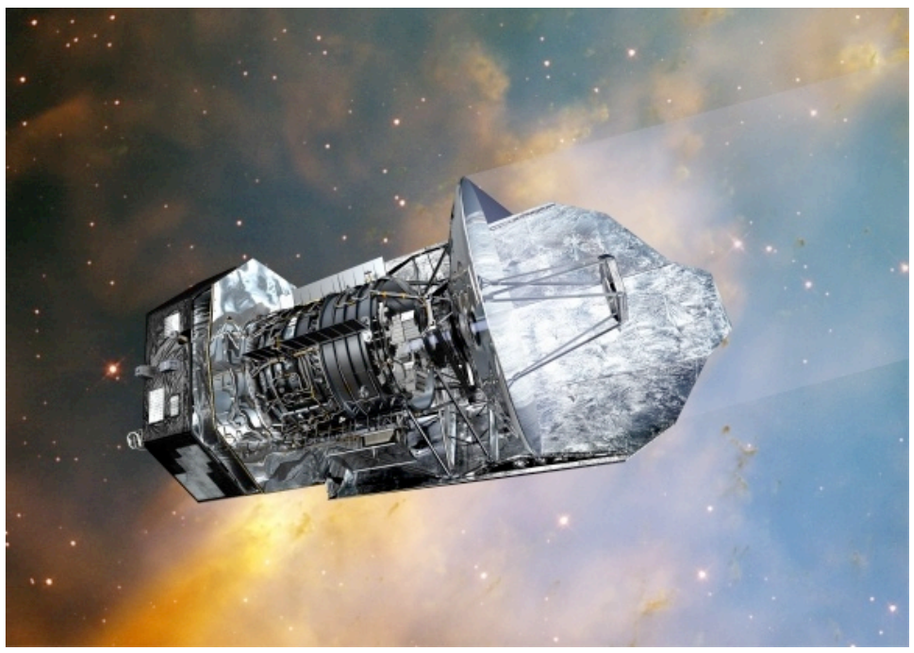
Dark Cosmology Centre

HERMES

ATLAS

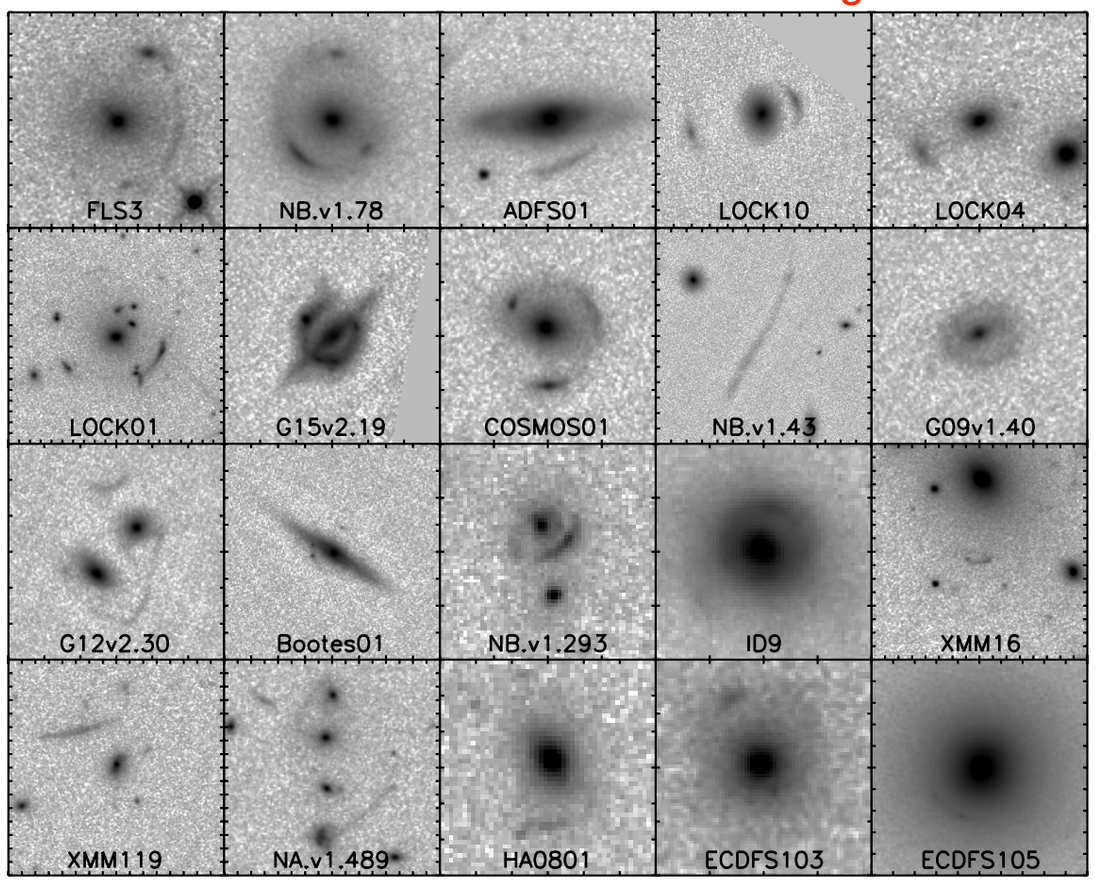
Strong lensing at sub-mm wavelengths: results from Herschel follow up programs

Julie Wardlow



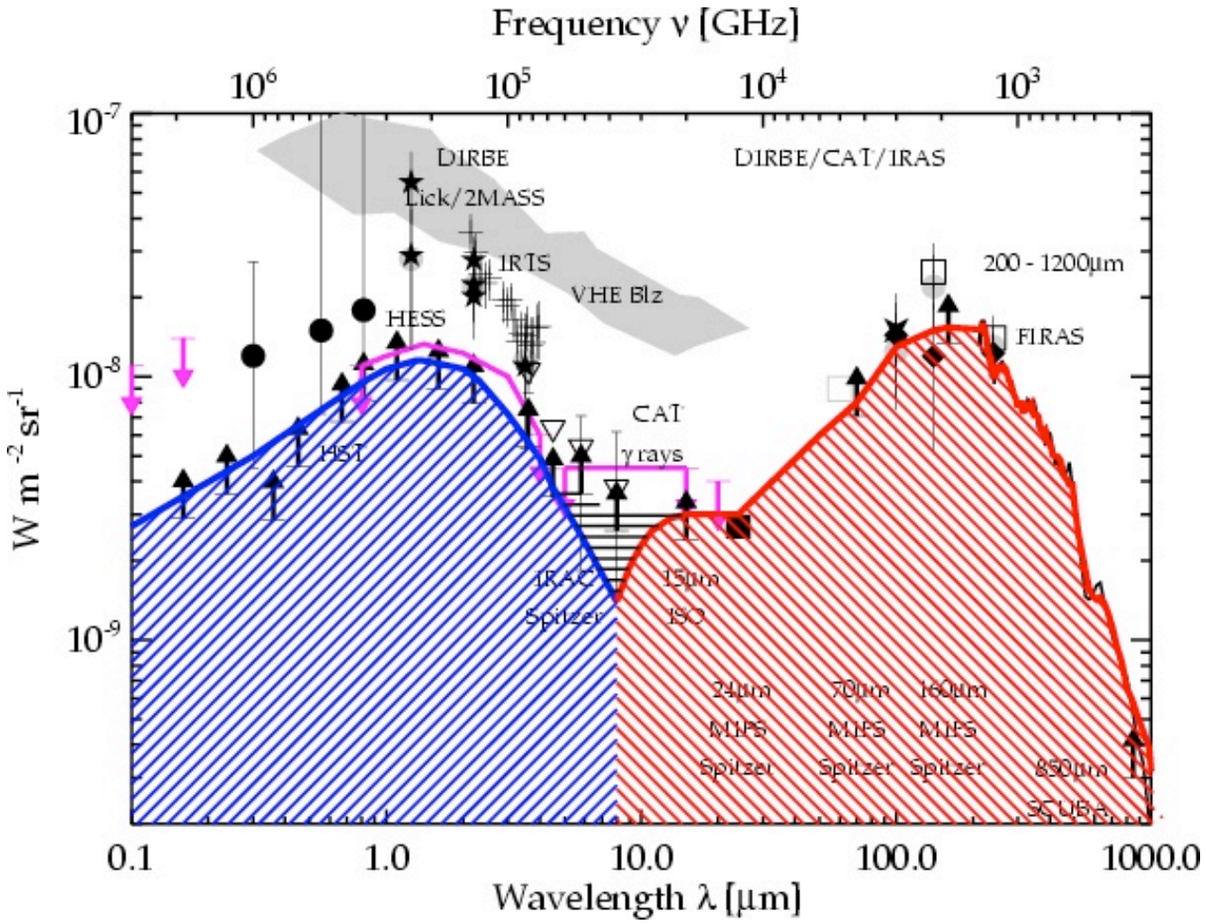
Herschel/SPIRE: 250, 350, 500μm

Calanog et al. 2014



Why survey the far-IR?

