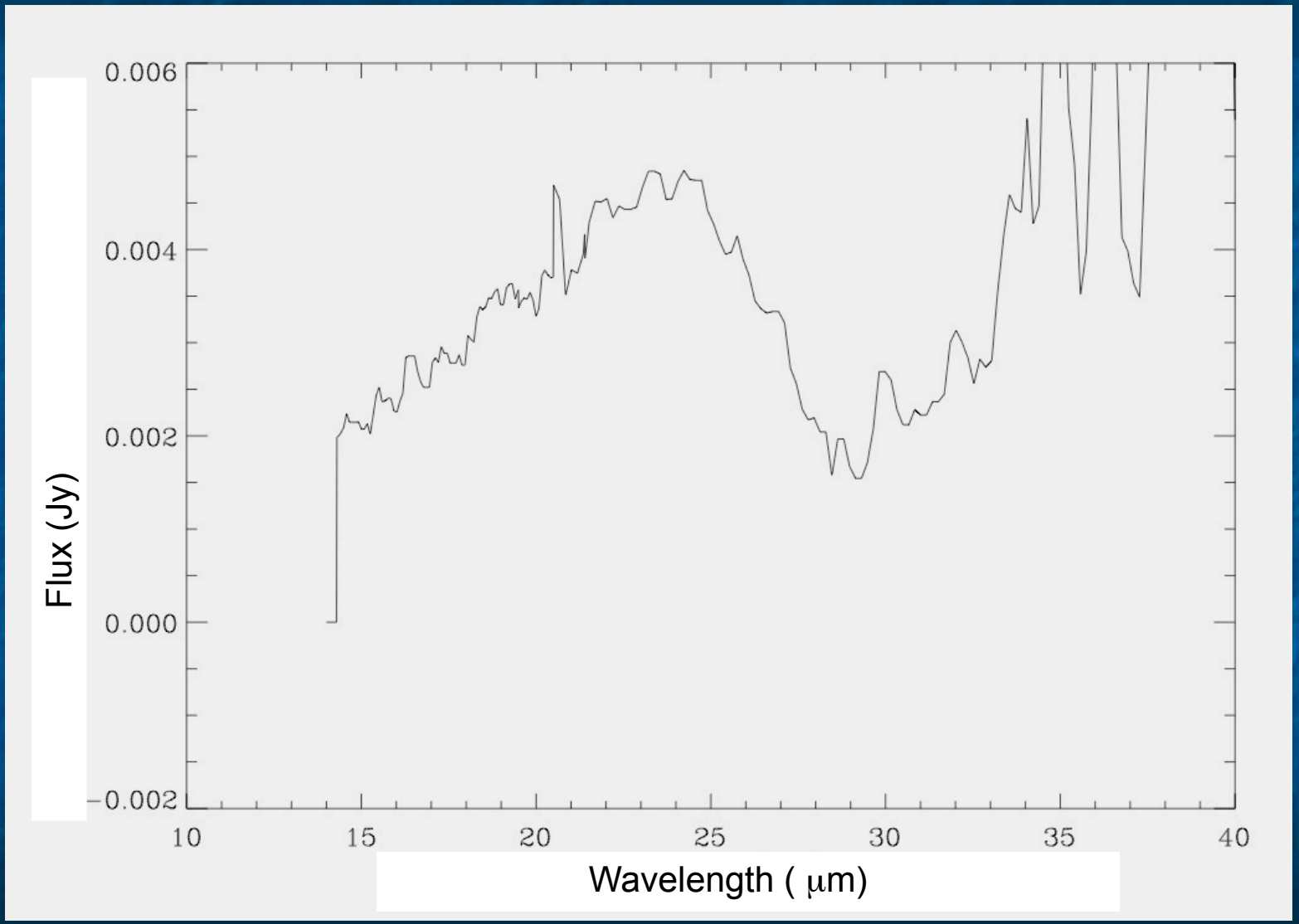






