CCAT - Sept13/06, Cardiff

Population of Far-IR background galaxies & z-machine style emission line surveys

Scott C. Chapman

(IoA Cambridge)

Galaxy Evolution: Where are we, where do we go?

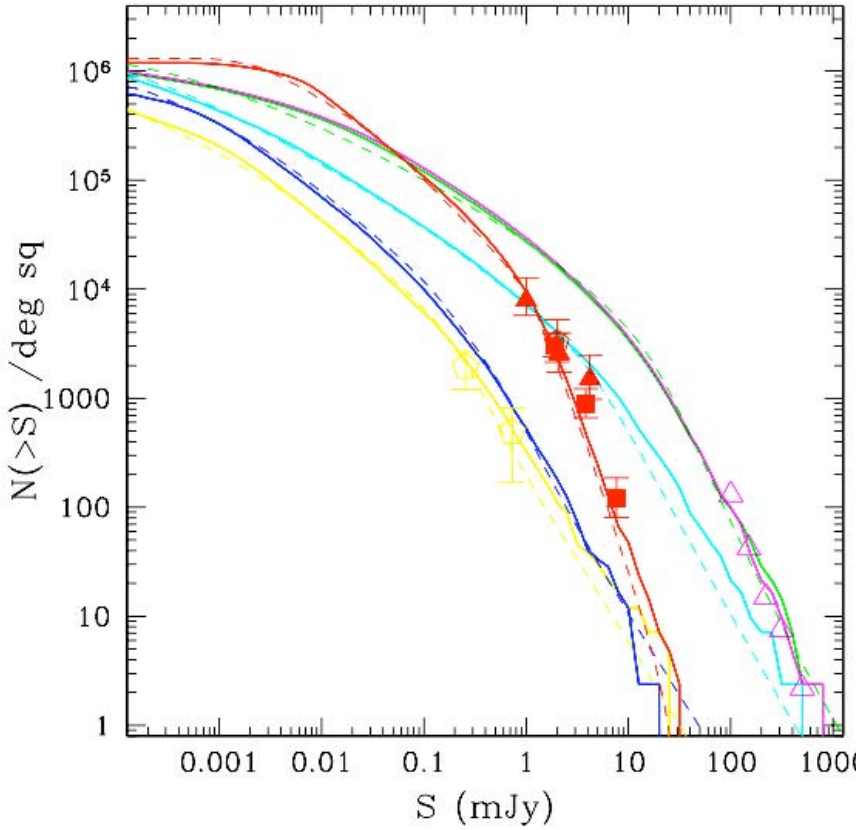
1) Currently only scratching the surface of luminous/massive galaxies (Spitzer and Herschel are/will help considerably)

-still unsure if we have census of all z~2 luminous galaxies

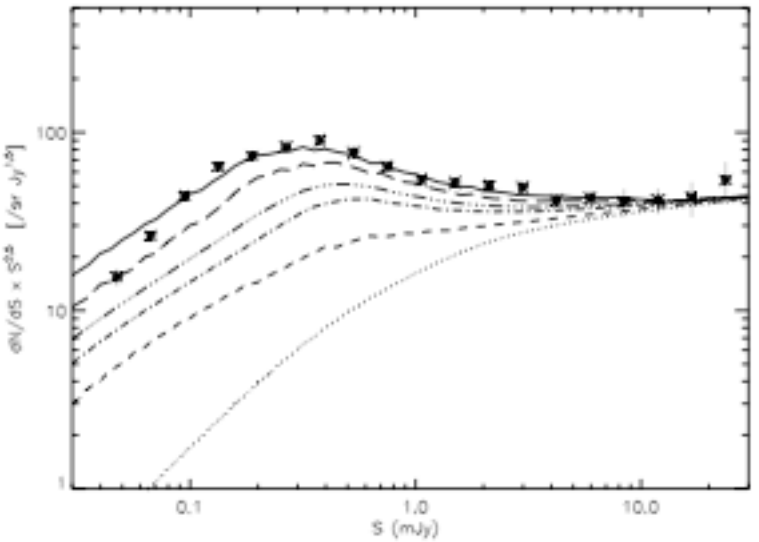
2) To really understand galaxy formation and evolution (<M* galaxies), we need larger facilities.

-finding the hyper-luminous peaks in different bands not enough.

Counts and Models



24um



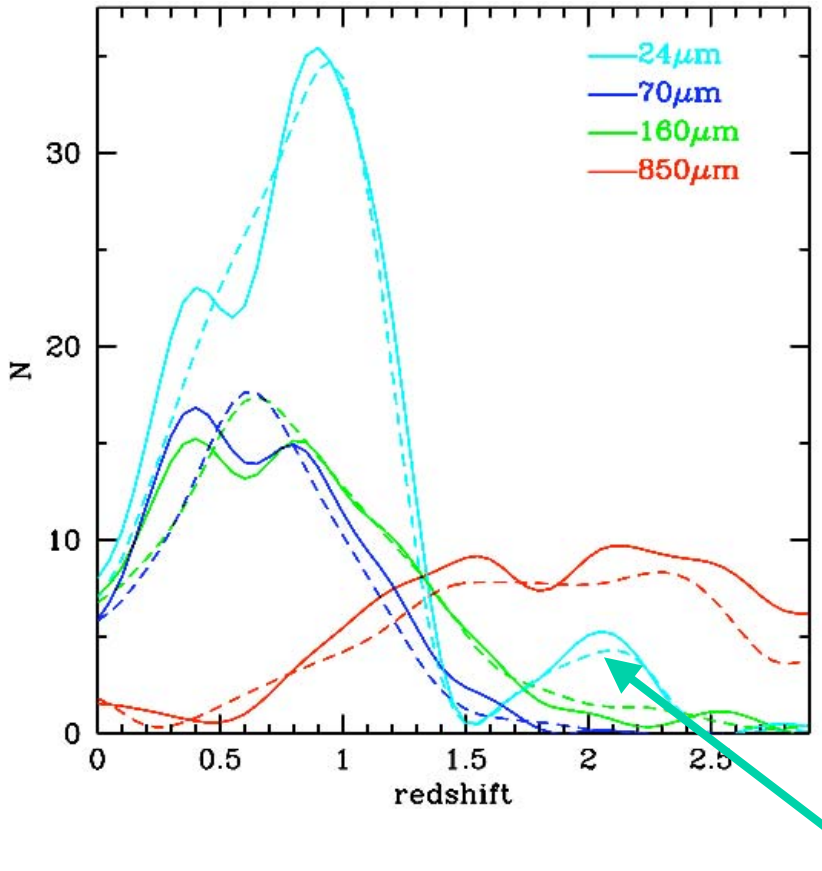
Old models (Dole+, Chary/Elbaz, Chapman/Lewis, etc.) easily fit data