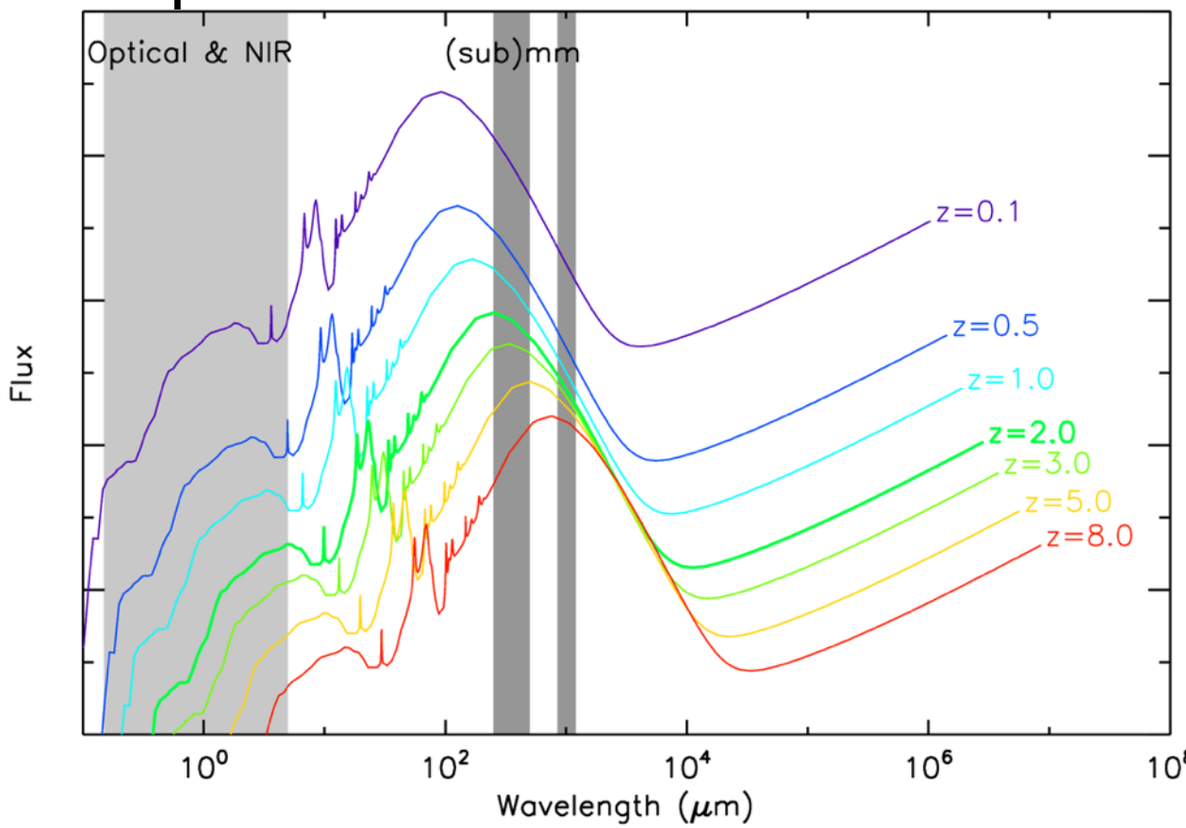
~50% of stellar photons are reprocessed by dust



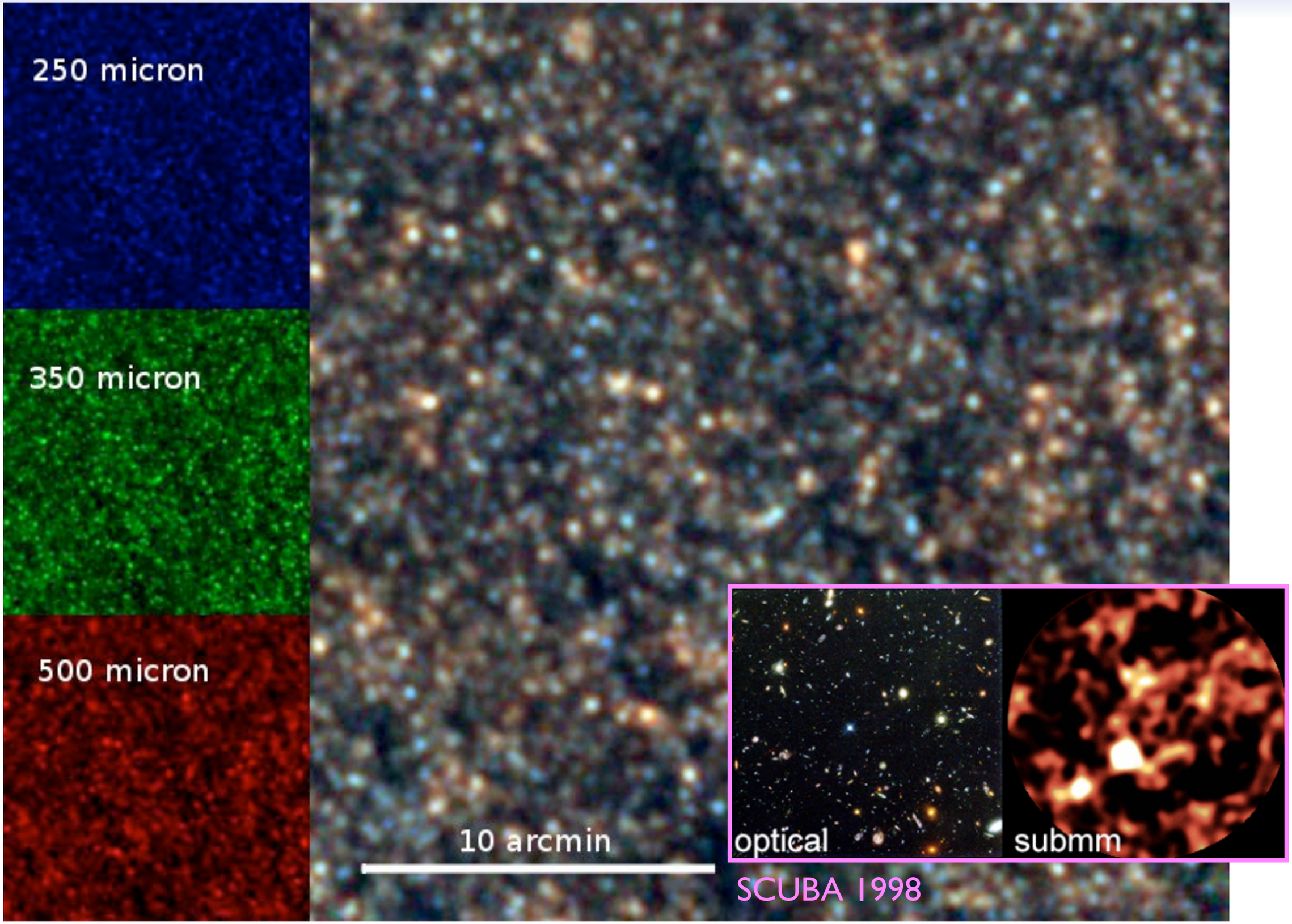
Dole et al. 2006

"Negative" K-correction = efficient high-z selection

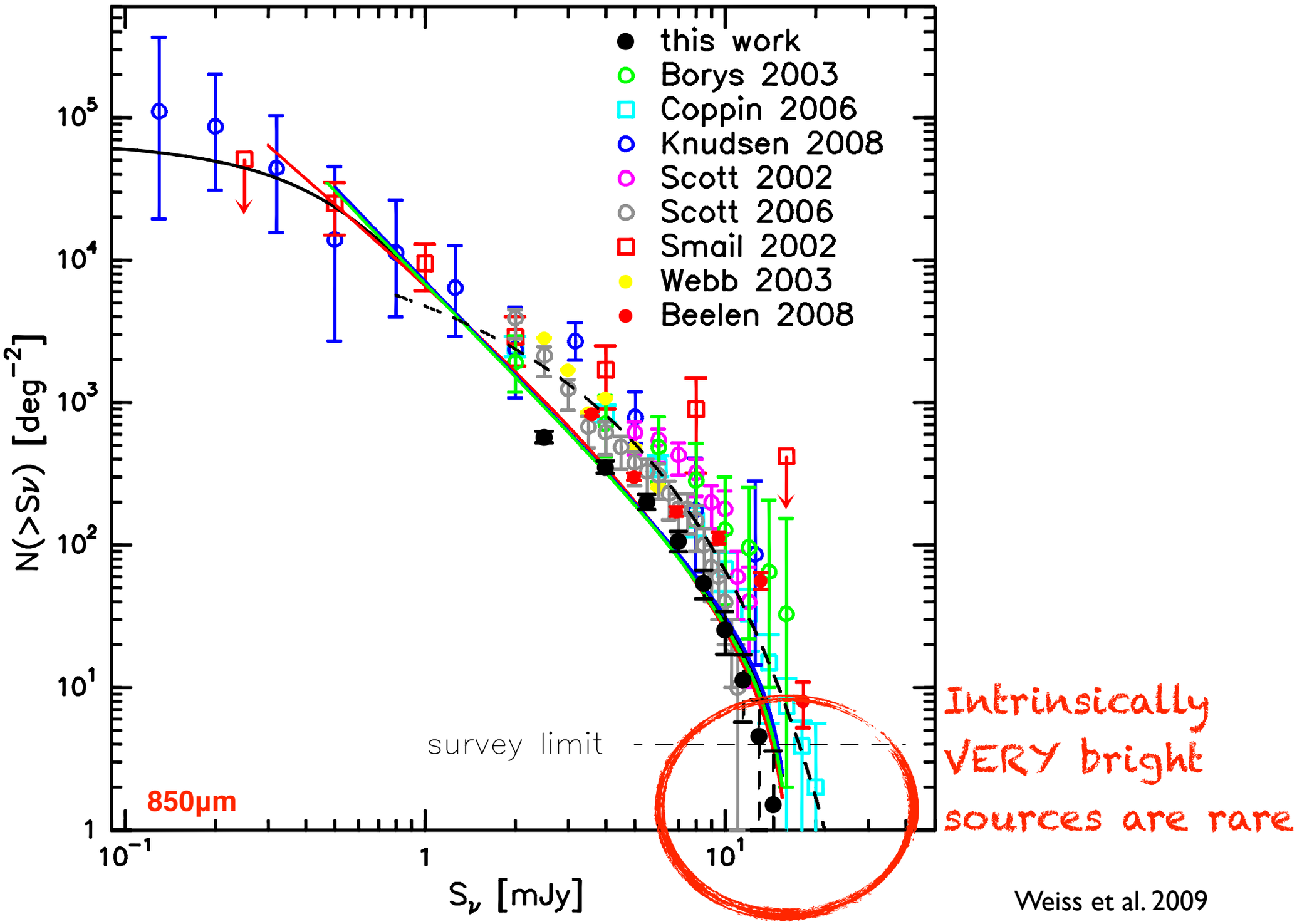
Arp 220 redshifted:



HerMES data: GOODS-N



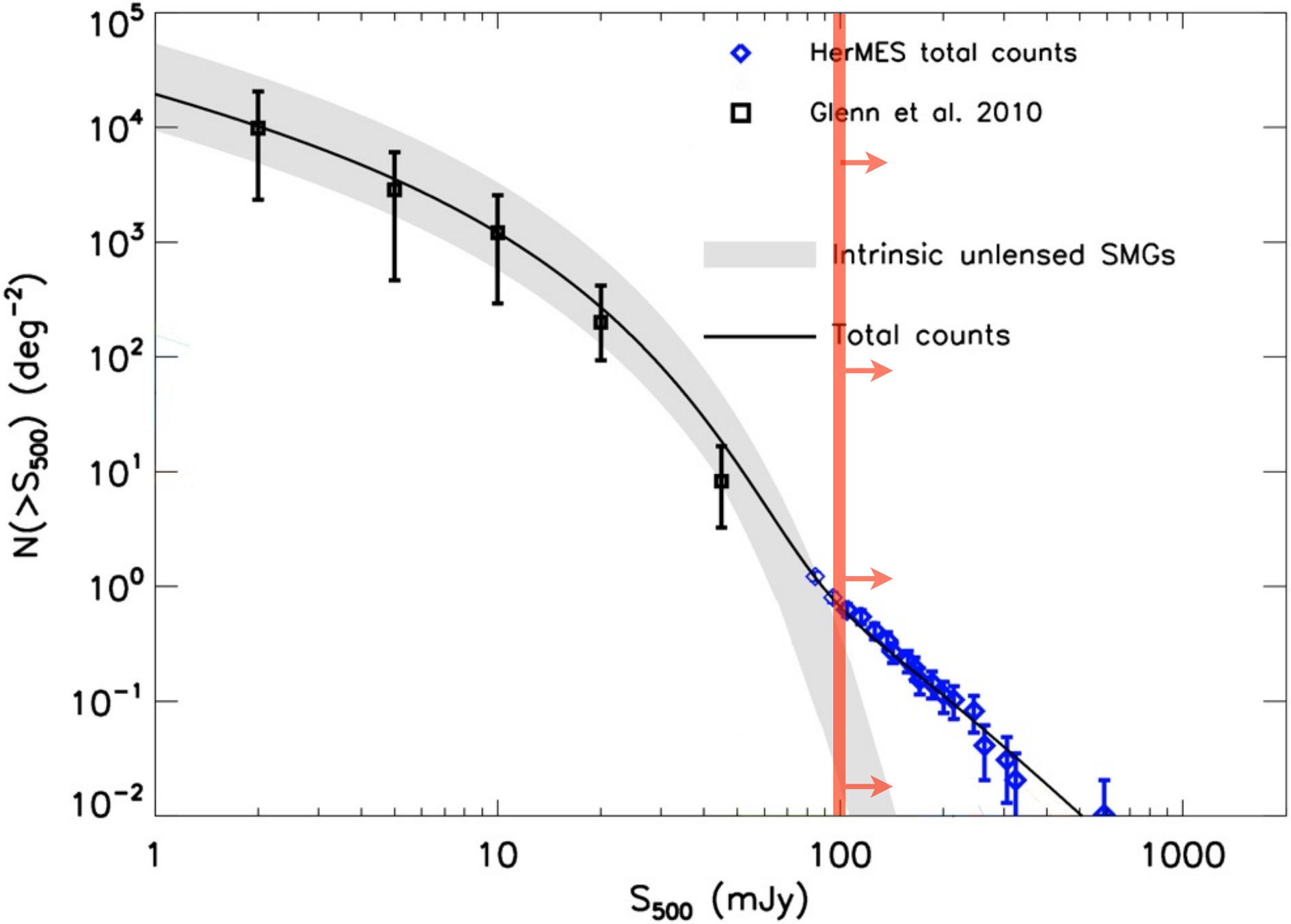
Lensed galaxies are readily identifiable in the far-IR



Weiss et al. 2009

See also Blain et al. 1996

HerMES lens selection (1):
S_{500}>100mJy

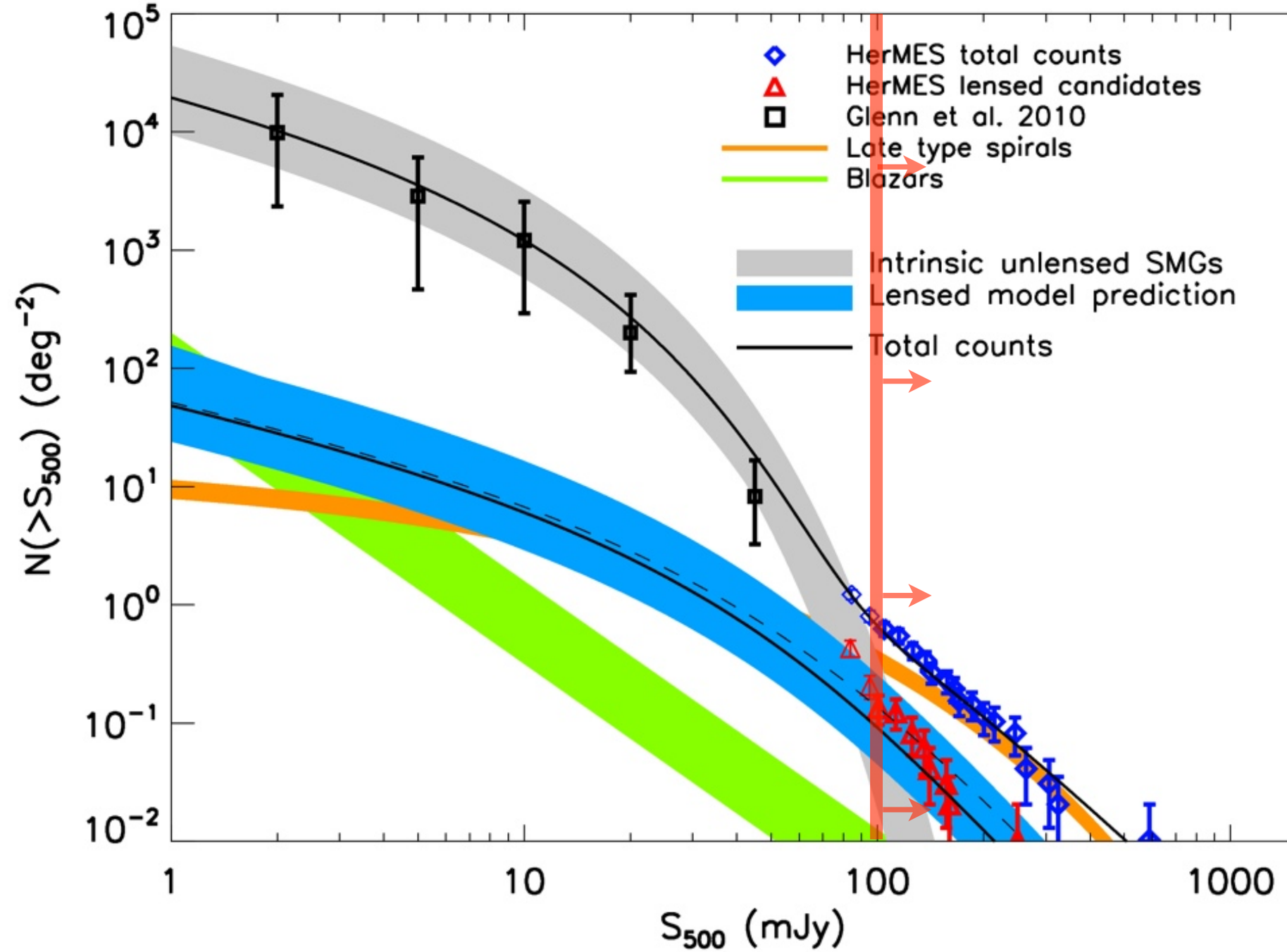


Candidates: ~0.15 deg^{-2}

Wardlow et al. 2013

HerMES lens selection (2)

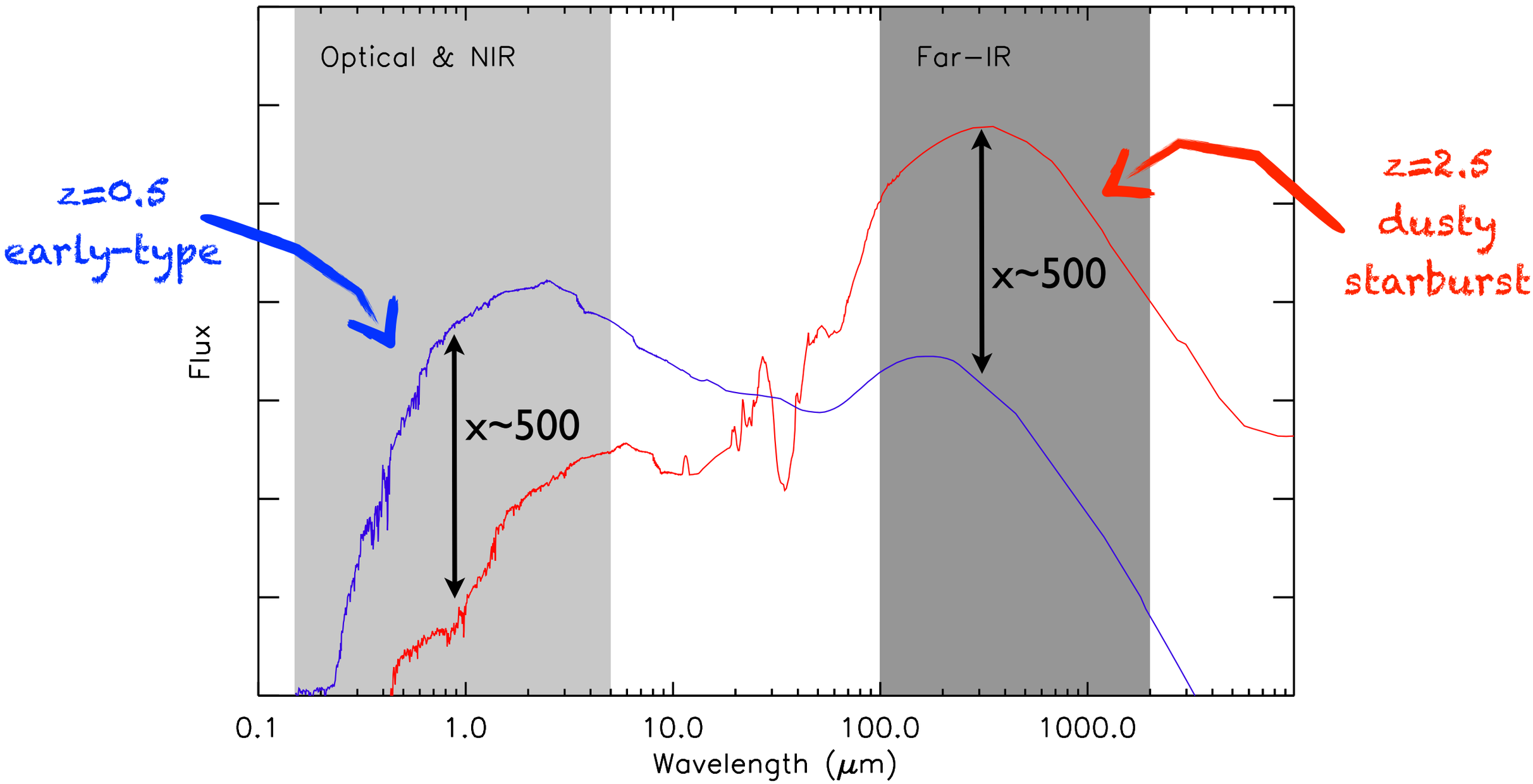
S_{500}>100mJy & no blazars or local spirals