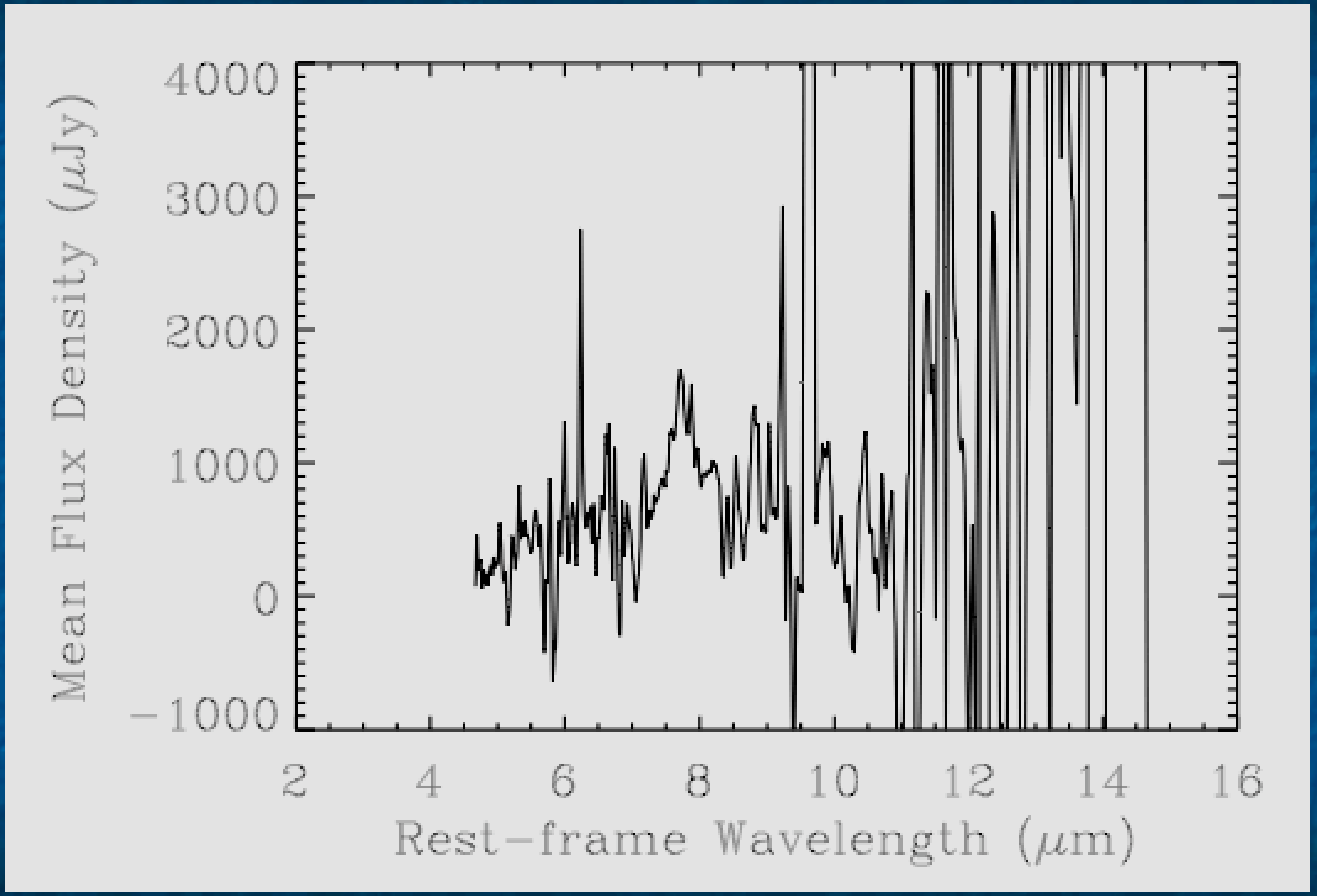
H.-R. Klöckner et al., in prep.