Spitzer forced refinements to models (eg., Lagache+04)

-strength of aromatics/PAHs, range of SEDs for a given luminosity

-epoch dependent density and luminosity evolution

N(z) Spitzer and submm galaxies



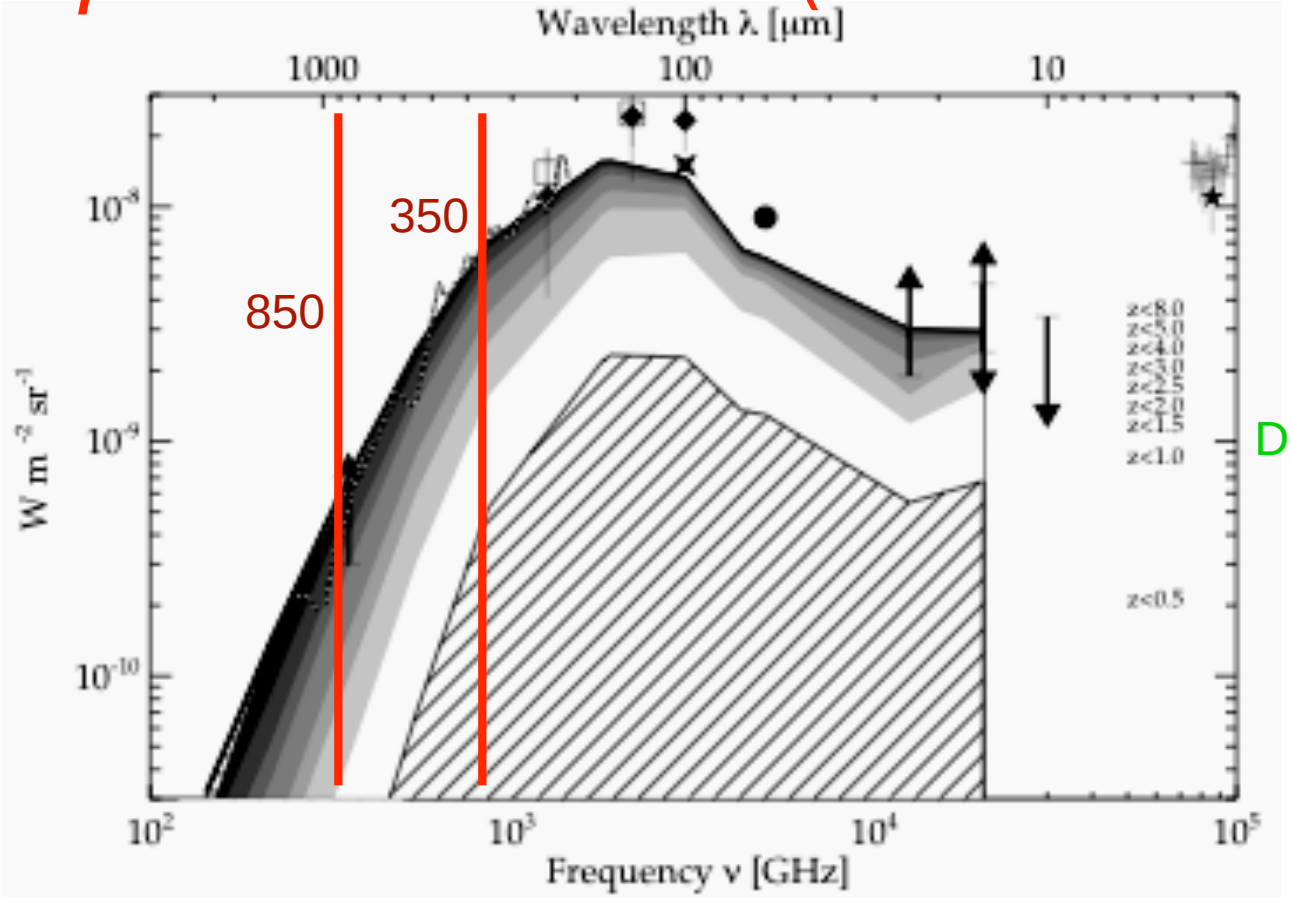
15um/24um hump at z~1 from 6-9um/11-14um aromatics

also z~2 hump in 24um from 6-9um aromatics?