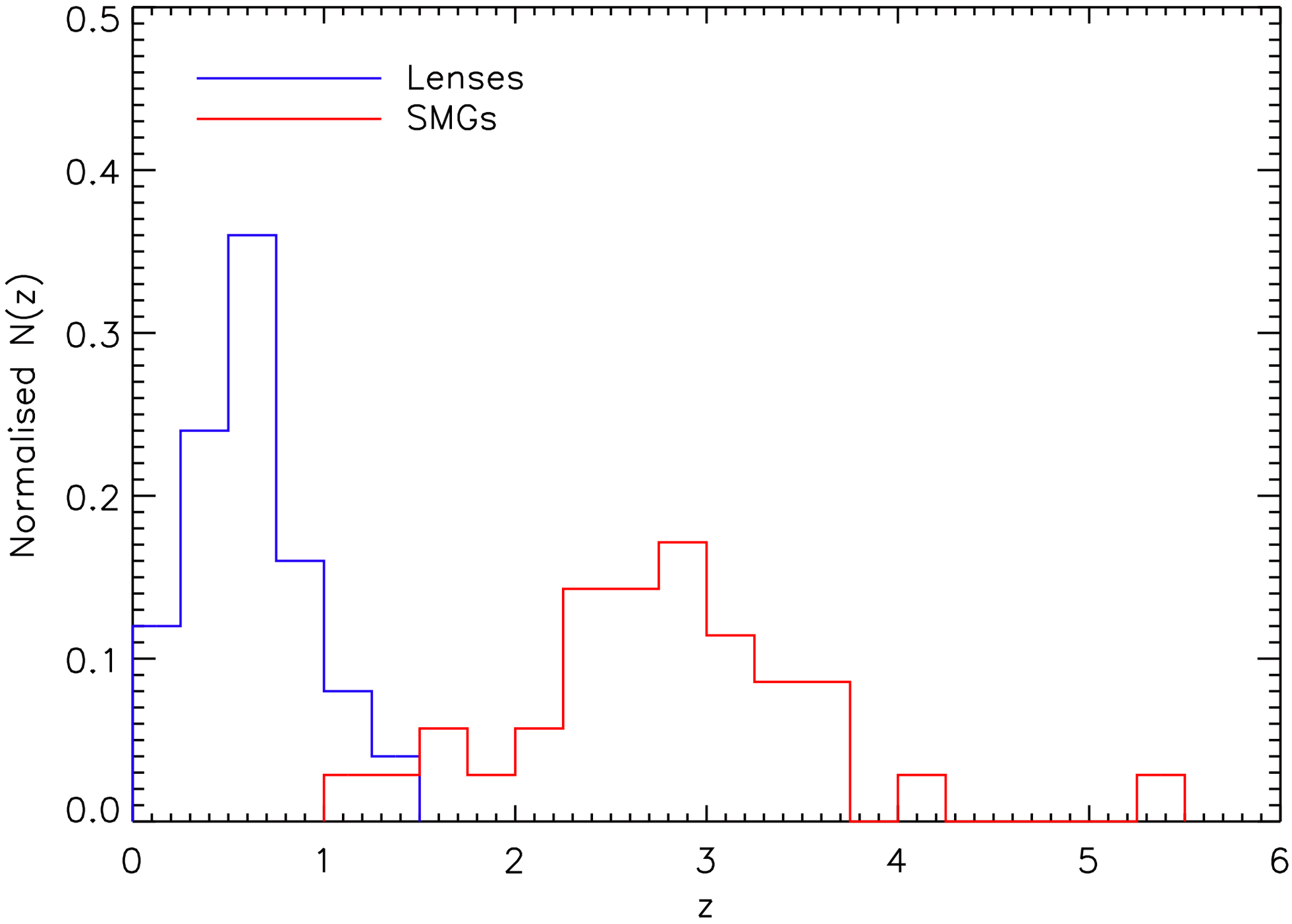
Candidates: ~0.15 deg^{-2}

Wardlow et al. 2013
See also Negrello et al. 2010

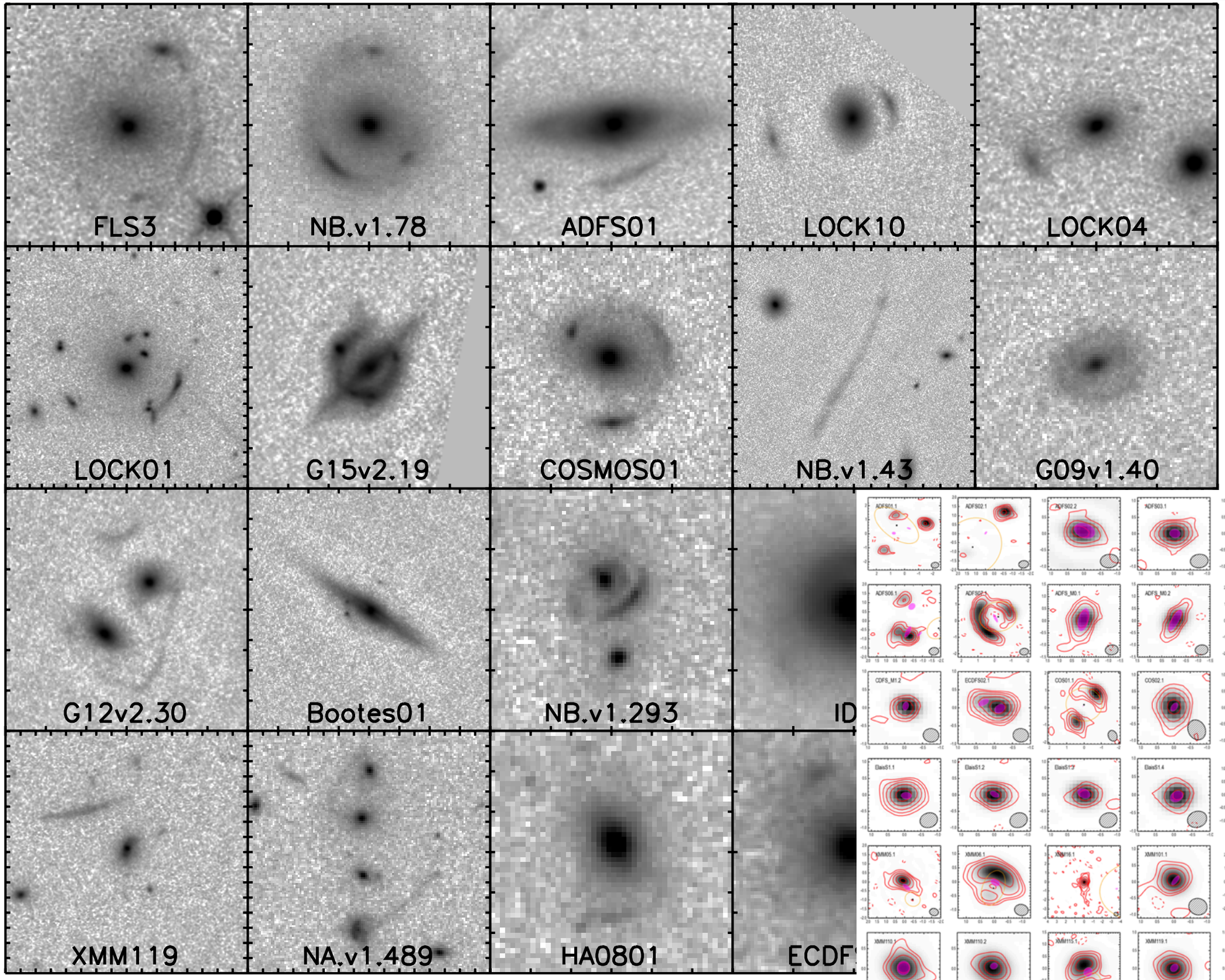
At many λ lensed SMGs easily separated from lenses

