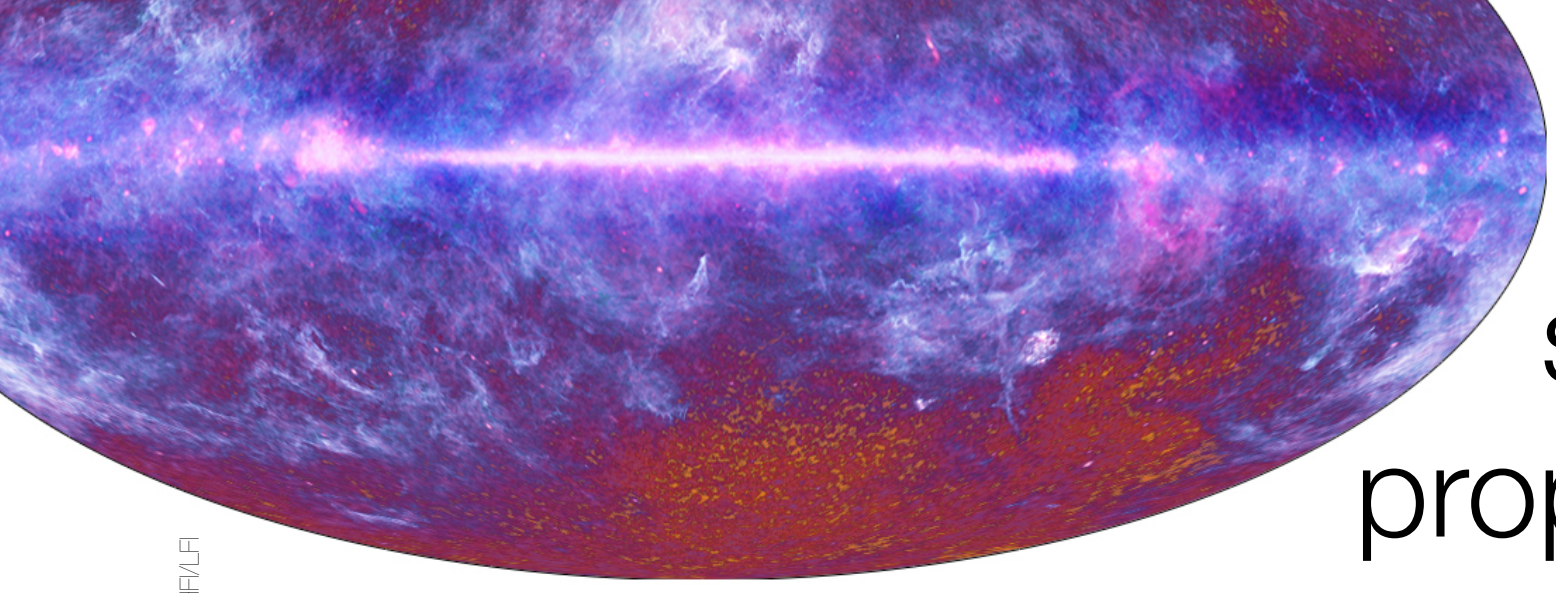


Planck/ESA/HFI/LFI

statistical properties of Planck infrared and radio ERCSC sources above 100 GHz

introduction 1.
an extragalactic sample from the ERCSC on 40% of the sky 2.
new Planck HFI number counts 3.
multifrequency euclidean level of counts 4.
conclusion 5.

Planck Collaboration

presented by Hervé Dole

Institut d'Astrophysique Spatiale, Orsay
Université Paris-Sud 11 et CNRS
Institut Universitaire de France

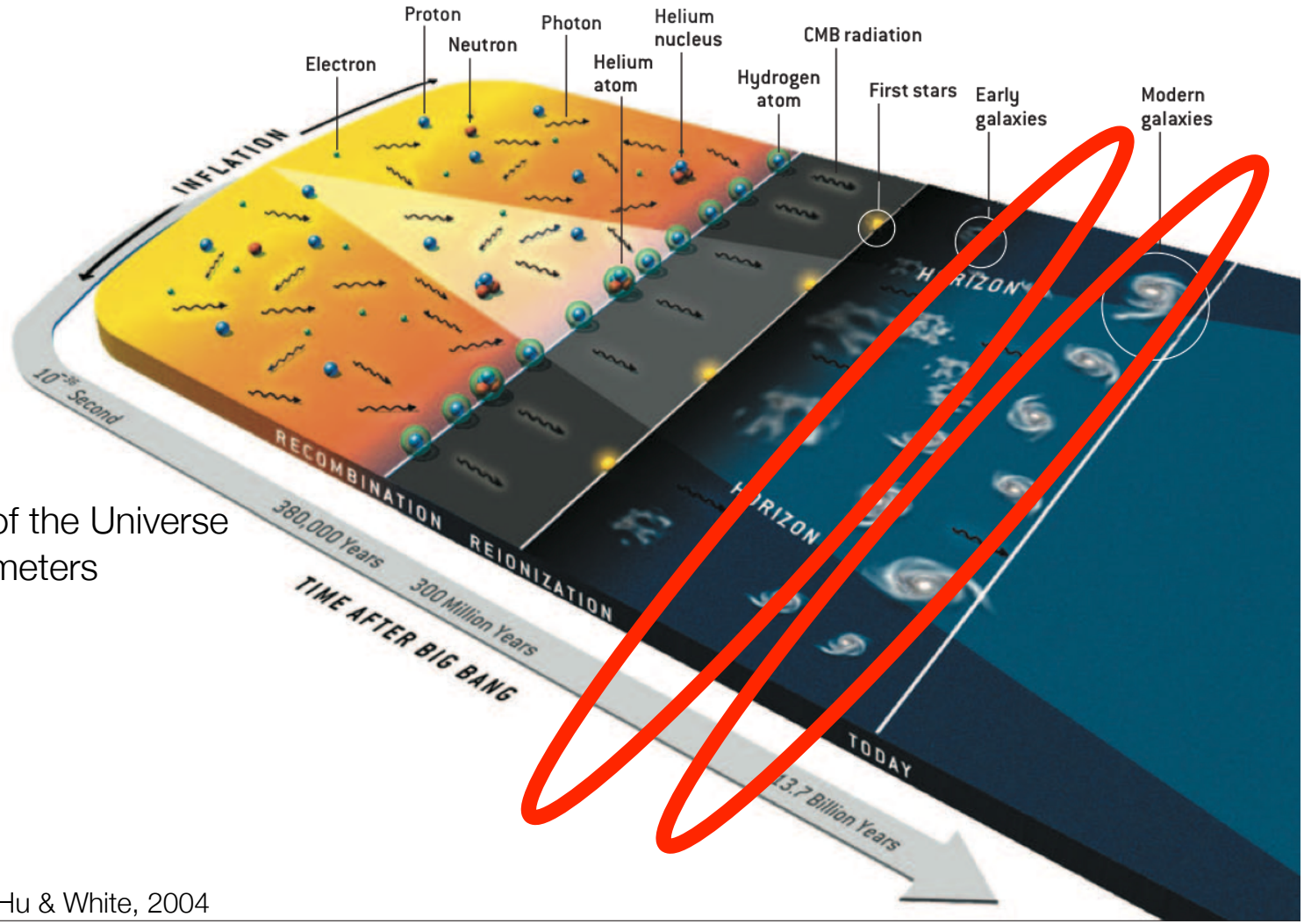
The scientific results that we present today are the product of the Planck Collaboration, including individuals from more than 50 scientific institutes in Europe, the USA and Canada

Planck is a project of the European Space Agency, with instruments provided by two scientific Consortia funded by ESA member states (in particular the lead countries: France and Italy) with contributions from NASA (USA) and telescope reflectors provided in a collaboration between ESA and a scientific Consortium led and funded by Denmark.

1. context, introduction

nexus between cosmology & astrophysics:
structure formation, galaxy formation & evolution

processes at play:
- fundamental forces
- dark components of the Universe
- cosmological parameters



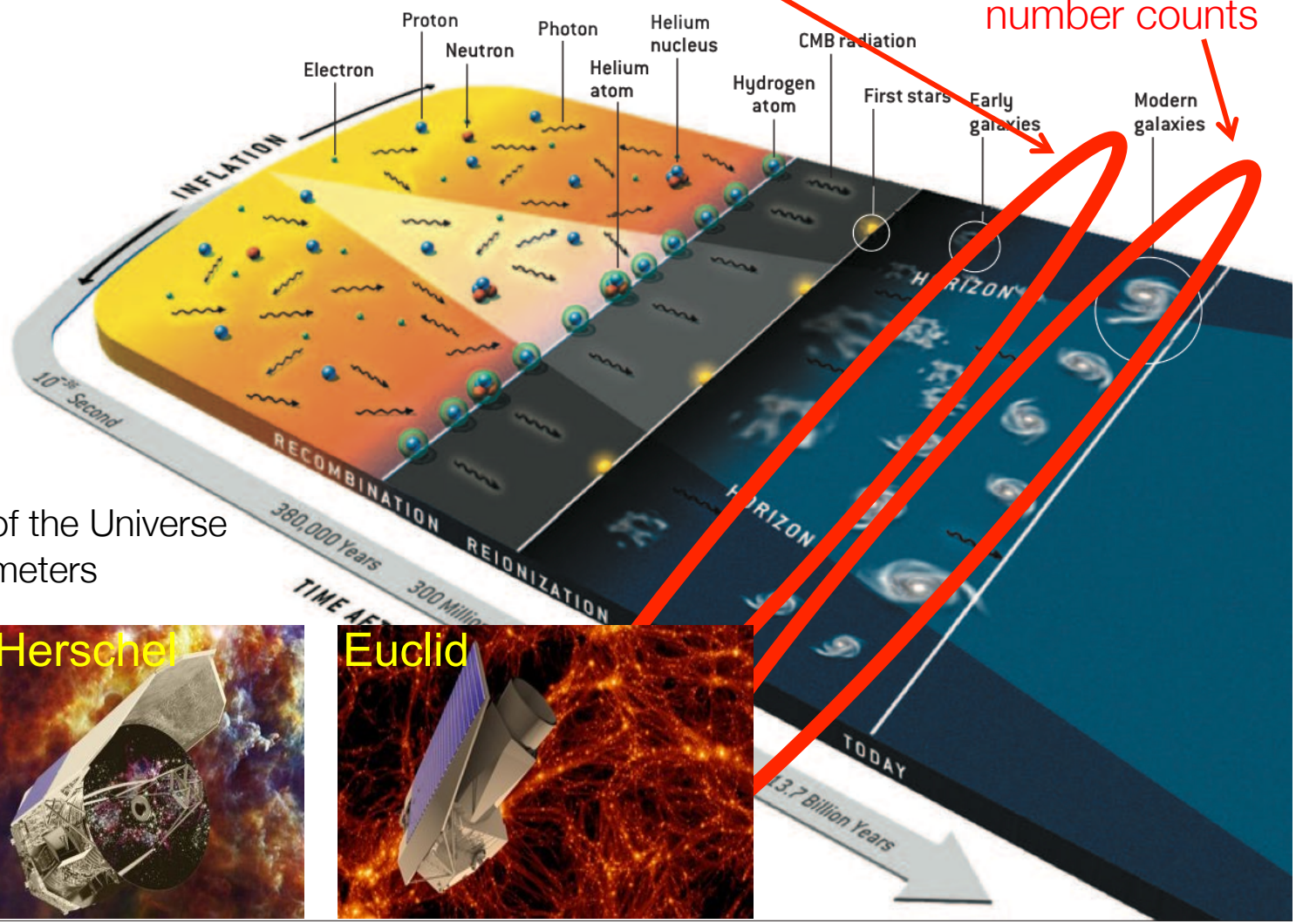
Hu & White, 2004

1. context, introduction

nexus between cosmology & astrophysics:
structure formation, galaxy formation & evolution