(Chapman,Lewis,Helou 2003, 2005 model predictions)

K-corrections mean that 15/24/850 probe CIB in well-defined, and distinct z ranges: z=0.7 (15um), z=1.1 (24um), z=2.3 (850um)

Components of FIRB (SCUBA2 and CCAT)



Dole et al. 2005

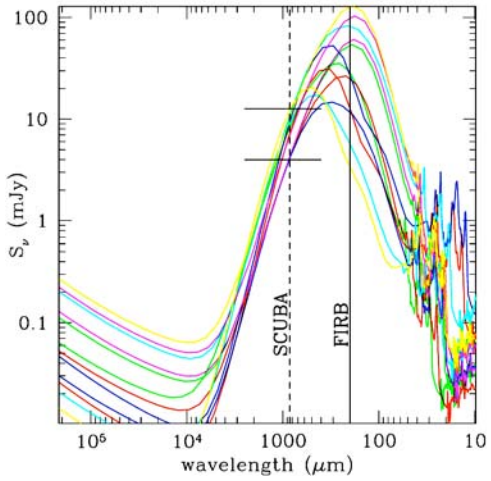
Submm is almost all high-z galaxies (80% z<4)

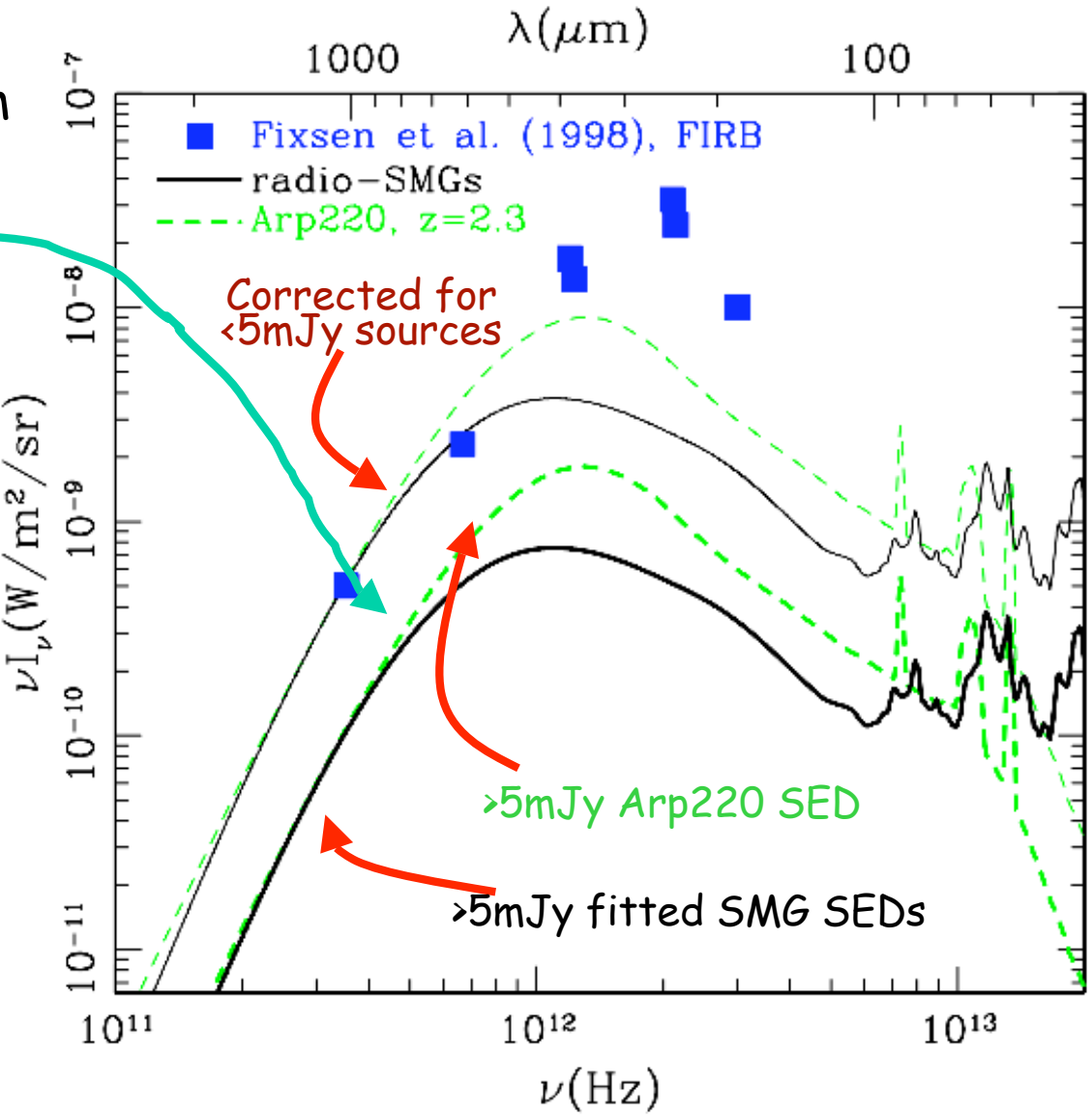
MidIR and FarIR is 80% z<1.7

SMM best (only?) way to probe the high-z components of FIRB

SCUBA contribution to mm/FIRB

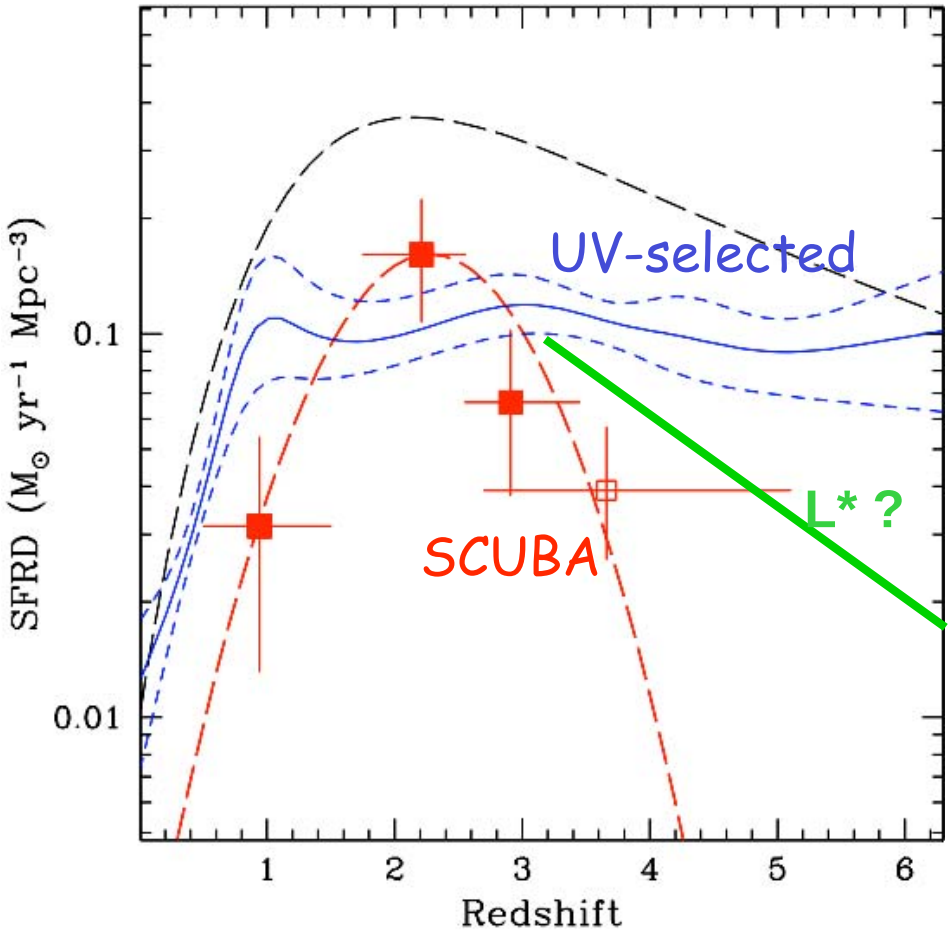
- >0.5mJy SCUBA population produces 80-100% of 850um background