Mid-infrared spectra

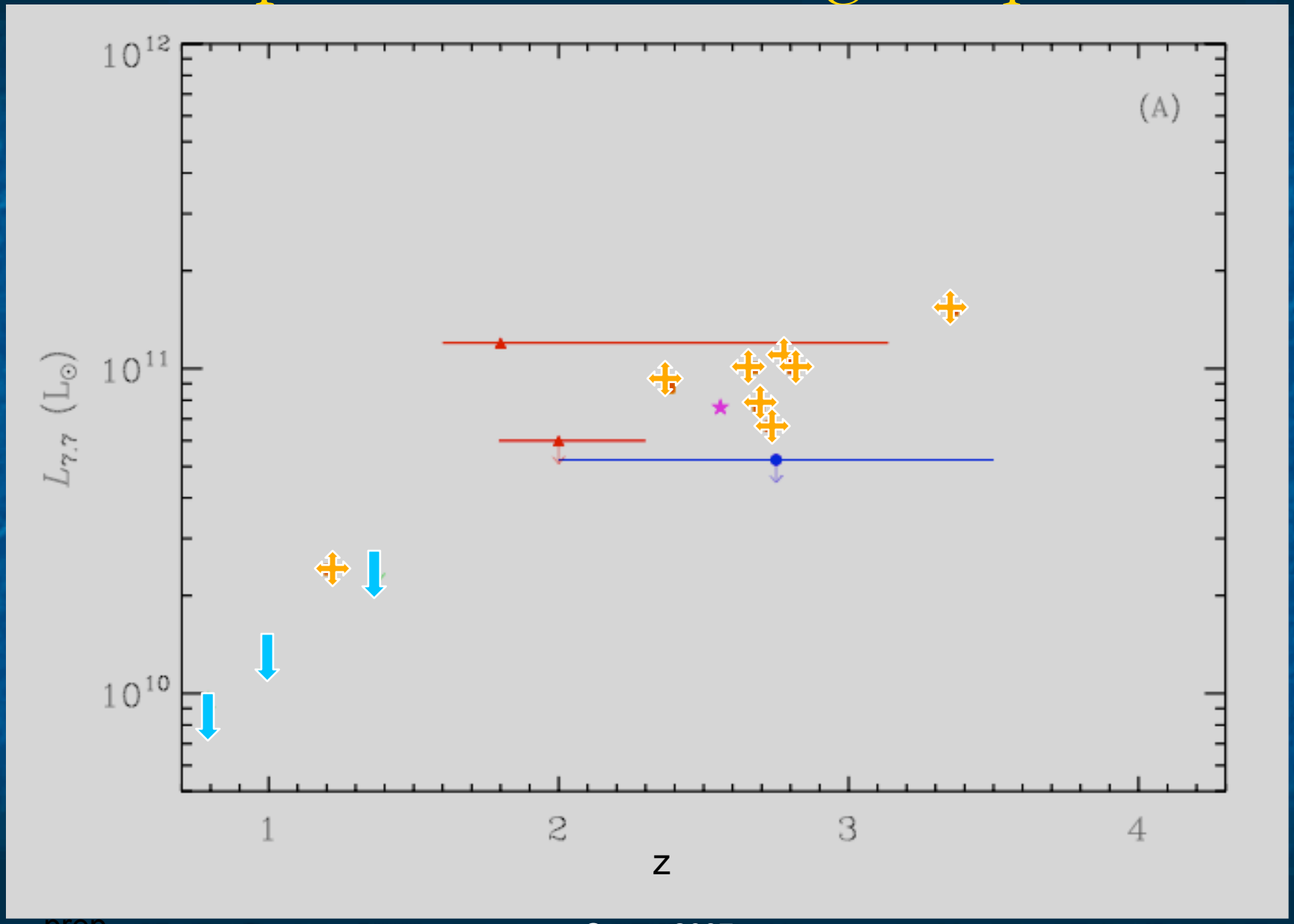


Seeon 2007

Stacking sources with weak PAHs