Planck search for high-z structures (protoclusters, lenses)

Planck number counts



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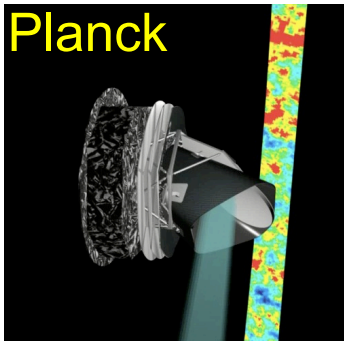
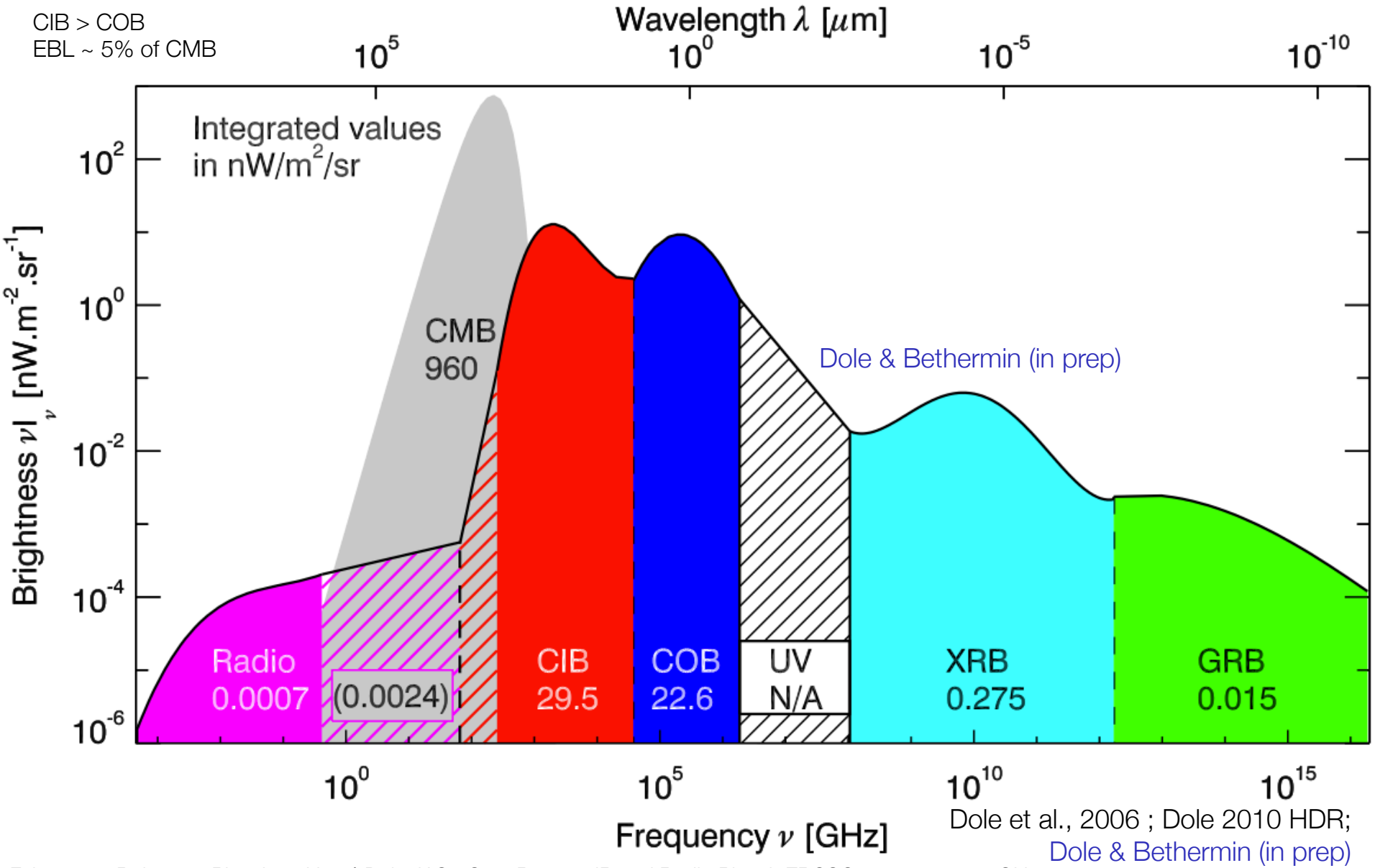


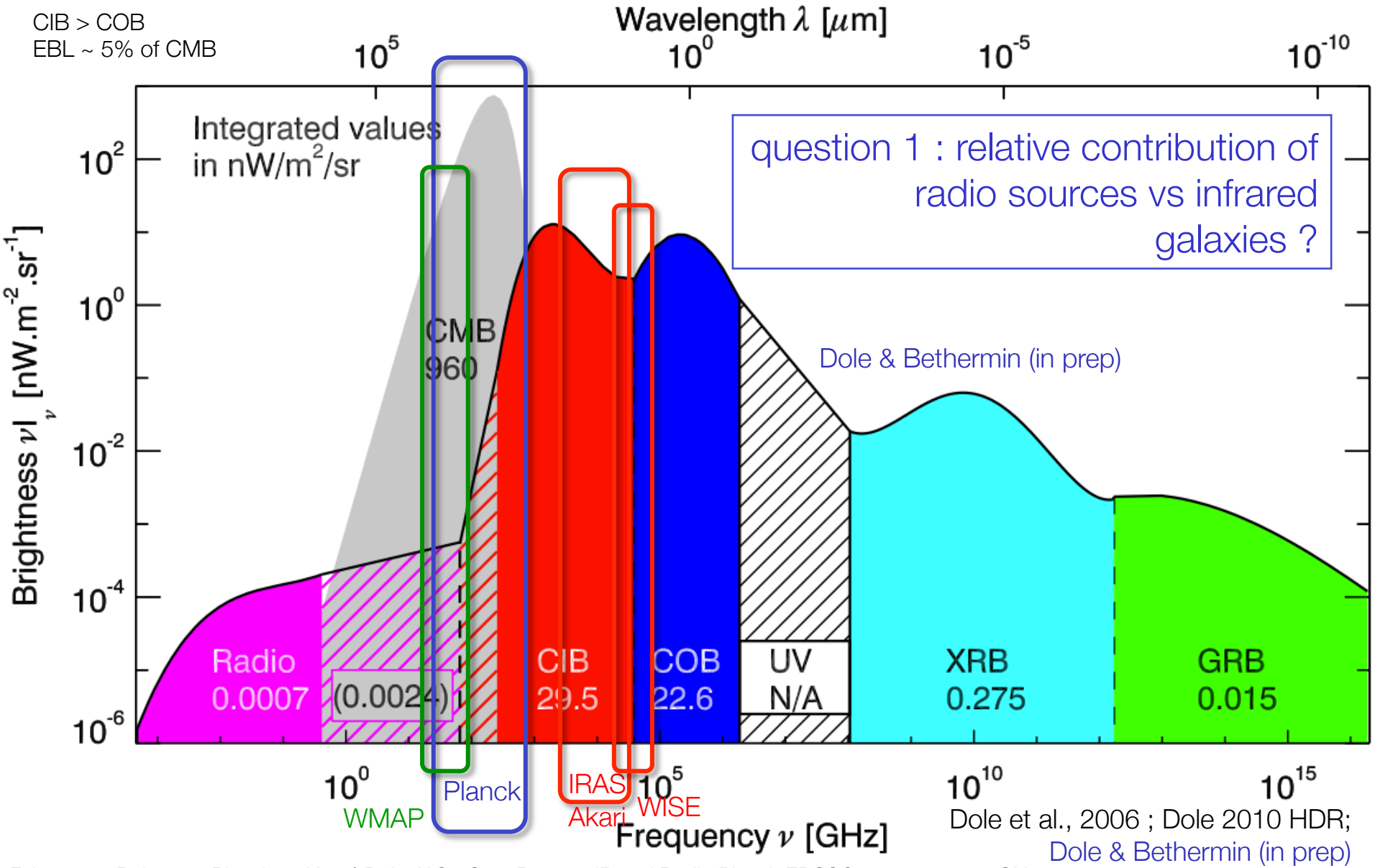
Universe's SED and uniqueness of Planck

CIB > COB
EBL ~ 5% of CMB



Dole et al., 2006 ; Dole 2010 HDR;
Dole & Bethermin (in prep)