  - CCAT territory!
- Median redshift of bright SMGs is z~2.3
- Fit dust SEDs to radio/850um at known z
- 850um population produces bulk of the >400um FIRB





The Star Formation History of the Universe

- X-ray & extended-radio => SCUBA galaxies *not* dominated by AGN
- interpret far-IR luminosities in terms of star formation (30% AGN)



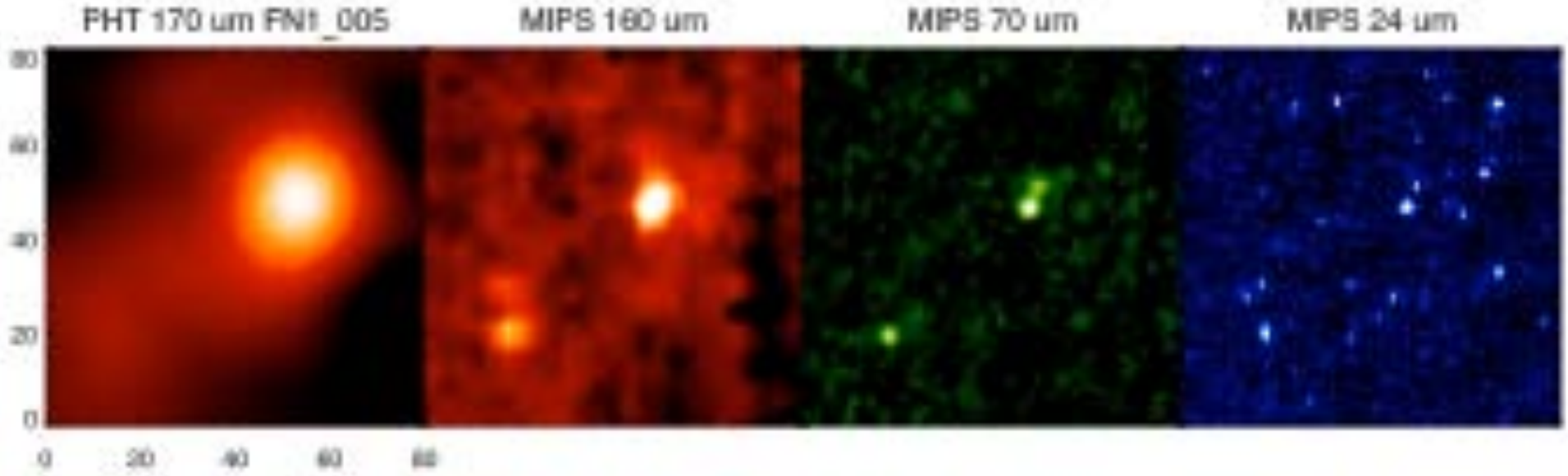
(Chapman et al. 2004)

- SMGs are the main site of massive star formation at z>2
- UV galaxies evolve differently from SCUBA galaxies
- Balance between obscured and unobscured SF has shifted drastically in last 80% T_{Hub}