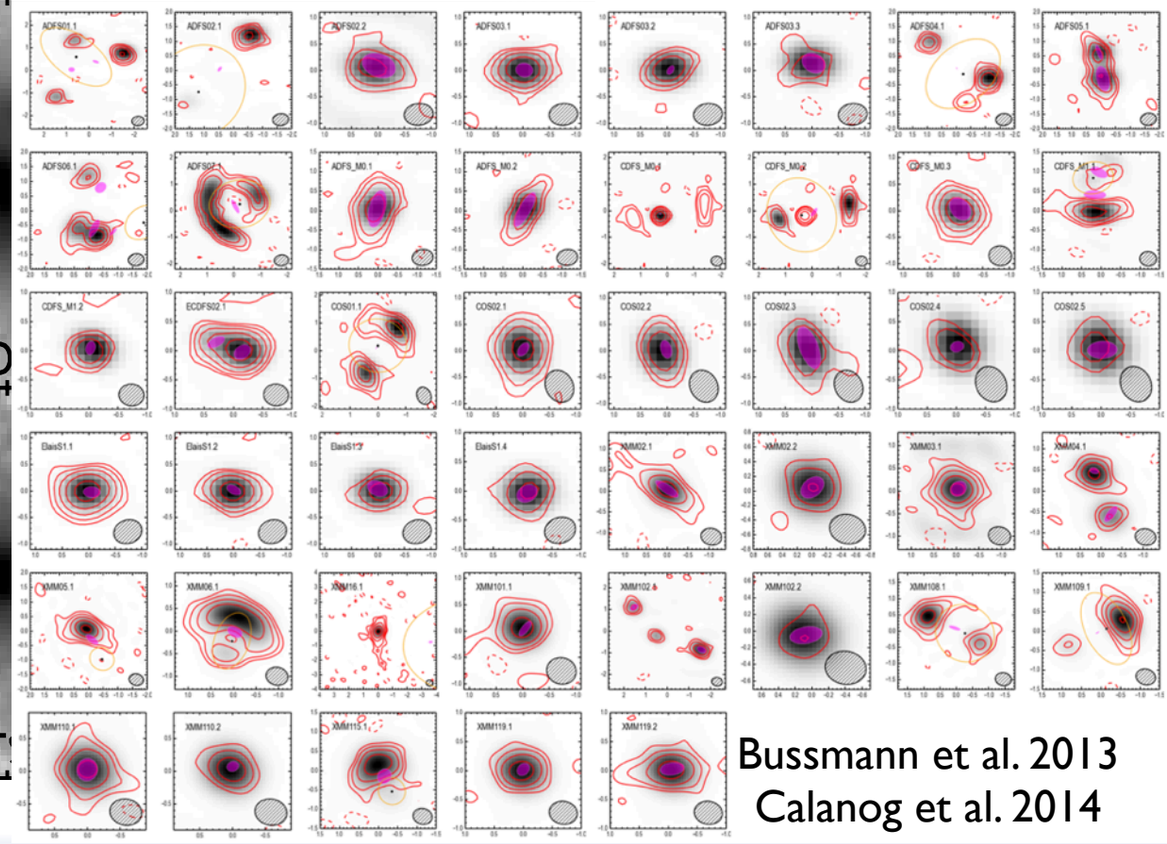


N(z): typically z=2–4 SMGs lensed by z<1.5 galaxies



A sample of Herschel lens systems

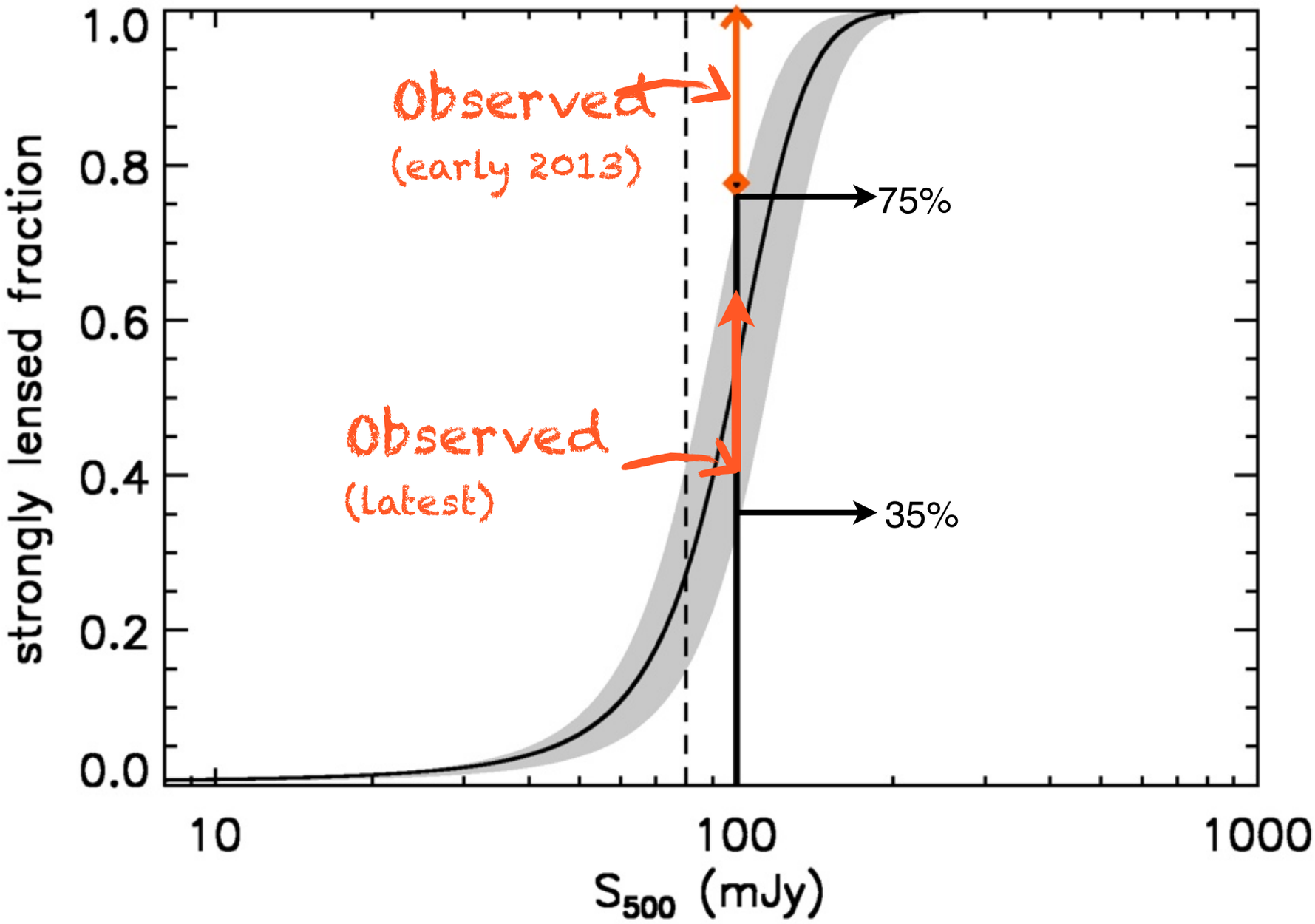




Bussmann et al. 2013
Calanog et al. 2014

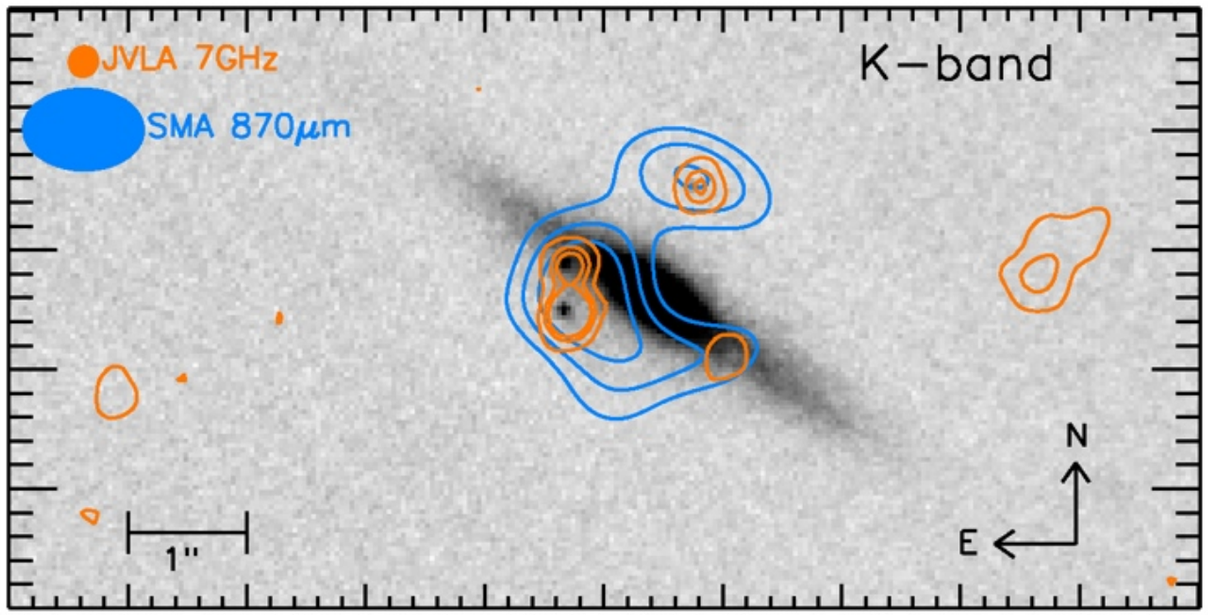
Lens candidates have ~35–75% fidelity

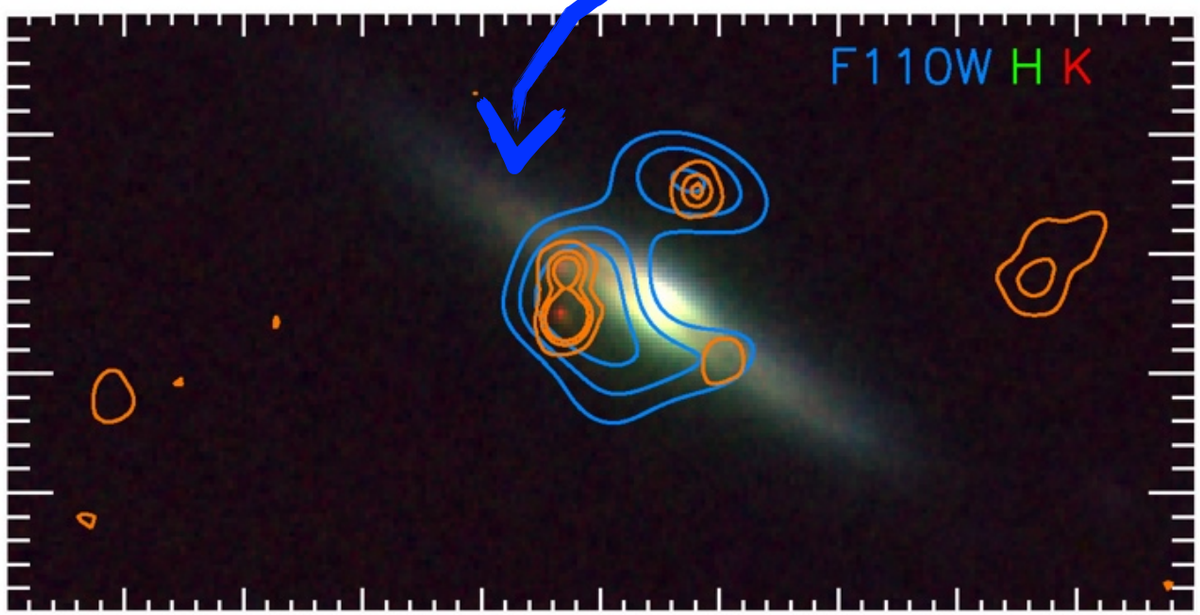