Universe's SED and uniqueness of Planck



today's extragalactic bkg light

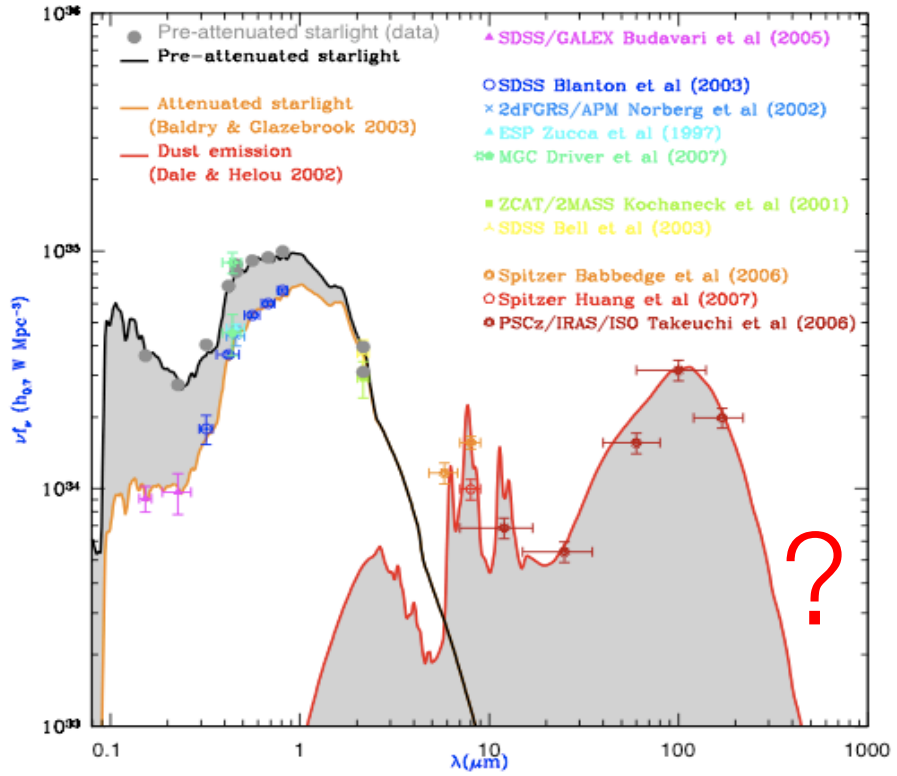


FIG. 4.— The cosmic energy output covering the region dominated by starlight (left peak) and by dust emission (right peak). The orange line shows the observed (uncorrected) cosmic energy output from the total nearby galaxy population, while the black line shows the same after correction for the fraction of photons attenuated by dust. The discrepancy in the integrals over these two curves yields the total energy of starlight lost to heating of the dust grains. If starlight is the only source of dust heating then this energy loss must equal the total radiant energy of the dust emission (i.e., the two shaded regions must and do contain equal energy).

Driver + 2008

question 2 : luminosity density of dusty sources above 160um ?

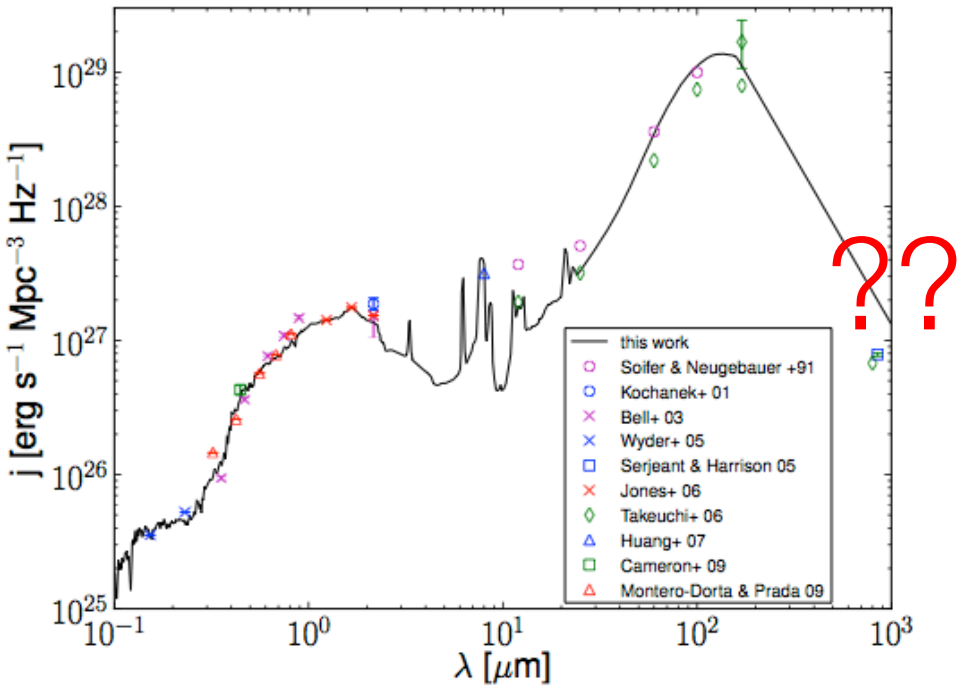
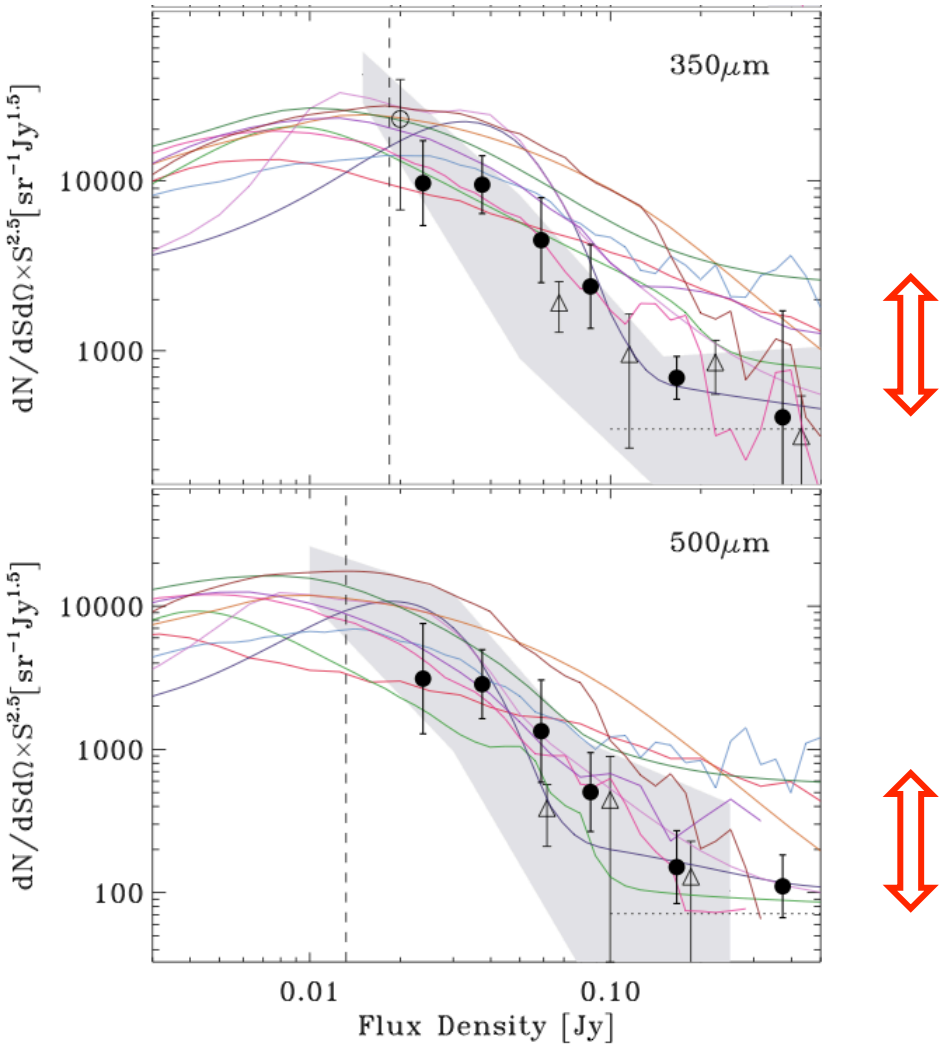


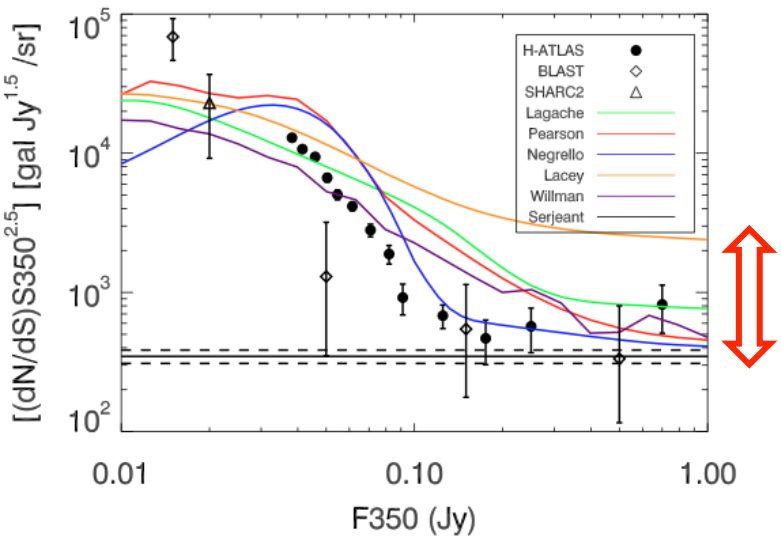
Figure 10. Comparison between our estimation of the local luminosity density (black line) and observational data from different surveys 12, 25, 60, 100 μm from Soifer & Neugebauer (1991); K-band from Kochanek et al. (2001); u, g, r, i, z, K-band from Bell et al. (2003 FUV, NUV from Wyder et al. (2005); 850 μm from Serjeant & Harrison (2005); bj, rf, J, H, K-band from Jones et al. (2006); 12 25, 60, 100, two different analysis for 170, 800 μm from Takeuchi et al. (2006) (two different analysis); 8 μm from Huang et al. (2007 B-band from Driver et al. (2008) and Cameron et al. (2009); and u, g, r, i, z from Montero-Dorta & Prada (2009).