Spitzer -- SPICA/BLISS,

ALMA, LMT, CCAT25

Confusion



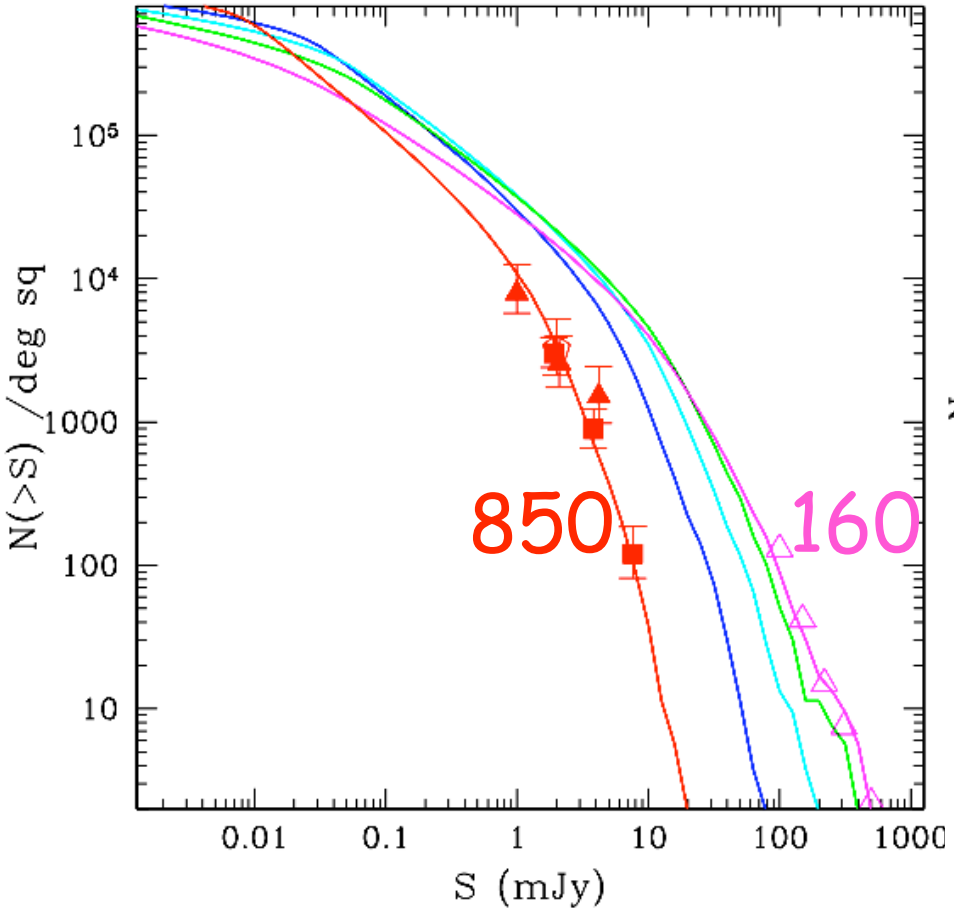
Currently impossible to probe high-z galaxies in FarIR!

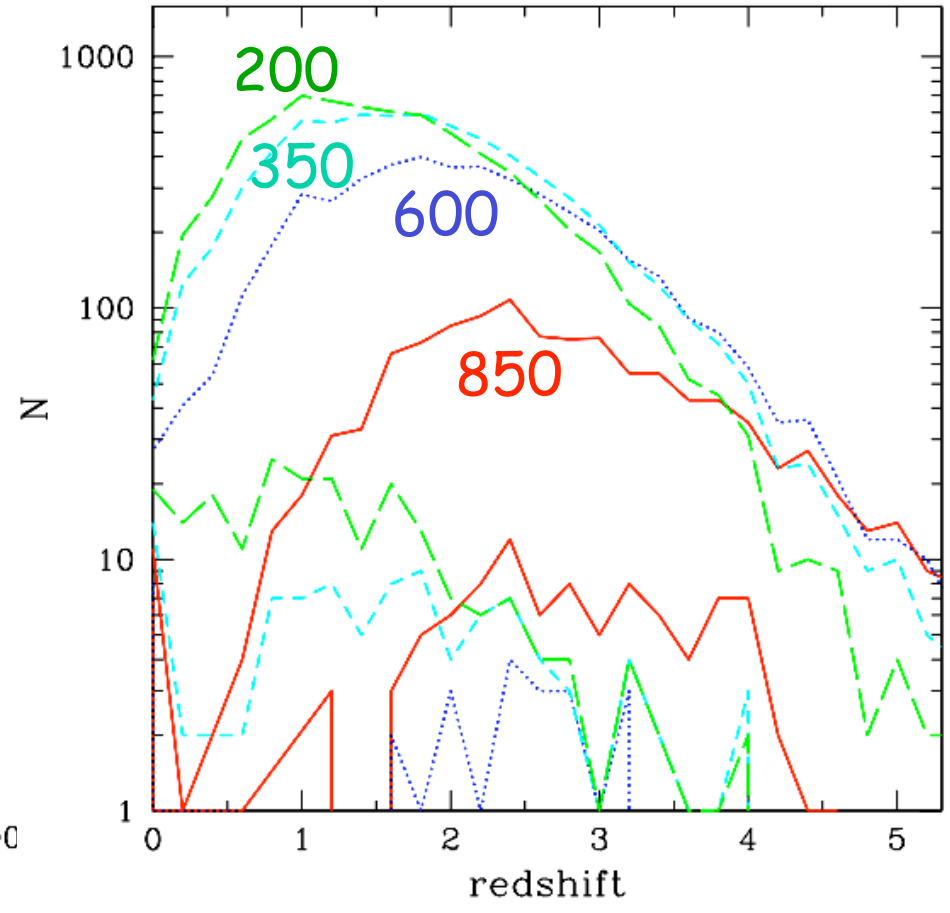
Nowhere near probing IR morphologies

Submm/FIR Continuum:

CCAT deep surveys…

Bivariate LF (Chapman+03) to model Td distribution.