Blazars & spirals removed

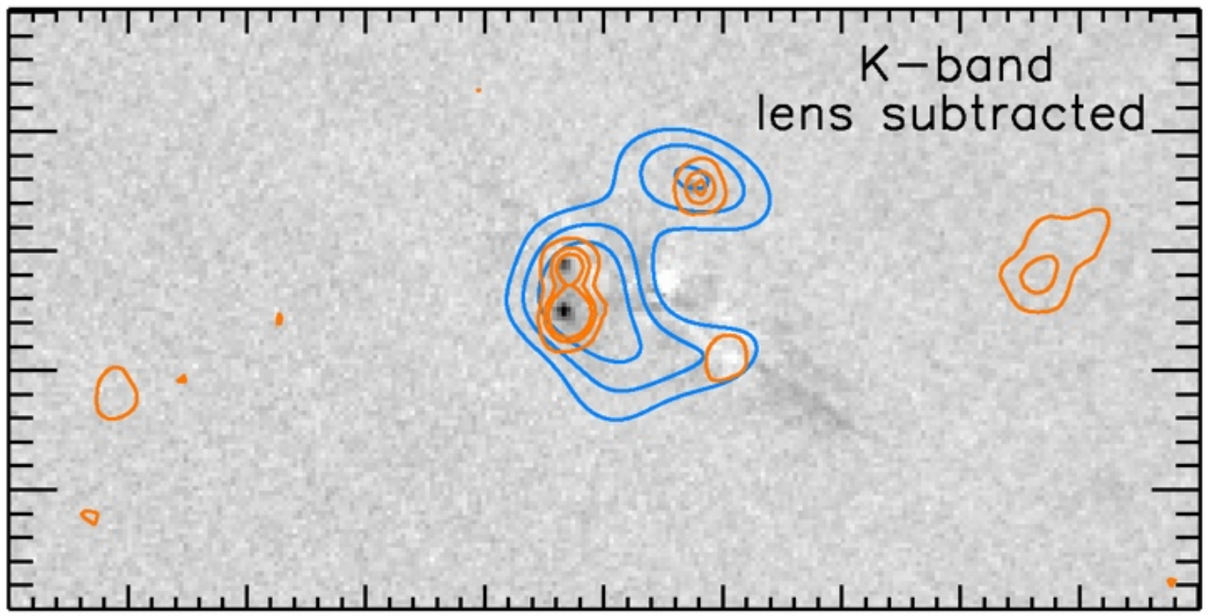


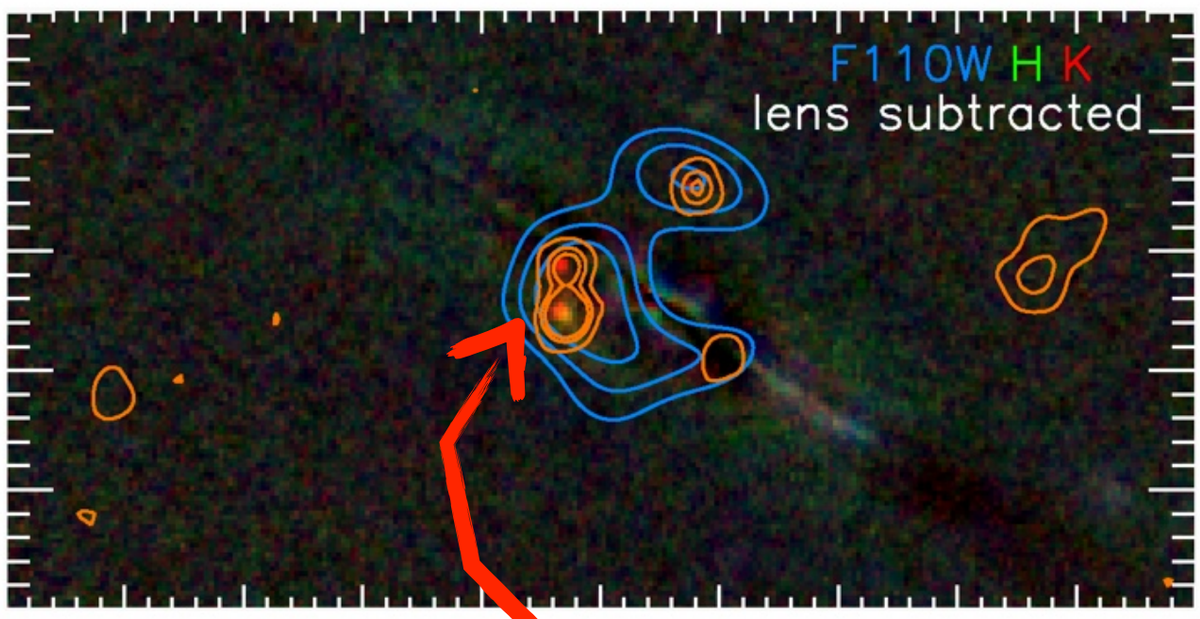
Wardlow et al. 2013

HBoötes02: a radio-loud AGN in a lensed SMG



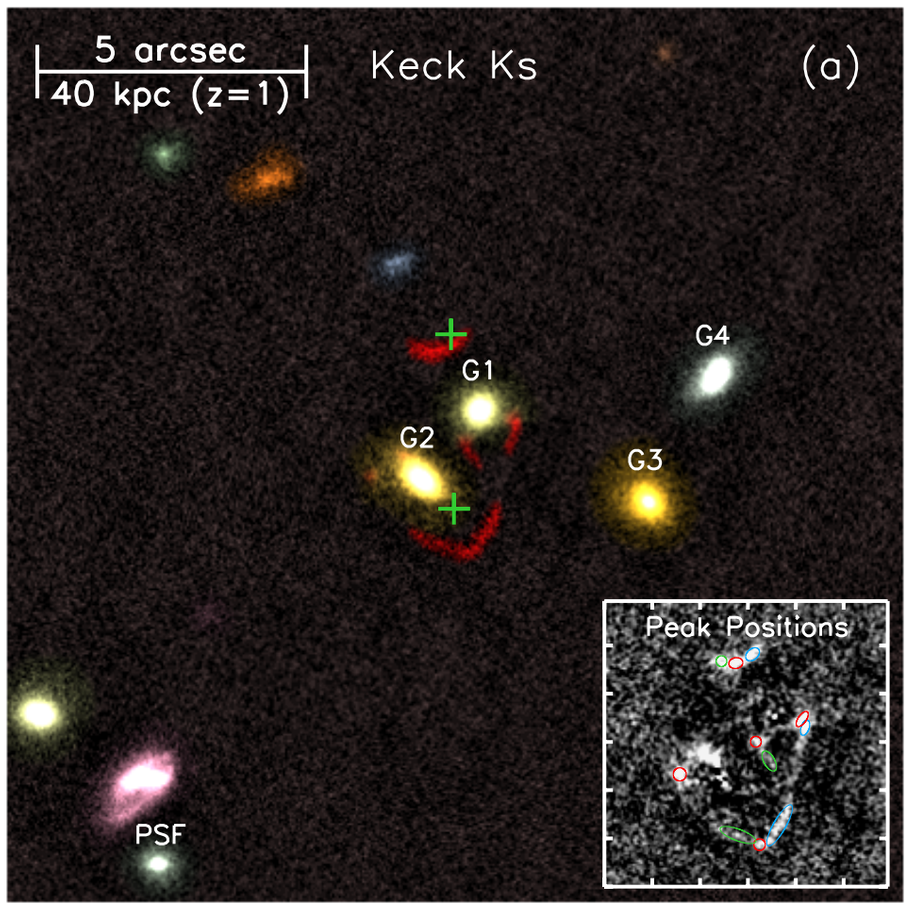


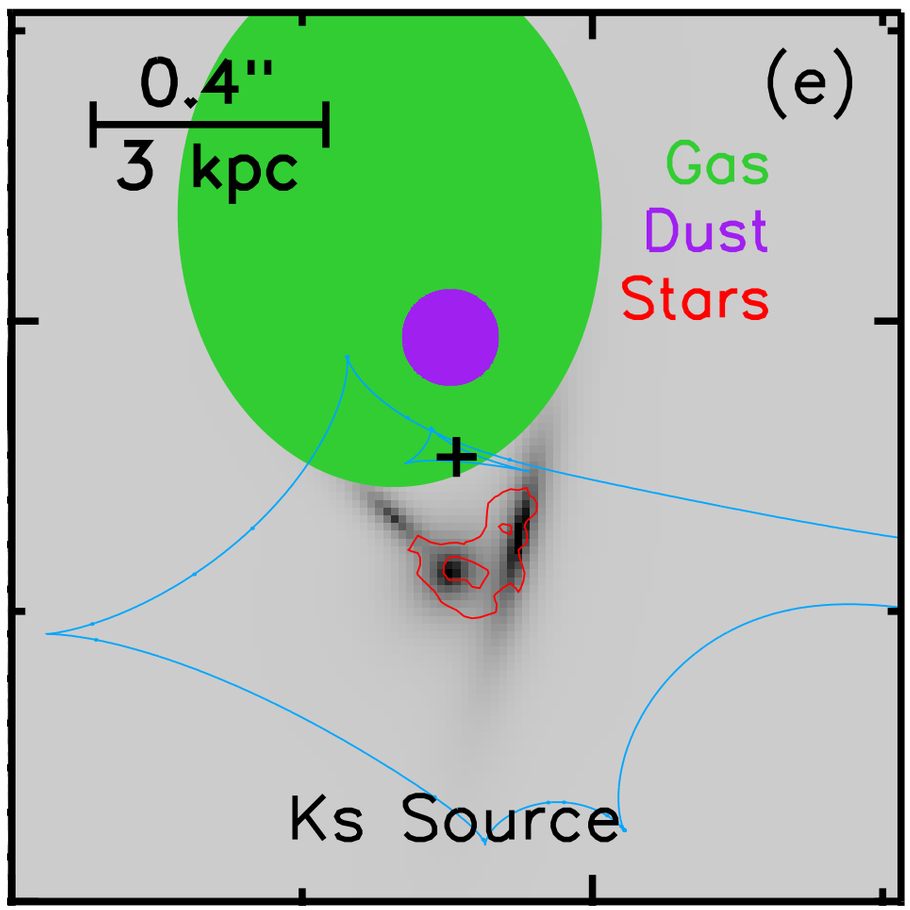




Lensed: HATLAS12–00 @ z=3.3

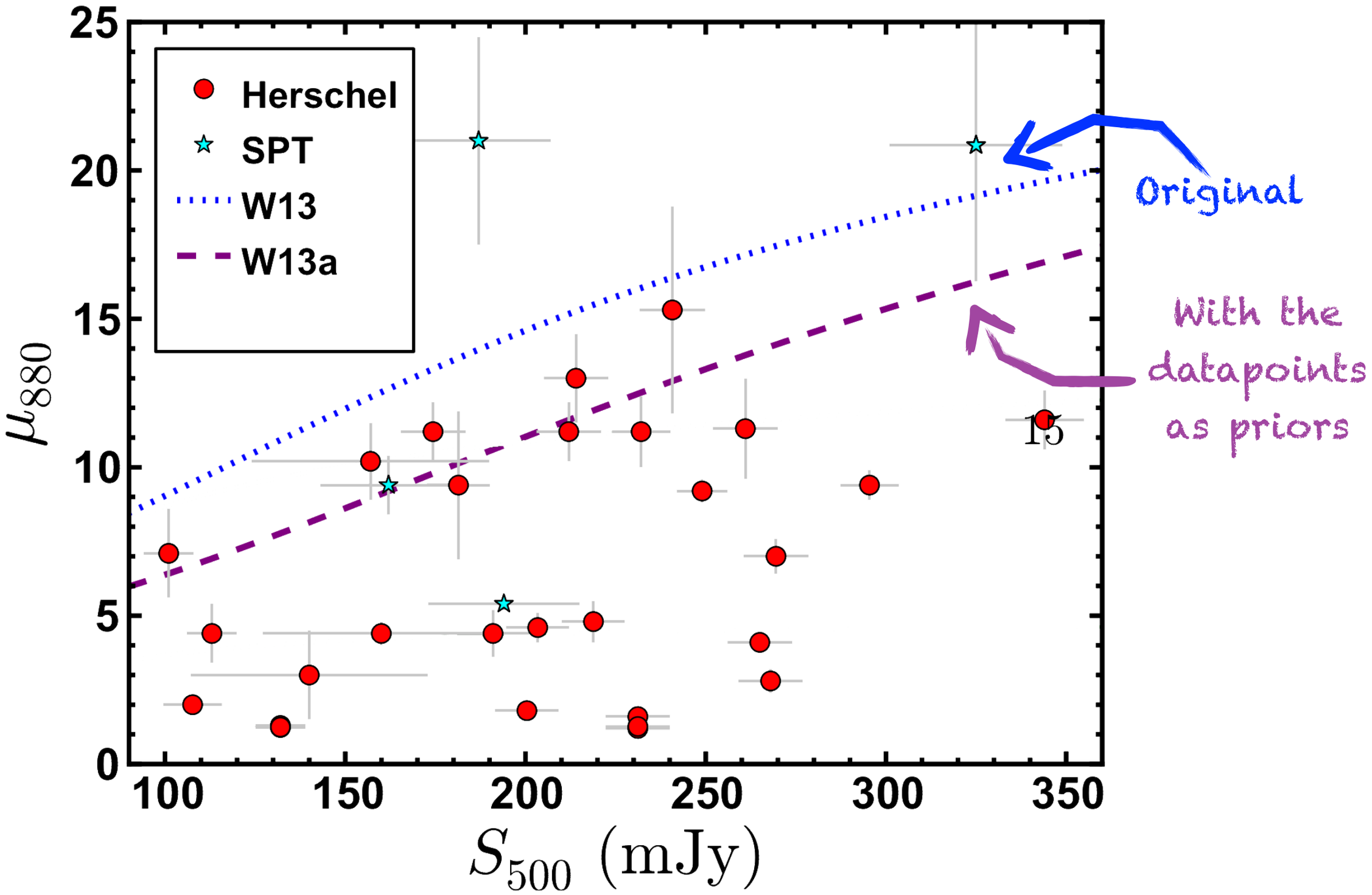