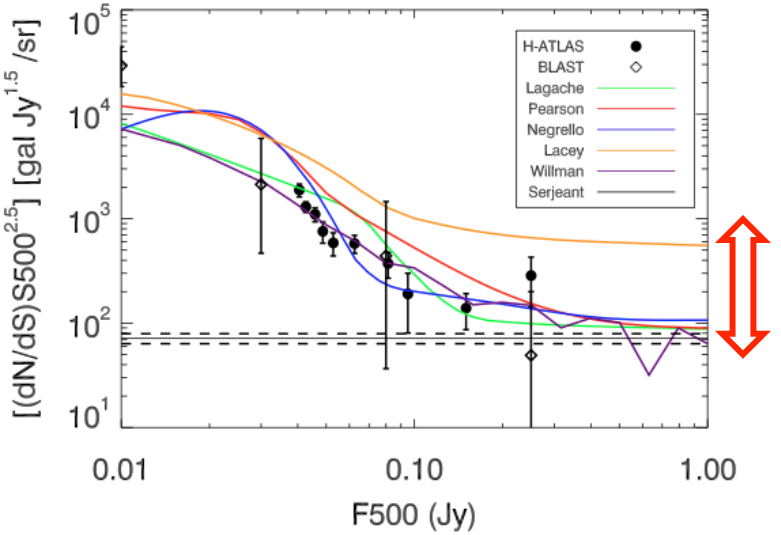
-> need for source statistics below 1800GHz (>160um)

Dominguez + 2010

we need more (bright fluxes and frequencies)





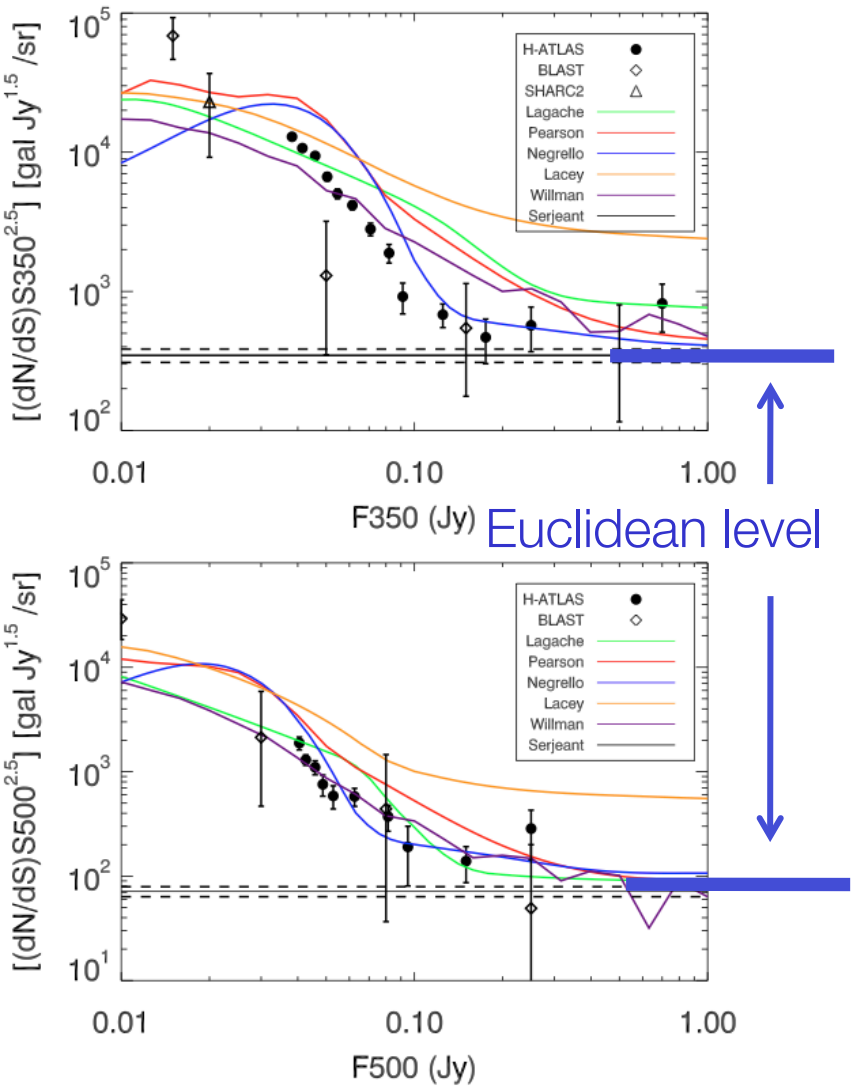


factor ~10 in model predictions at high flux density

Oliver+2010, Clements+2010

number counts

question 3 : what are the number counts at bright flux densities, and what is the Euclidean level ?



Oliver+2010, Clements+2010

2. an extragalactic sample drawn from the ERCSC on 40% of the sky

mask and zones

we use:
48% sky >= 545 GHz
64% sky <= 353 GHz

red = deep
green = medium
blue = shallow

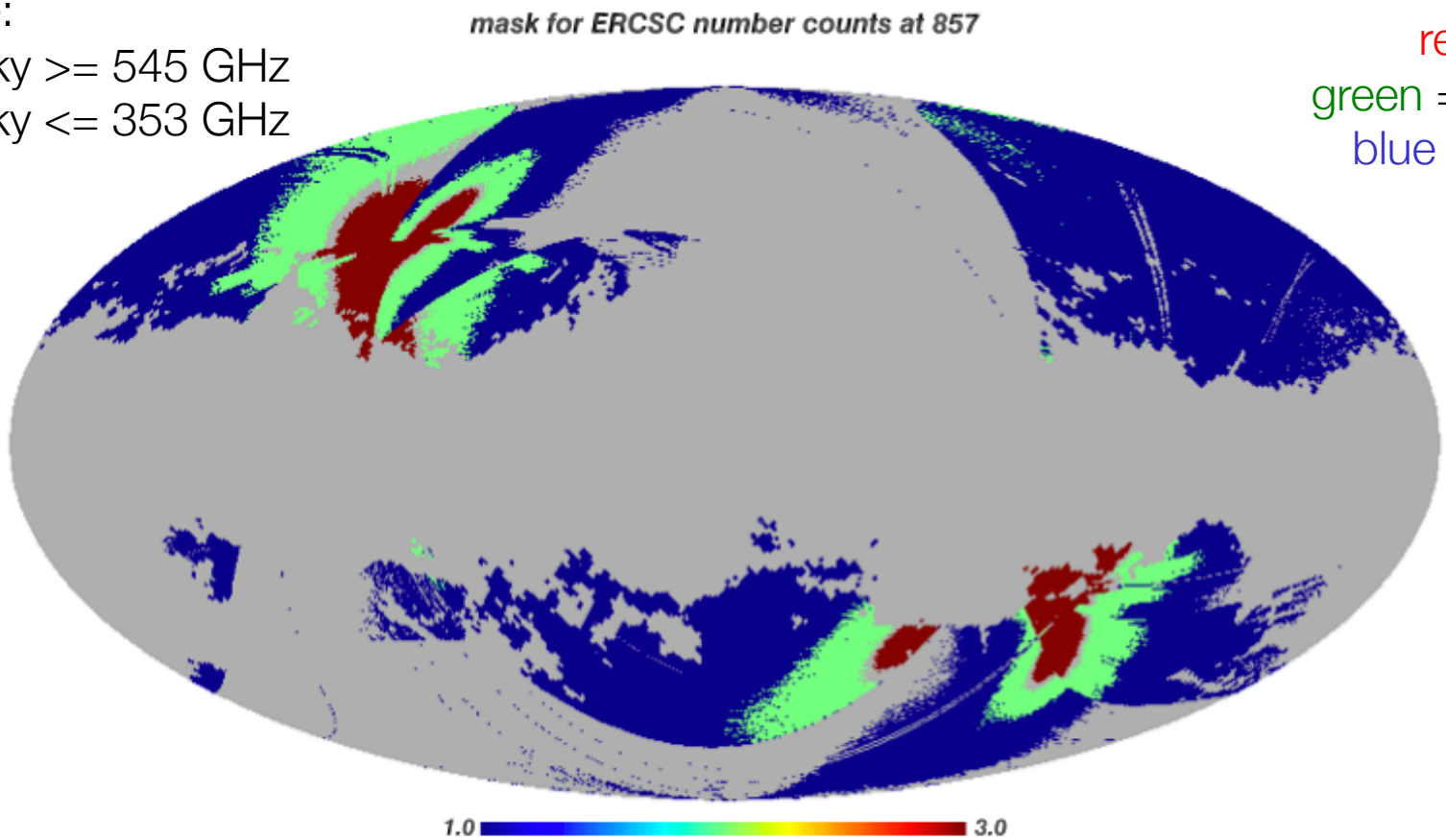


Figure 4. The 3 sky zones used in the analysis at 857 GHz: deep (red), medium (green), and shallow (light blue), and based on the 857 GHz hit counts.

sample drawn from ERCSC

ν GHz	number deep	number medium	number shallow	total source number	surface area deep	surface area medium	surface area shallow	total surface Sq. Deg.
857	77 (76)	262 (259)	719 (705)	1058 (1040)	880.1	2288.7	9800.1	12969.0
545	46 (46)	153 (153)	318 (316)	517 (515)	874.3	2324.1	9551.2	12749.5
353	35 (35)	104 (104)	198 (198)	337 (337)	1087.0	2971.1	12373.6	16431.8
217	17 (17)	65 (65)	183 (183)	265 (265)	1104.1	3169.4	11900.8	16174.3
143	13 (13)	48 (48)	184 (183)	245 (244)	1111.9	2972.2	11977.1	16061.1
100	14 (14)	45 (45)	158 (157)	217 (216)	1072.2	2870.4	12611.9	16554.5

3 zones of (rather close to) homogeneous completeness

200 to 1000 sources

number of sources (and actually used after completeness cut)