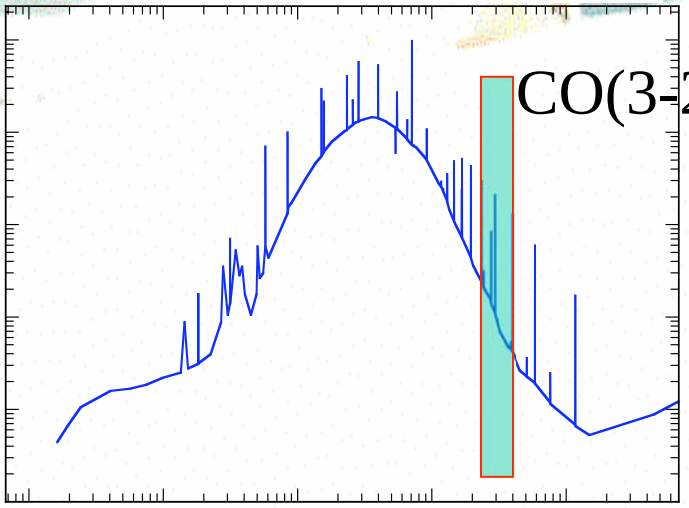


Molecular/Fine Structure emission lines

- Molecular gas *defines* sites of star formation
  - IRAM-PdBI Needs precise redshifts (500Mhz band)
  - 30 SMGs observed, 18 detected in CO

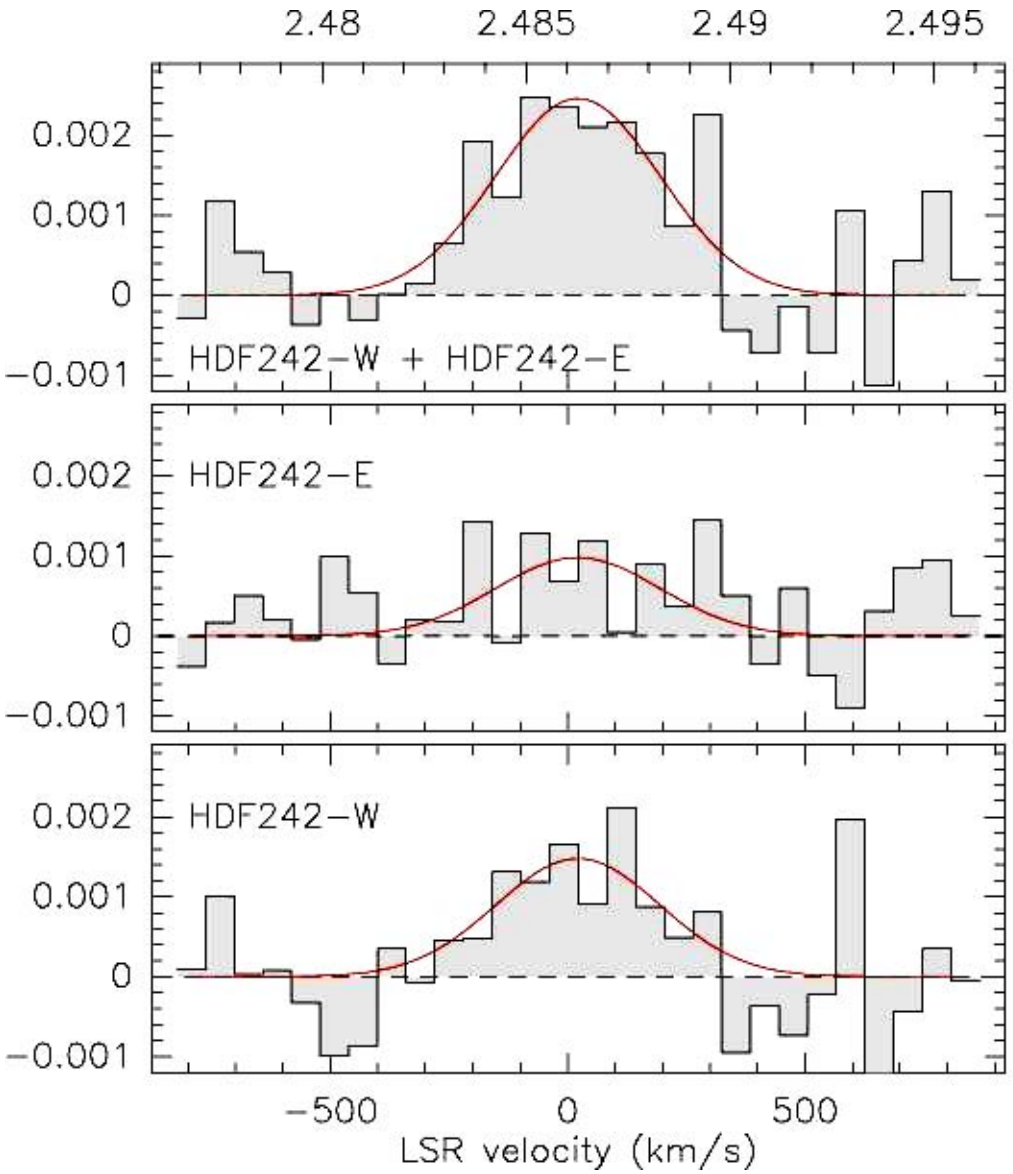
(Neri et al. 2003, Greve et al. 2005, Tacconi et al. 2005)