Observed





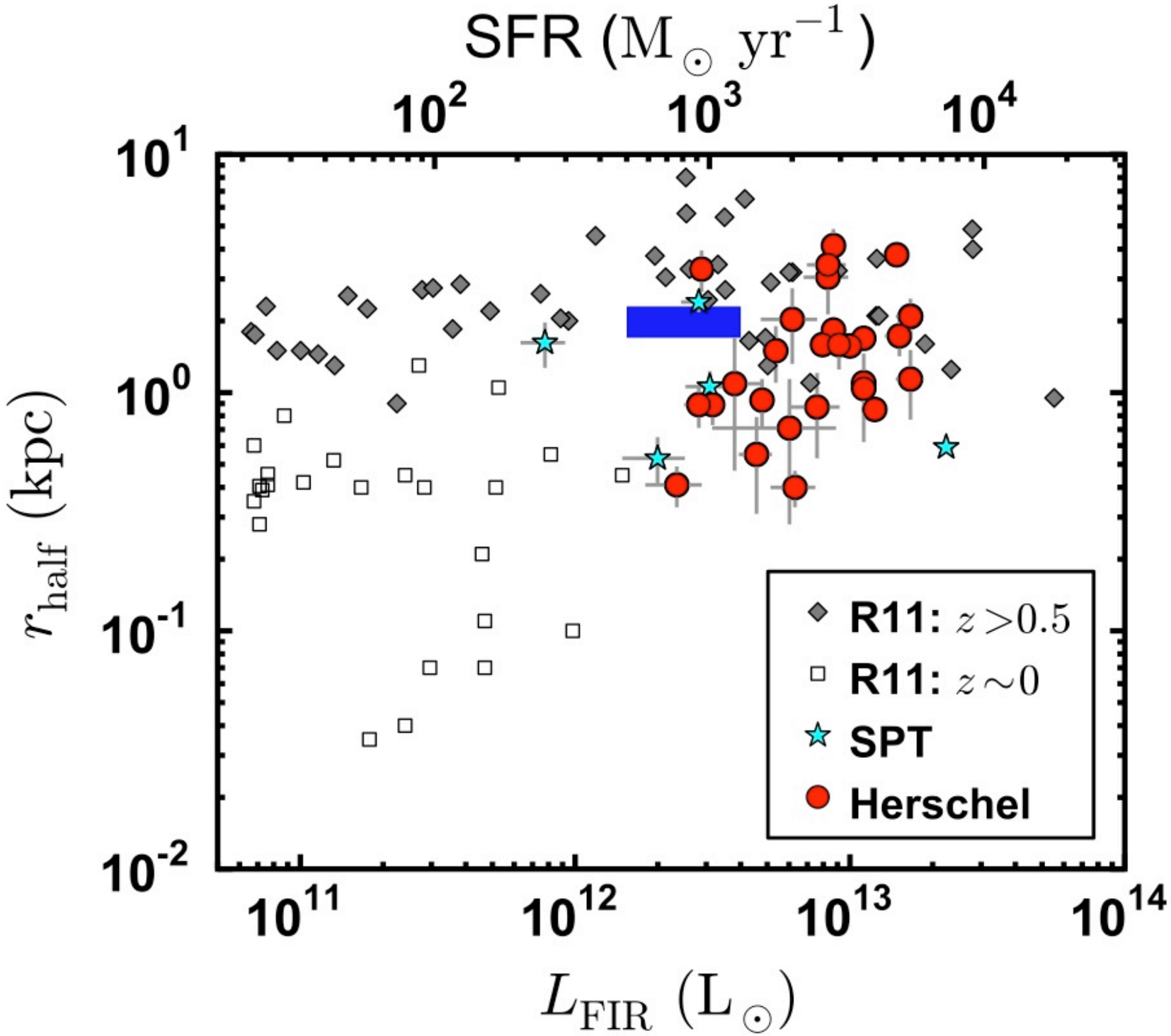
Fu et al. 2012

FIR magnification factors are ~a few

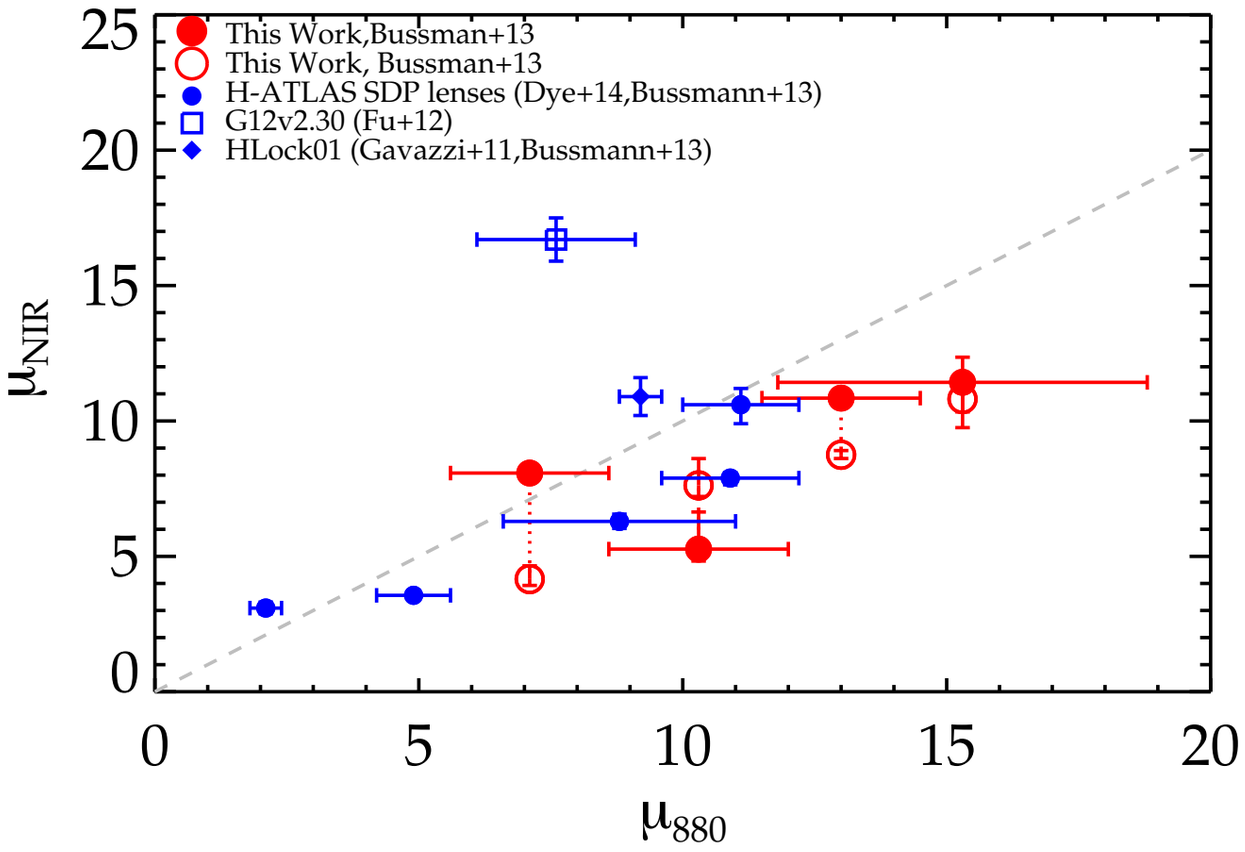


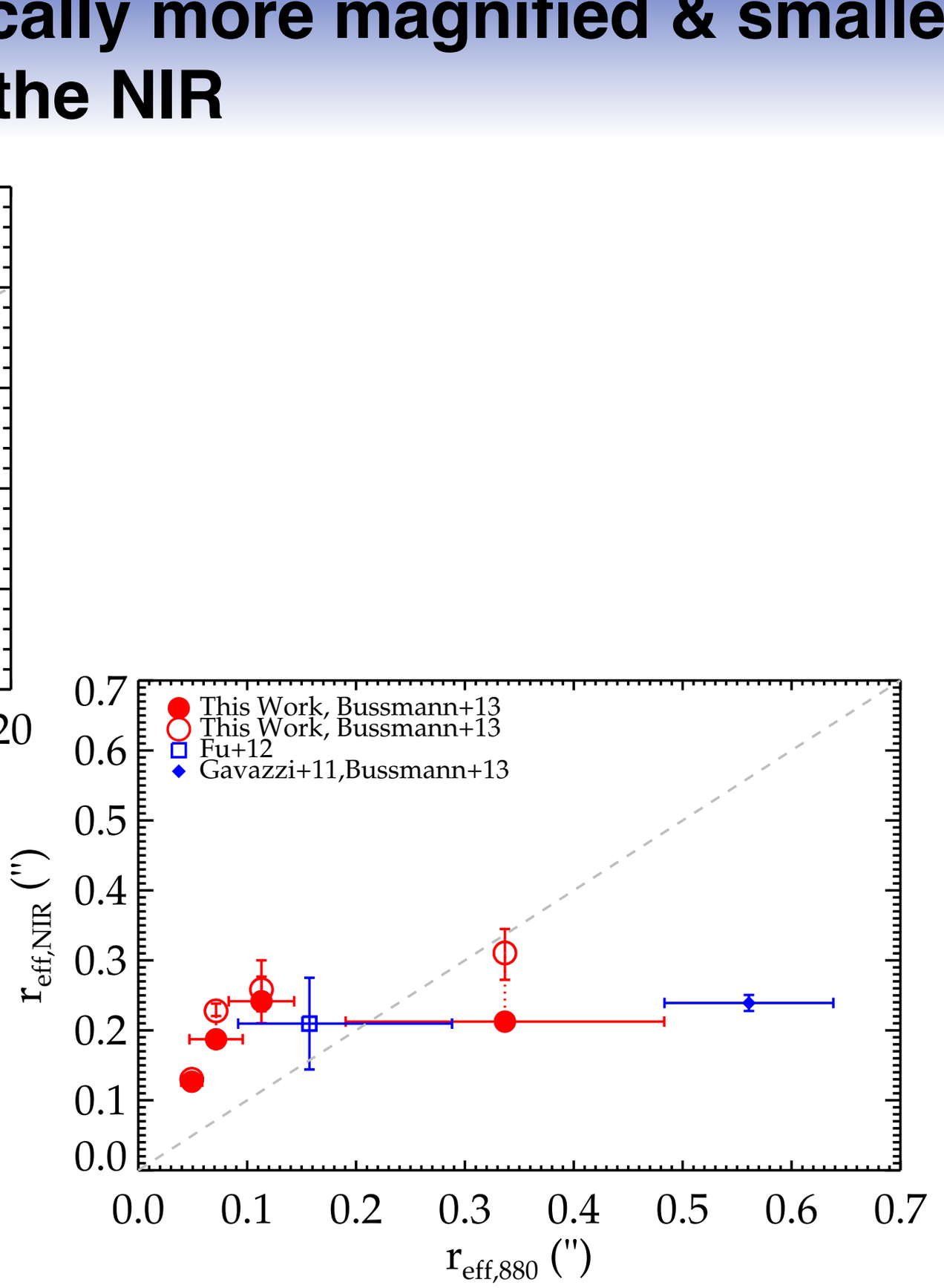
Adapted from Bussmann et al. 2013

Dust regions in lensed SMGs are ~0.5–3 kpc radius



The submm emission is typically more magnified & smaller than the NIR