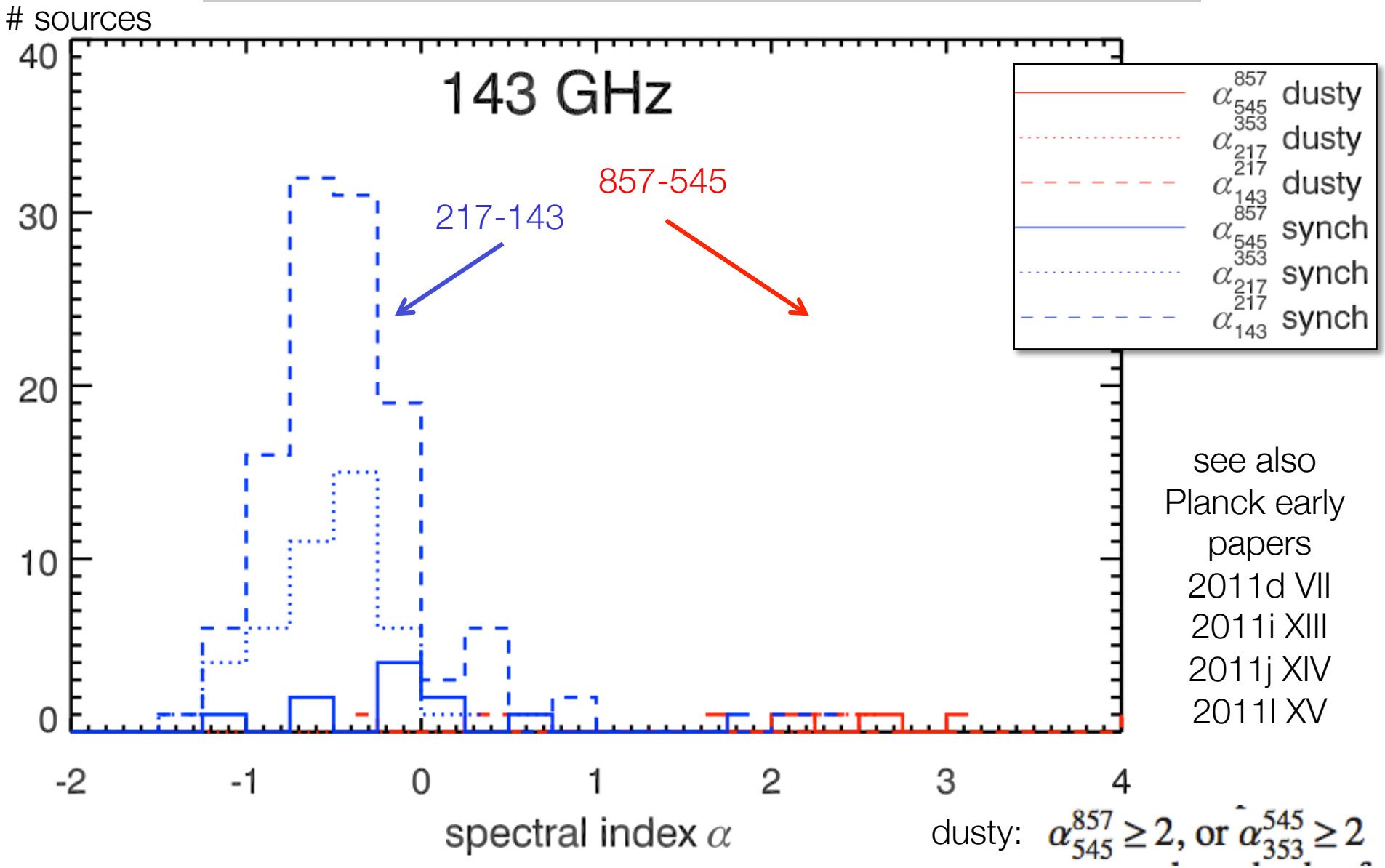
identification using databases

typically

fsky = 0.3 - 0.4

we use:
EXTENDED=0
FLUX

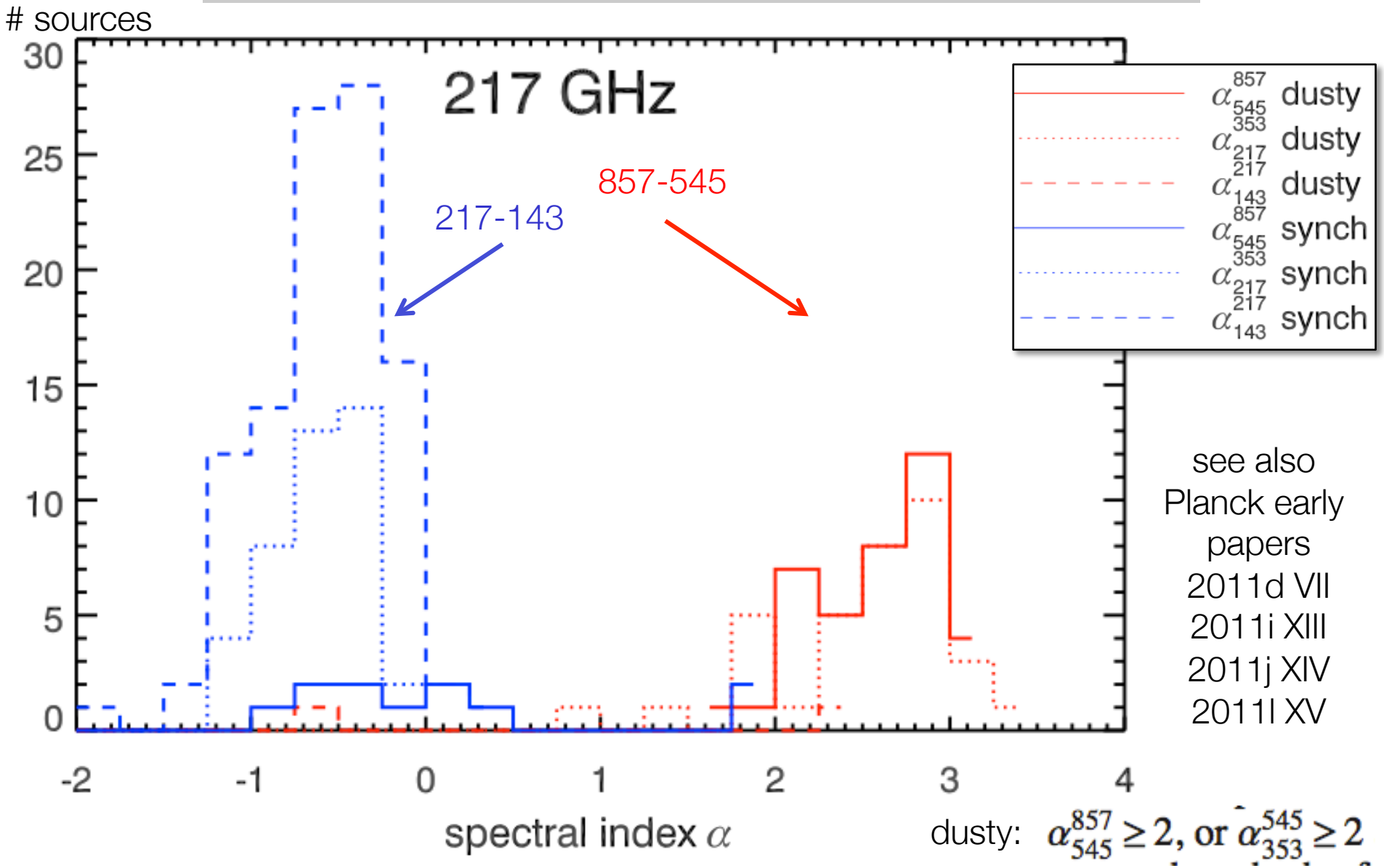
spectral indices: synchrotron



see also
Planck early
papers
2011d VII
2011i XIII
2011j XIV
2011l XV

dusty: $\alpha_{545}^{857} \geq 2$, or $\alpha_{353}^{545} \geq 2$

spectral indices: transition



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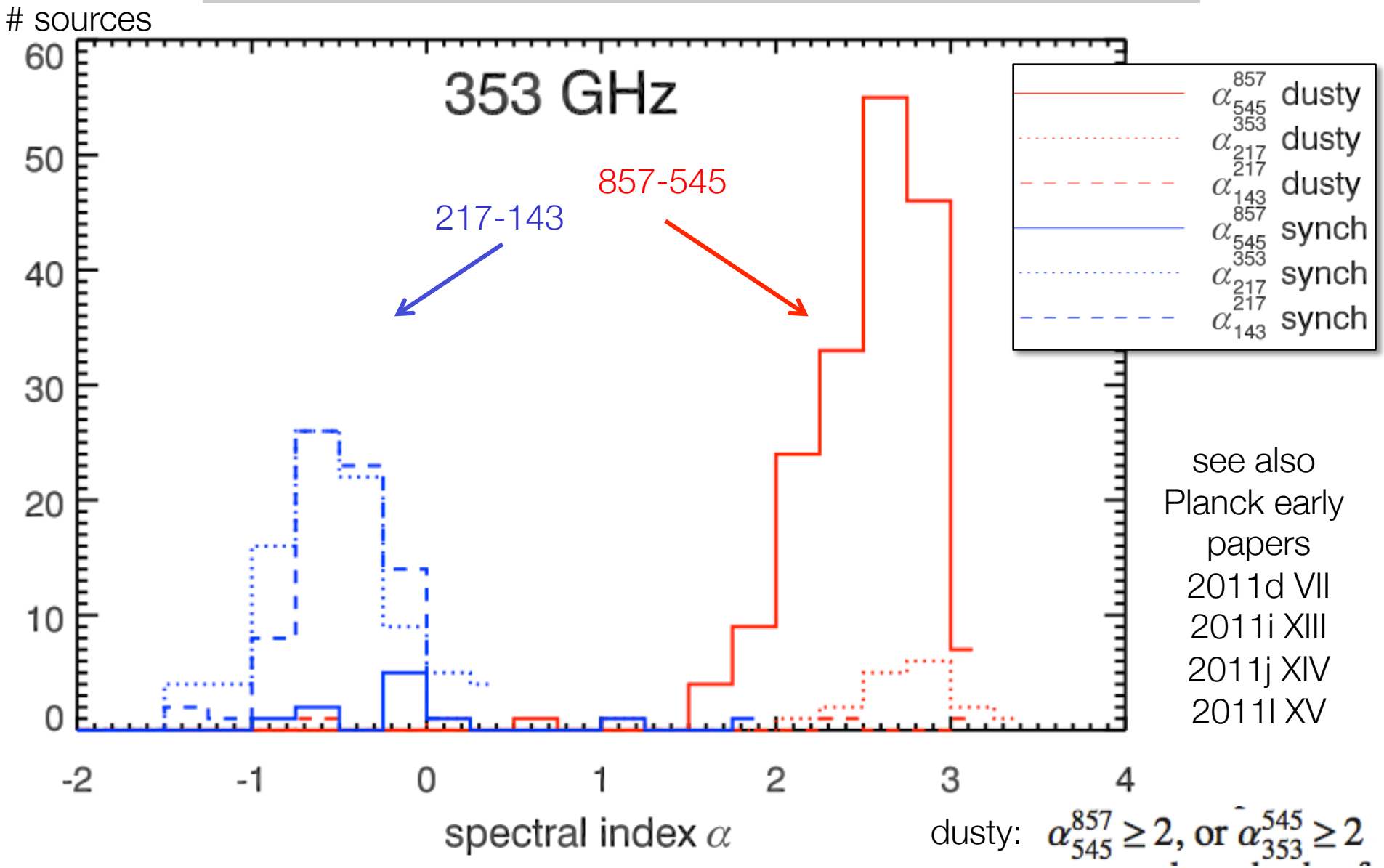