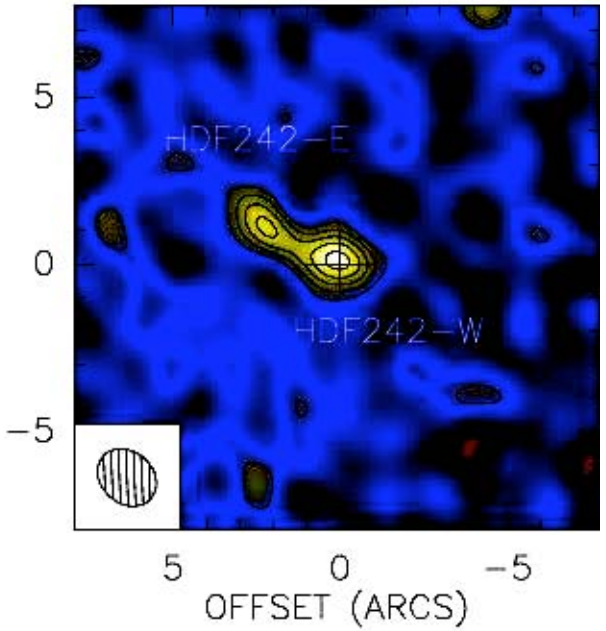
6x15m IRAM PdB Interferometer



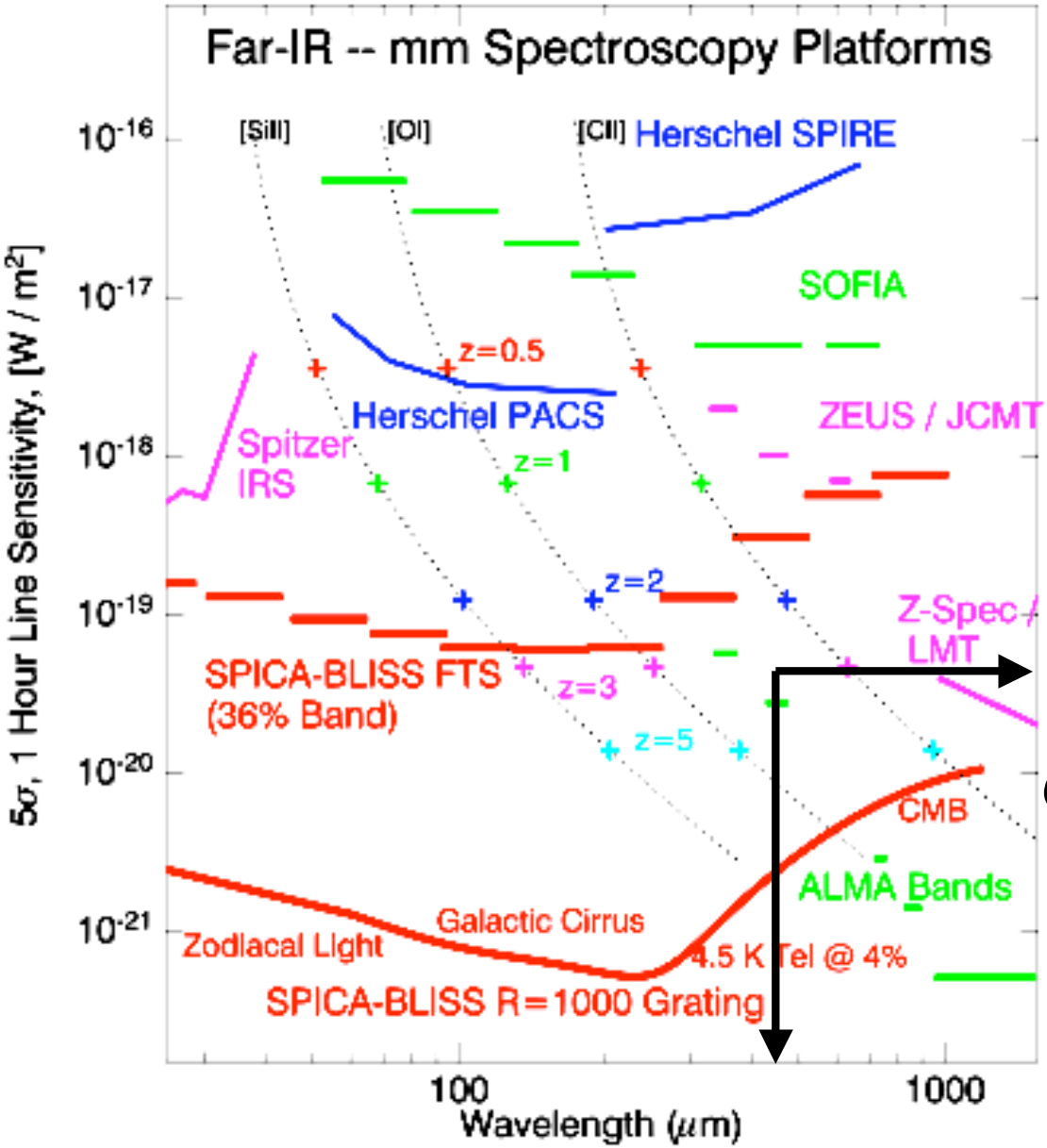
Longest baselines: Hi-Res CO studies

(Tacconi et al. 2005)