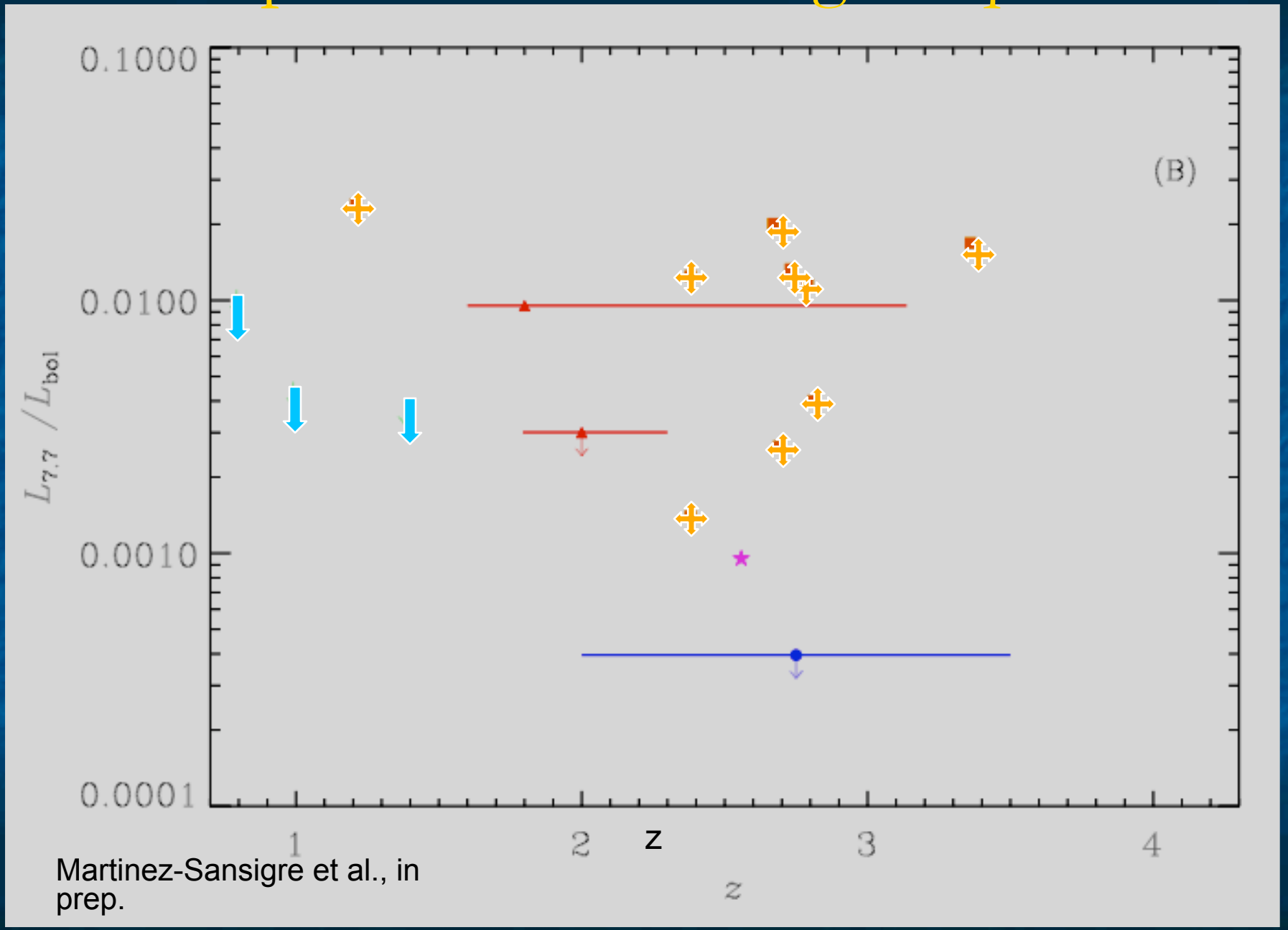


Comparison to other high-z quasars



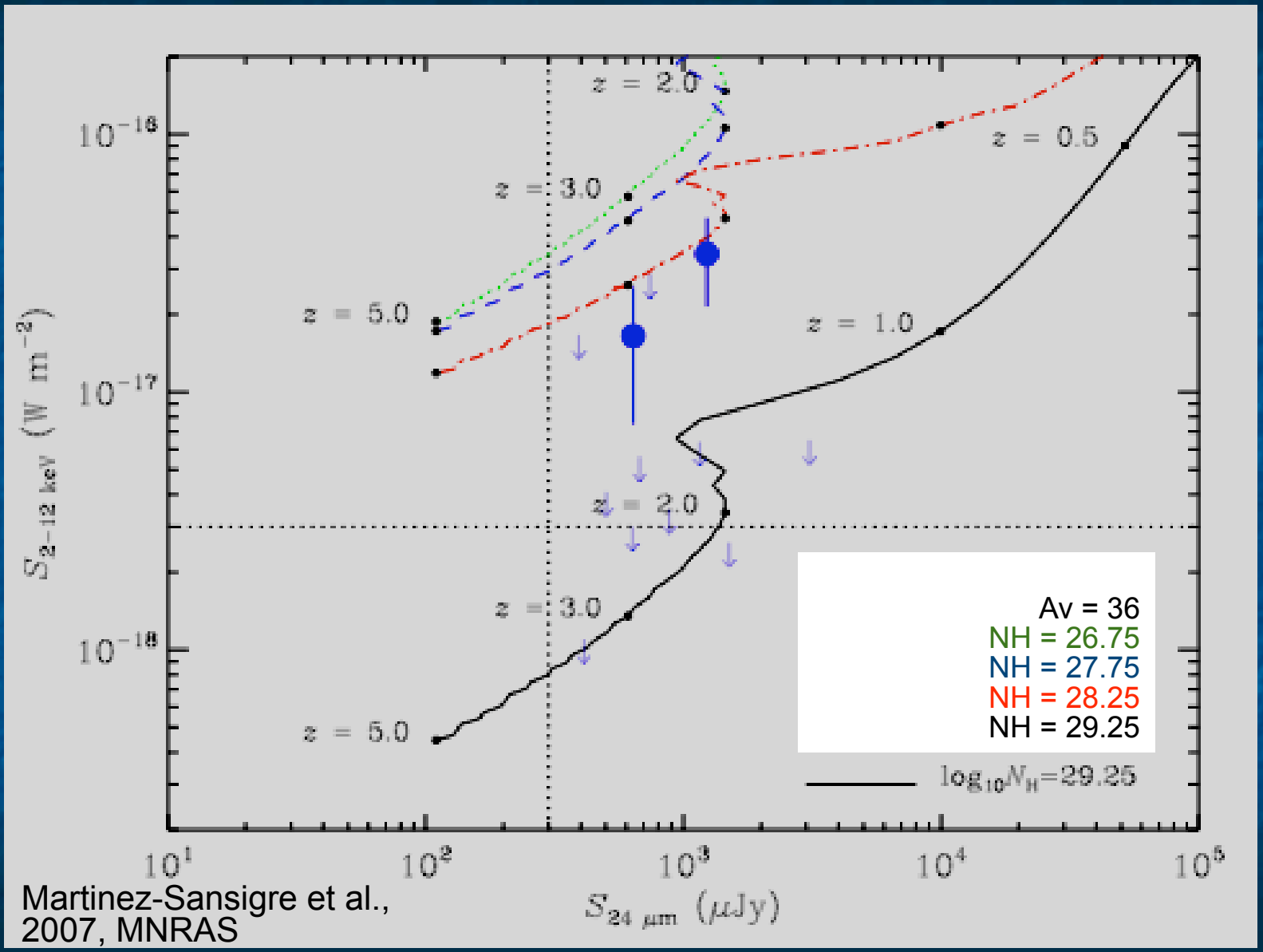
prep.

Comparison to other high-z quasars



Martinez-Sansigre et al., in prep.

Compton-thick?