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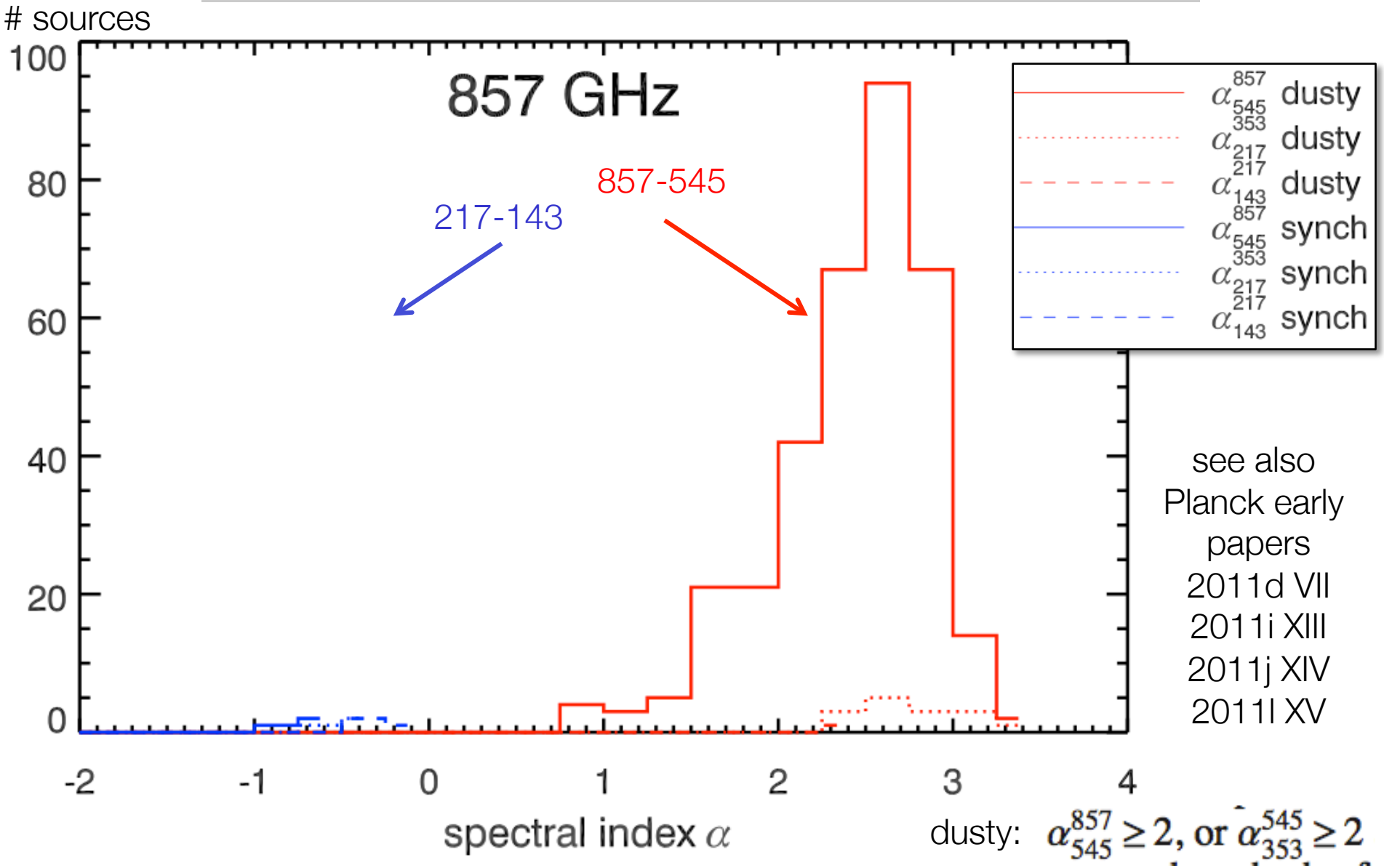
spectral indices: dusty



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2011d VII
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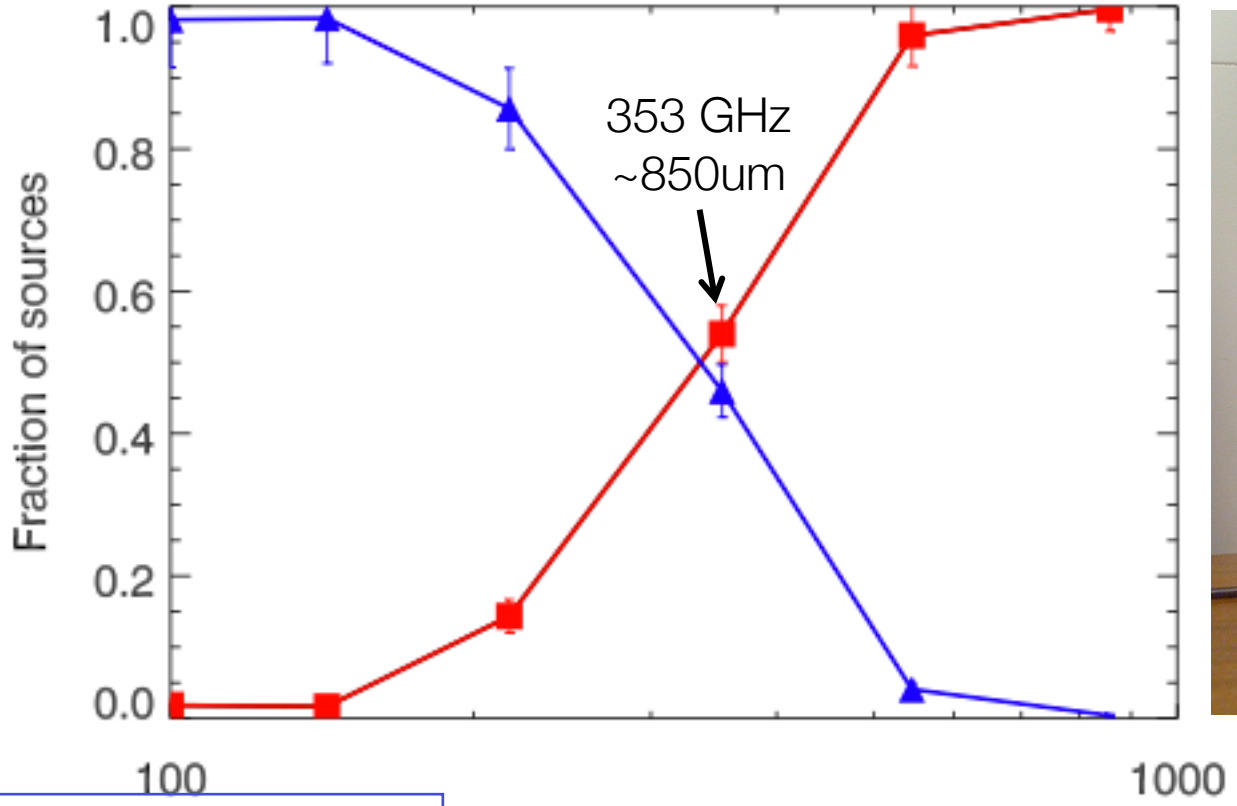
2011l XV

dusty: $\alpha^{857}_{545} \geq 2$, or $\alpha^{545}_{353} \geq 2$

dusty and synchrotron vs frequency

for ERCSC sources, i.e. bright sources



question 1 : relative contribution of radio sources vs infrared galaxies ?

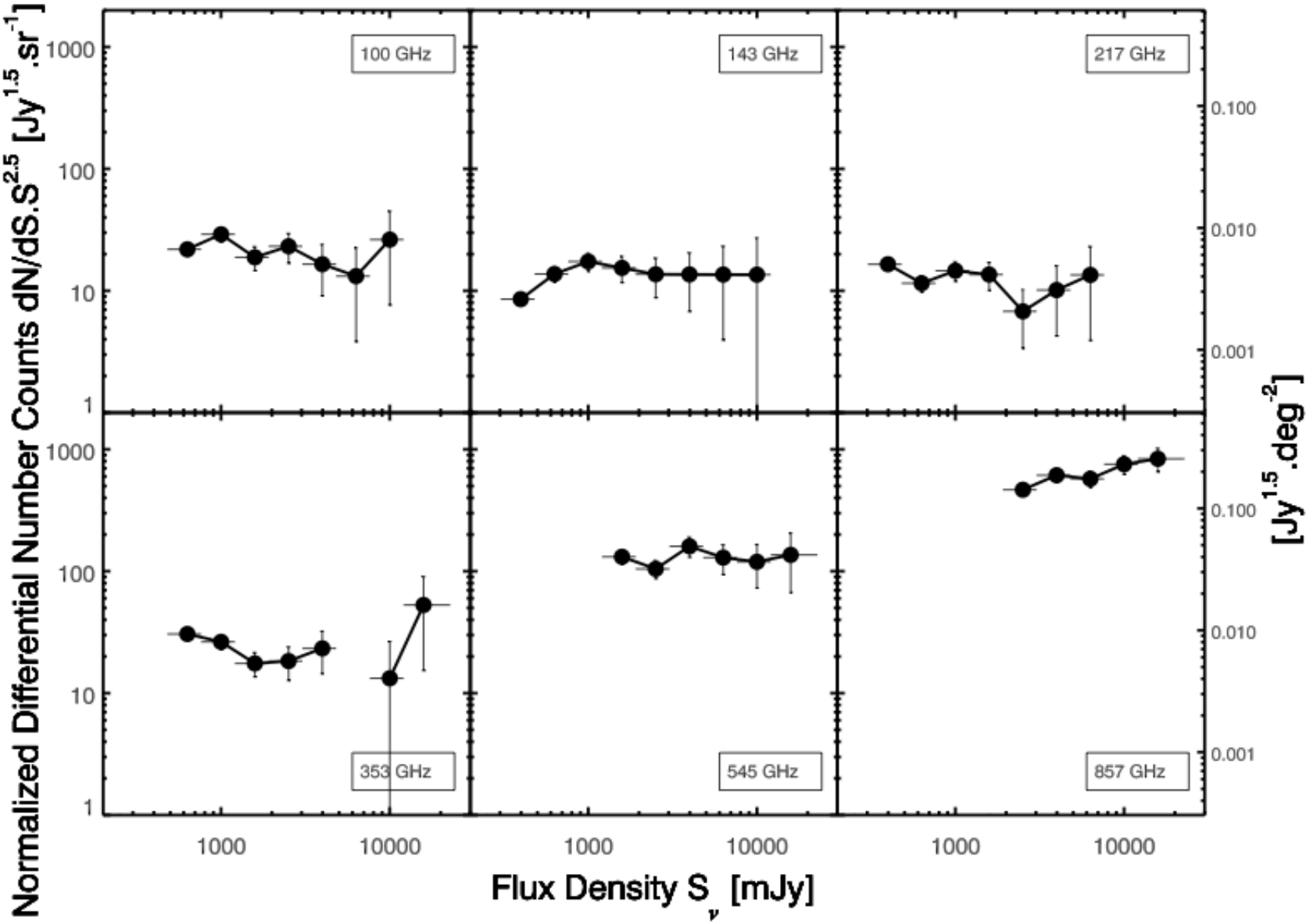
Figure 8. Fraction of galaxies types as a function of frequency: dusty (red) and synchrotron (blue). Error bars are poissonnian.