Fine Structure Lines: COLD, 3.5m aperture



ULIRG Cii

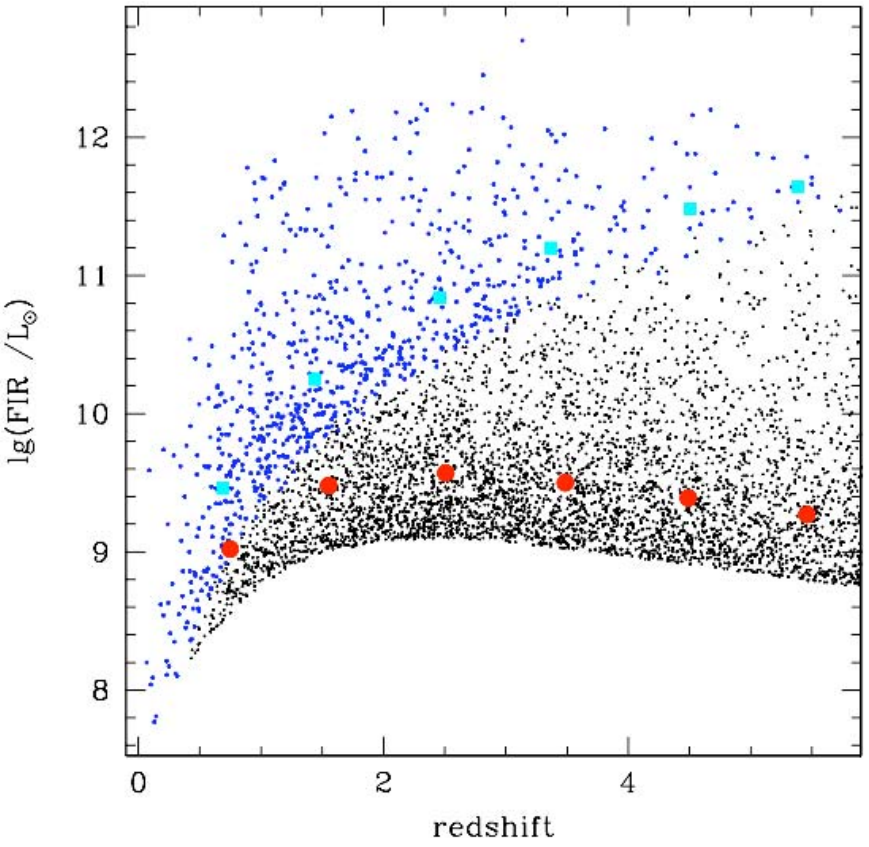
CCAT/z-spec

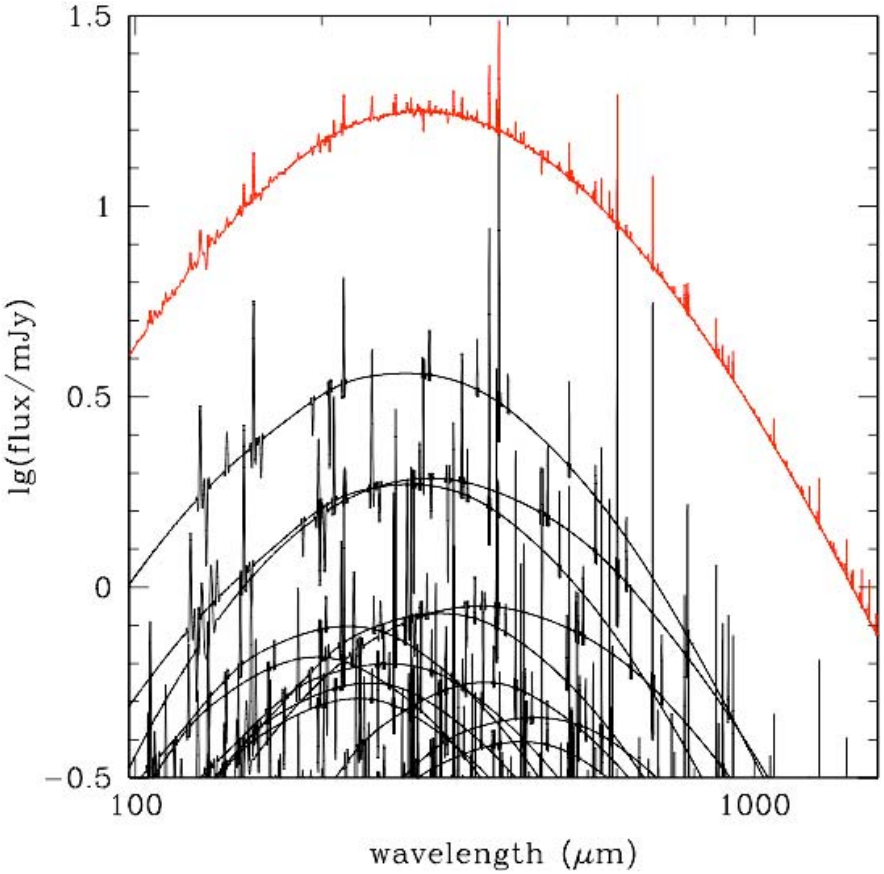
Simulation of all galaxies in 1′ beam:

-Bivariate LF : emission line templates matched to Arp220 or M82 based on dust temperature.

-14 brightest galaxies contribute the bulk of the detectable lines.

-CCAT targeted low-res spectroscopy could survey large numbers of obscured galaxies for *redshifts, line strengths and ratios.*





The End