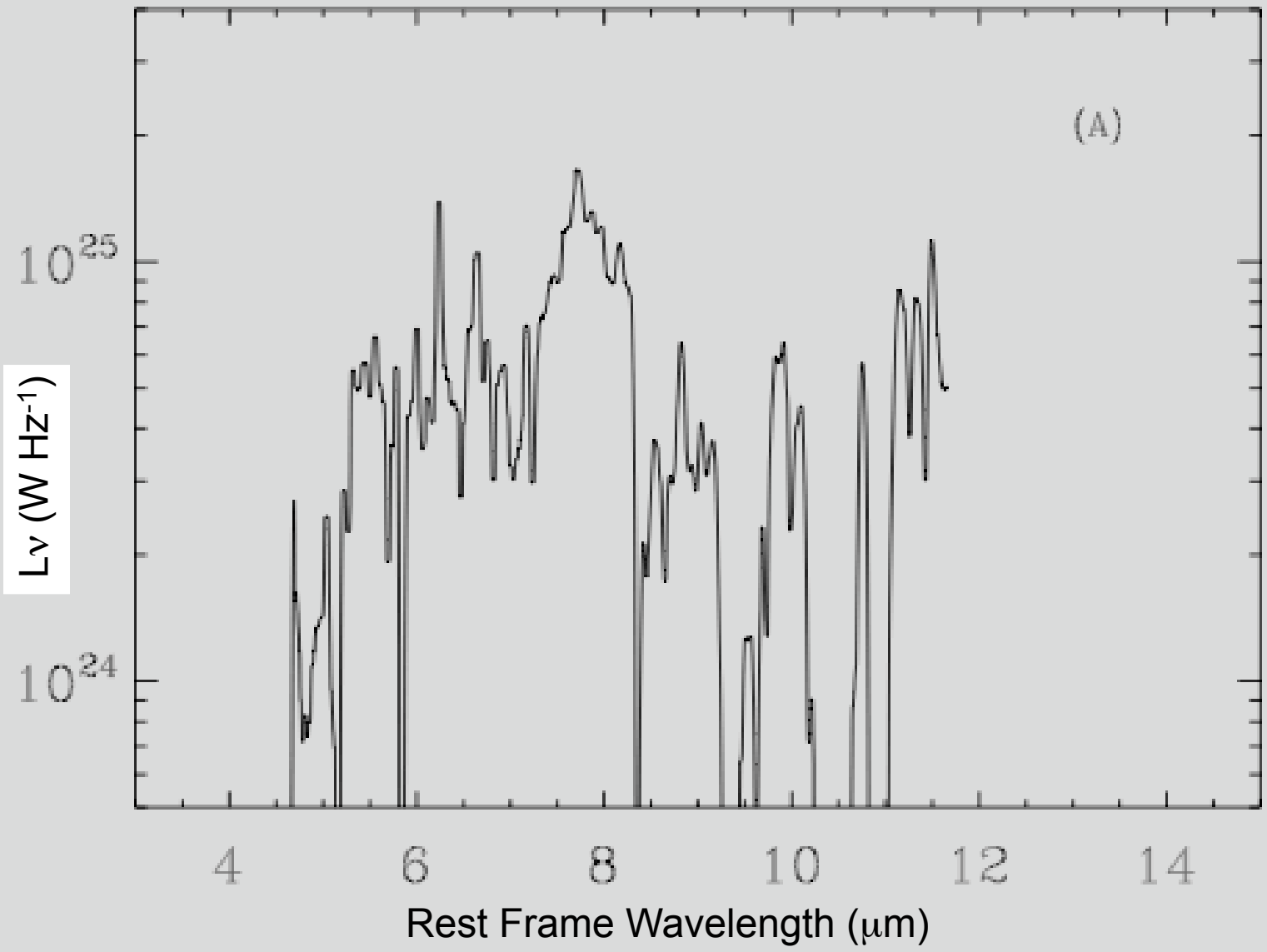
Martinez-Sansigre et al., 2007, MNRAS

Summary

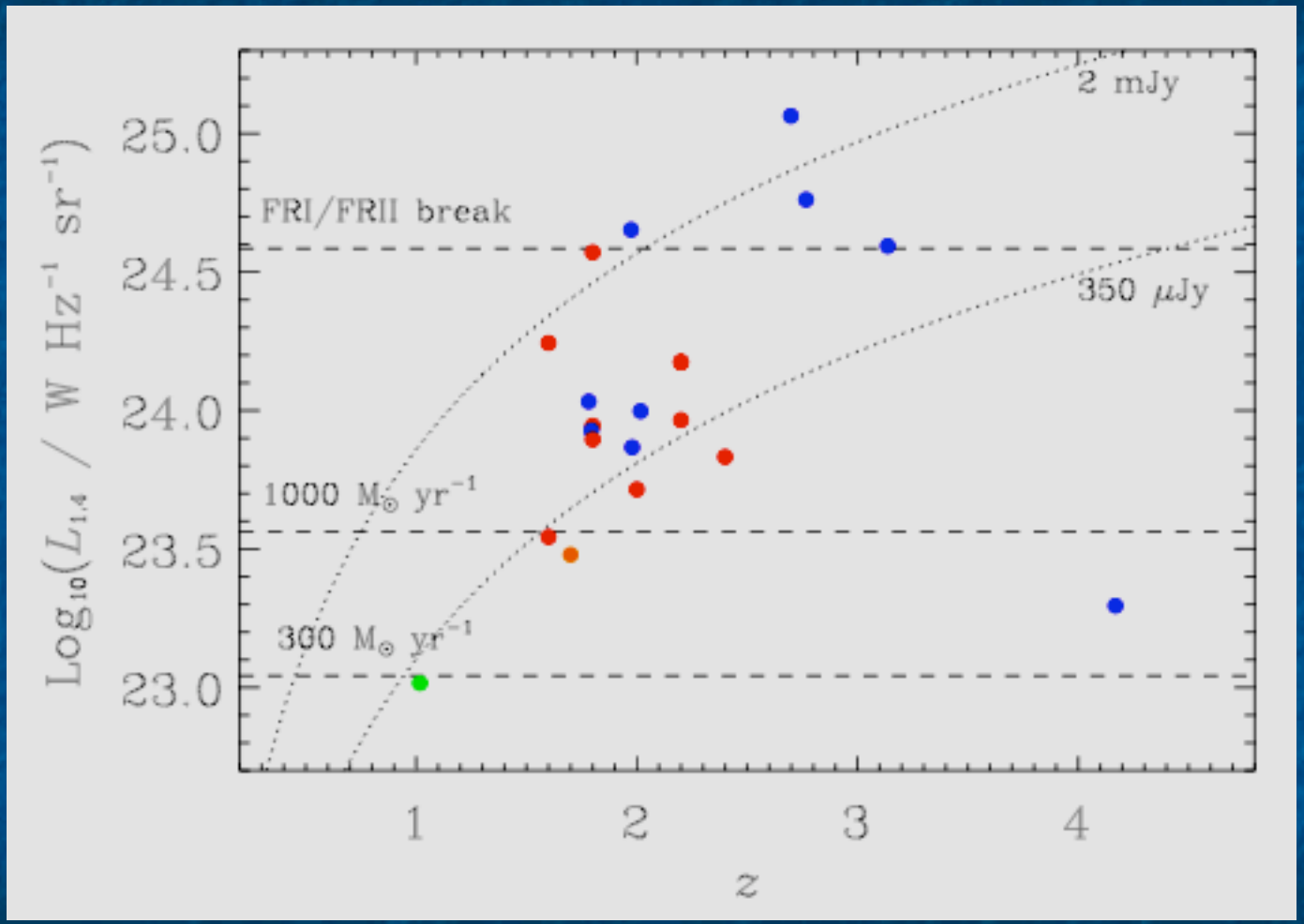
- 50-80 % of z~2 quasars obscured (probably ~66-75%).
- ~50% have blank optical spectra, some of these have the radio jet pointing at us. Probable obscuration by host galaxy.
- Obscured quasars have stronger PAHs than unobscured or X-ray absorbed high-z quasars, but comparable to submillimetre-selected galaxies.
- Many are probably Compton-thick.
- They have the characteristics expected for heavily obscured phase of SMBH growth, prior to hypothetical AGN feedback.

Thank You!