3. new extragalactic number counts from Planck HFI data

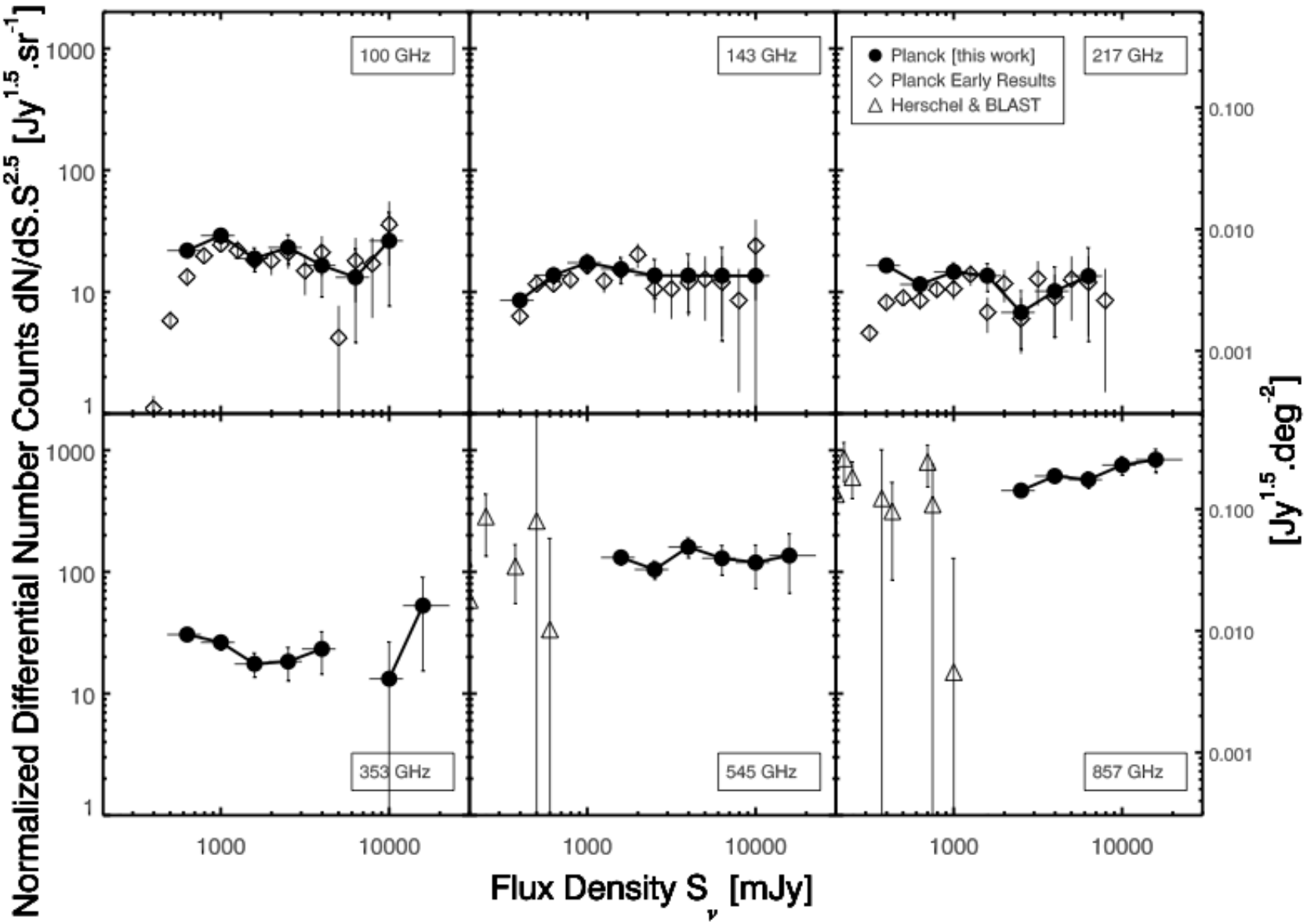
80% completeness or more

error bars dominated by cosmic variance

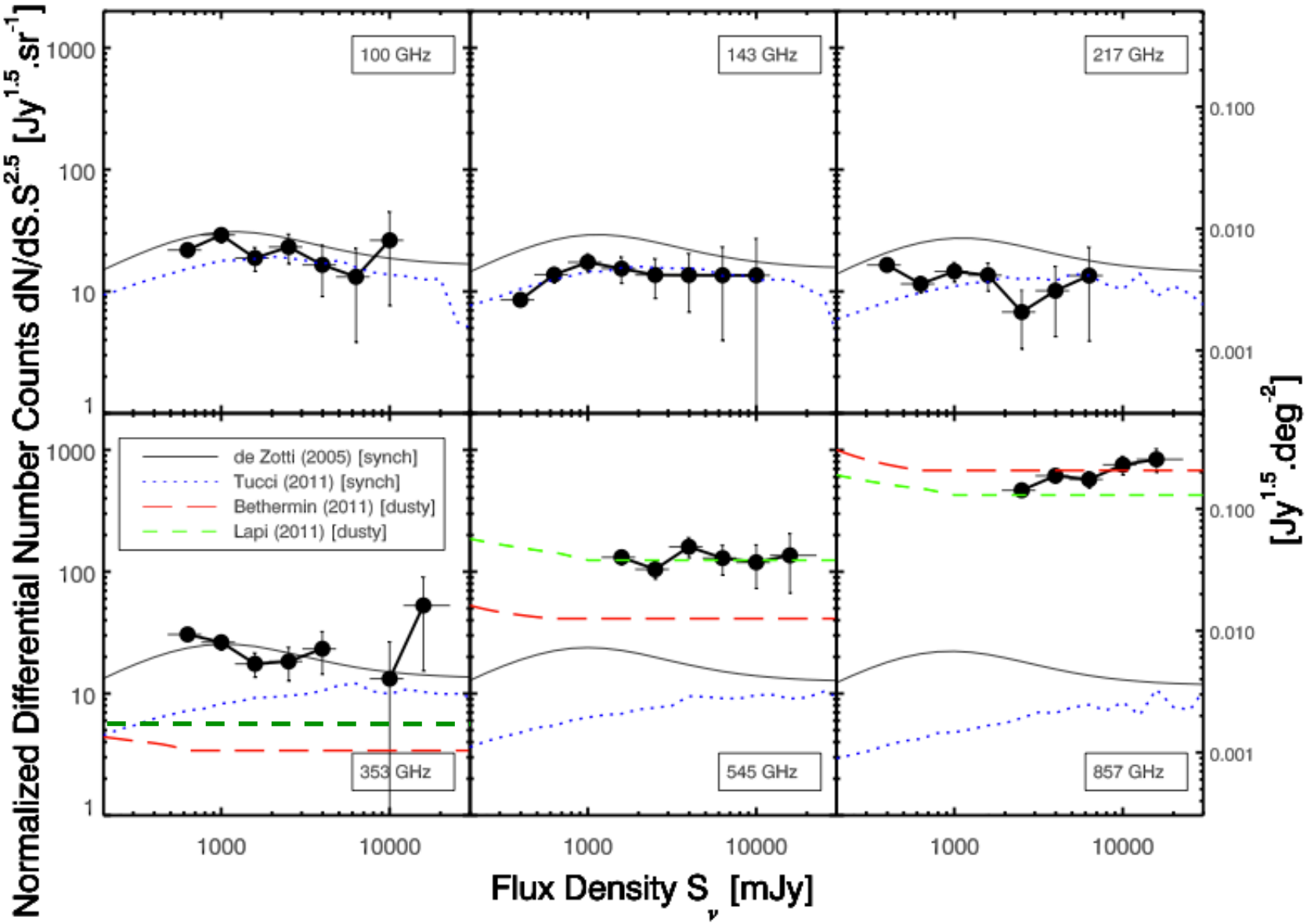
number counts 100 – 857 GHz



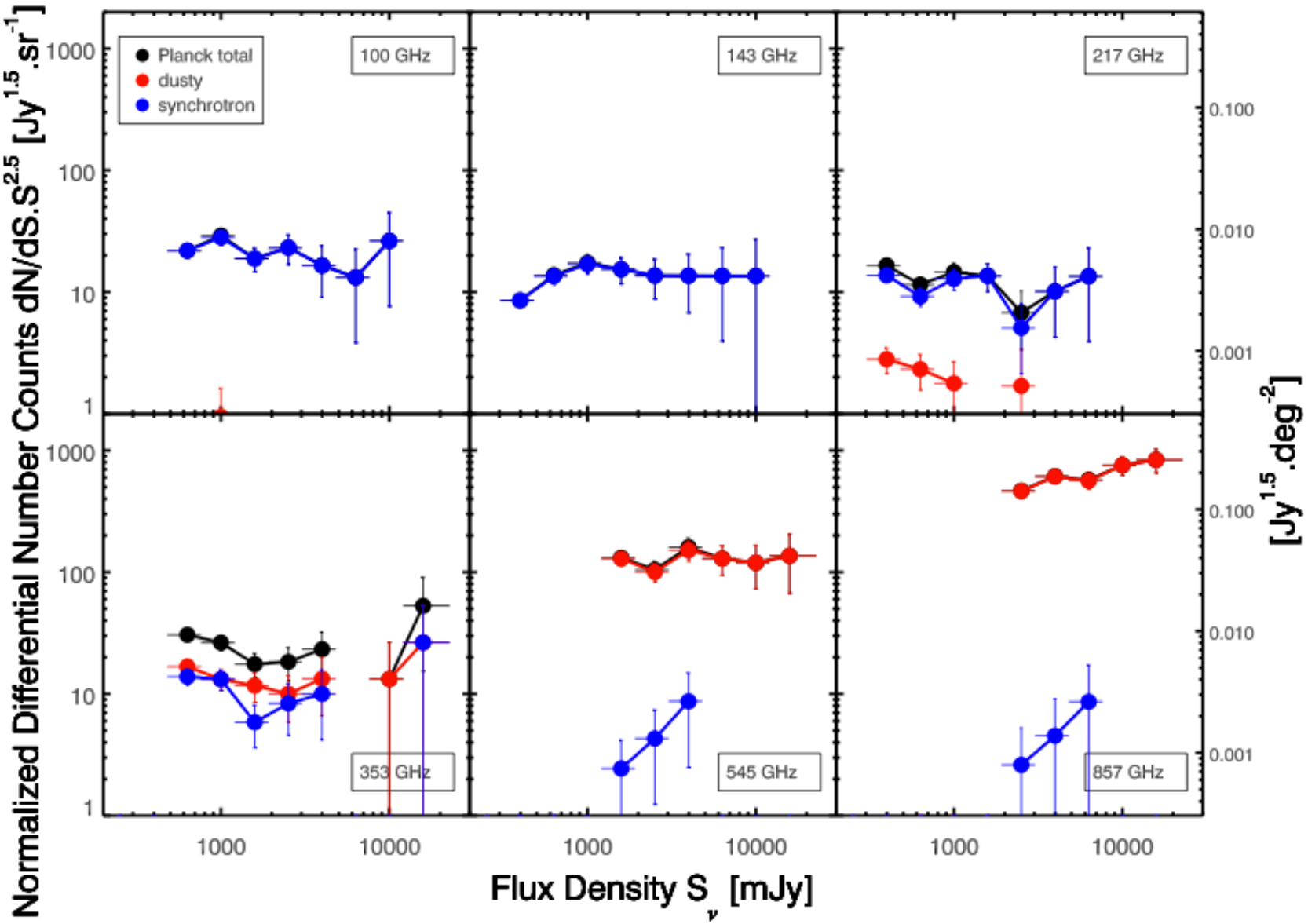