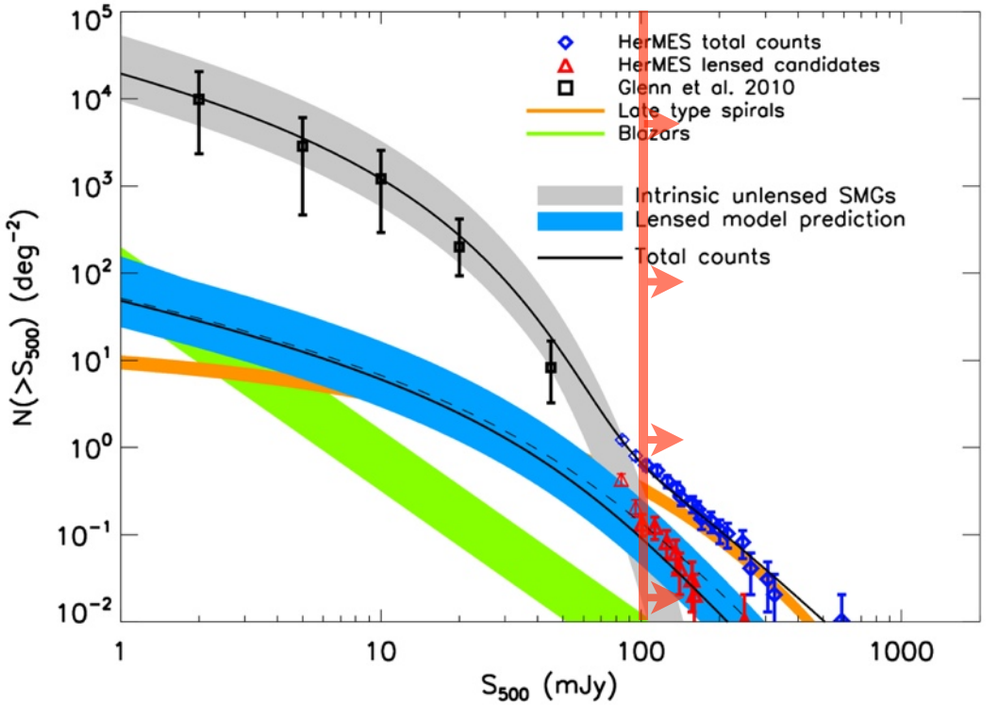




Calanog et al. 2014

Summary

Wide-area, submm surveys can efficiently identify strongly lensed high-redshift galaxies by simply selecting the brightest sources.



Herschel selected galaxy-galaxy lenses are proving useful in probing obscured star-formation.