Stacking sources with weak PAHs

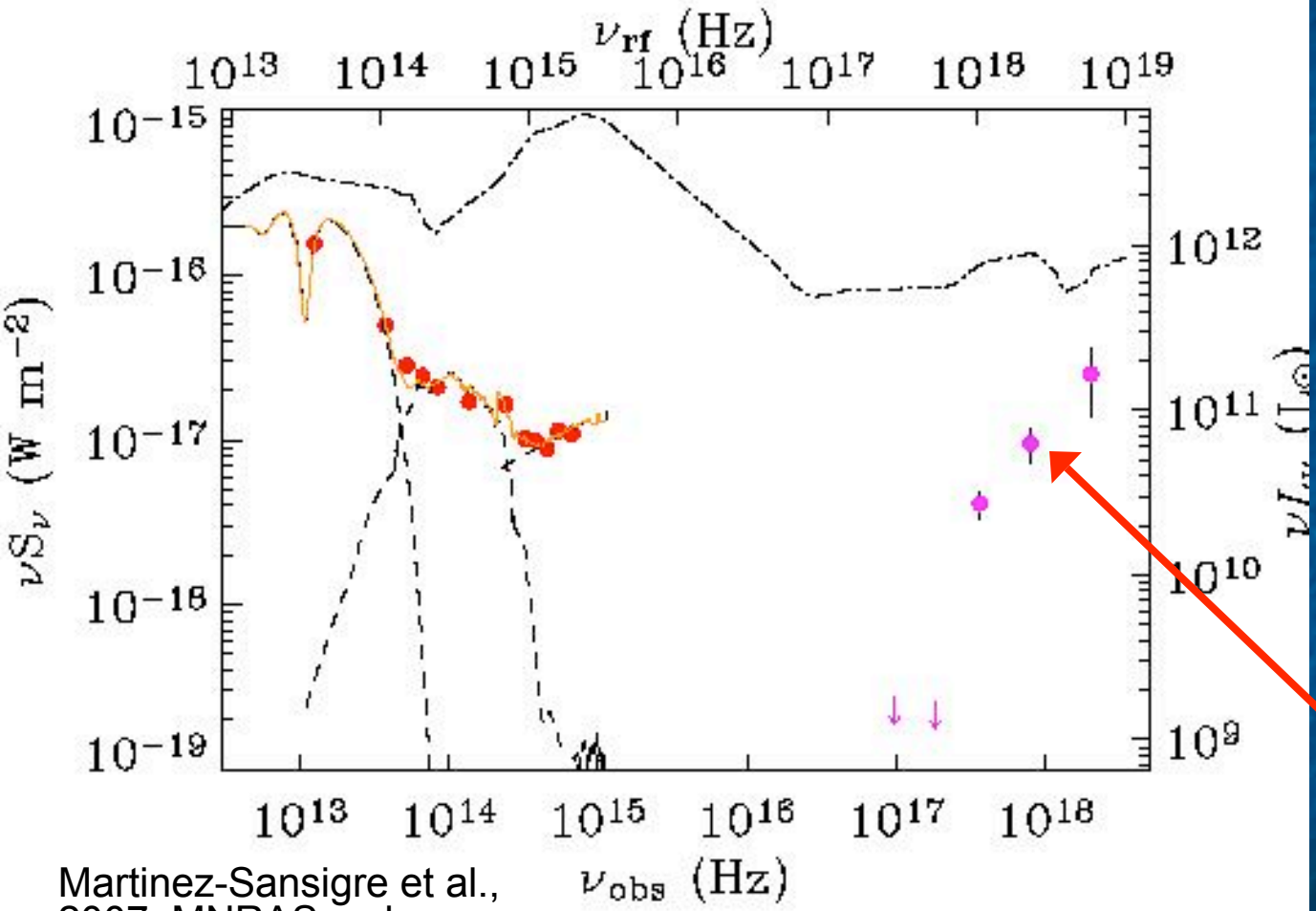


Radio intermediate …



Seeon 2007

Similar sample in SXDF



Martinez-Sansigre et al., 2007, MNRAS, subm.

z phot = 1.90

z spec = 2.08

Av ≈ 35

log Nh ≈ 27.5