number counts 100 – 857 GHz



number counts 100 – 857 GHz

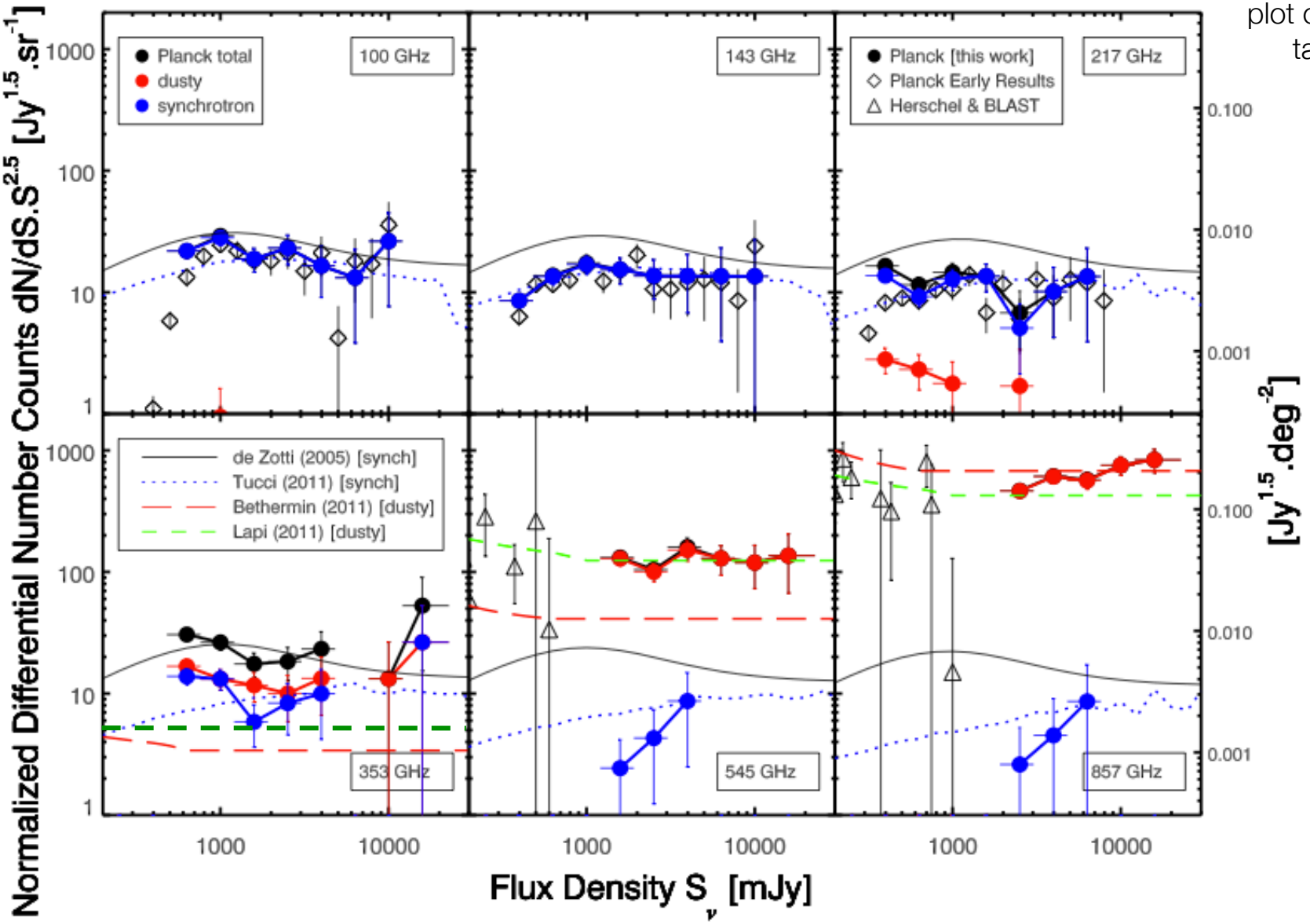


number counts 100 – 857 GHz



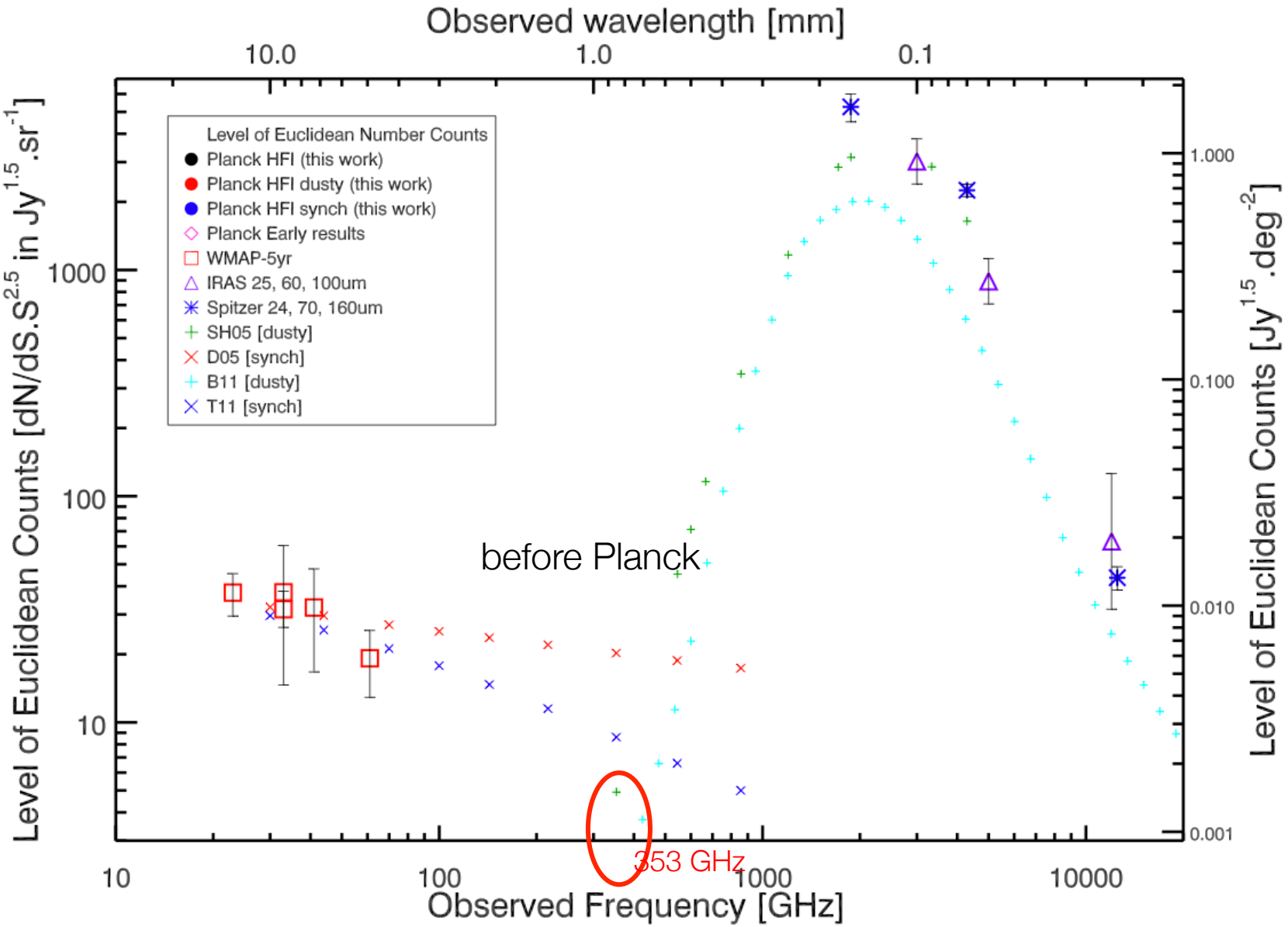
number counts 100 – 857 GHz

if you're sleeping: THIS is the key plot of the talk



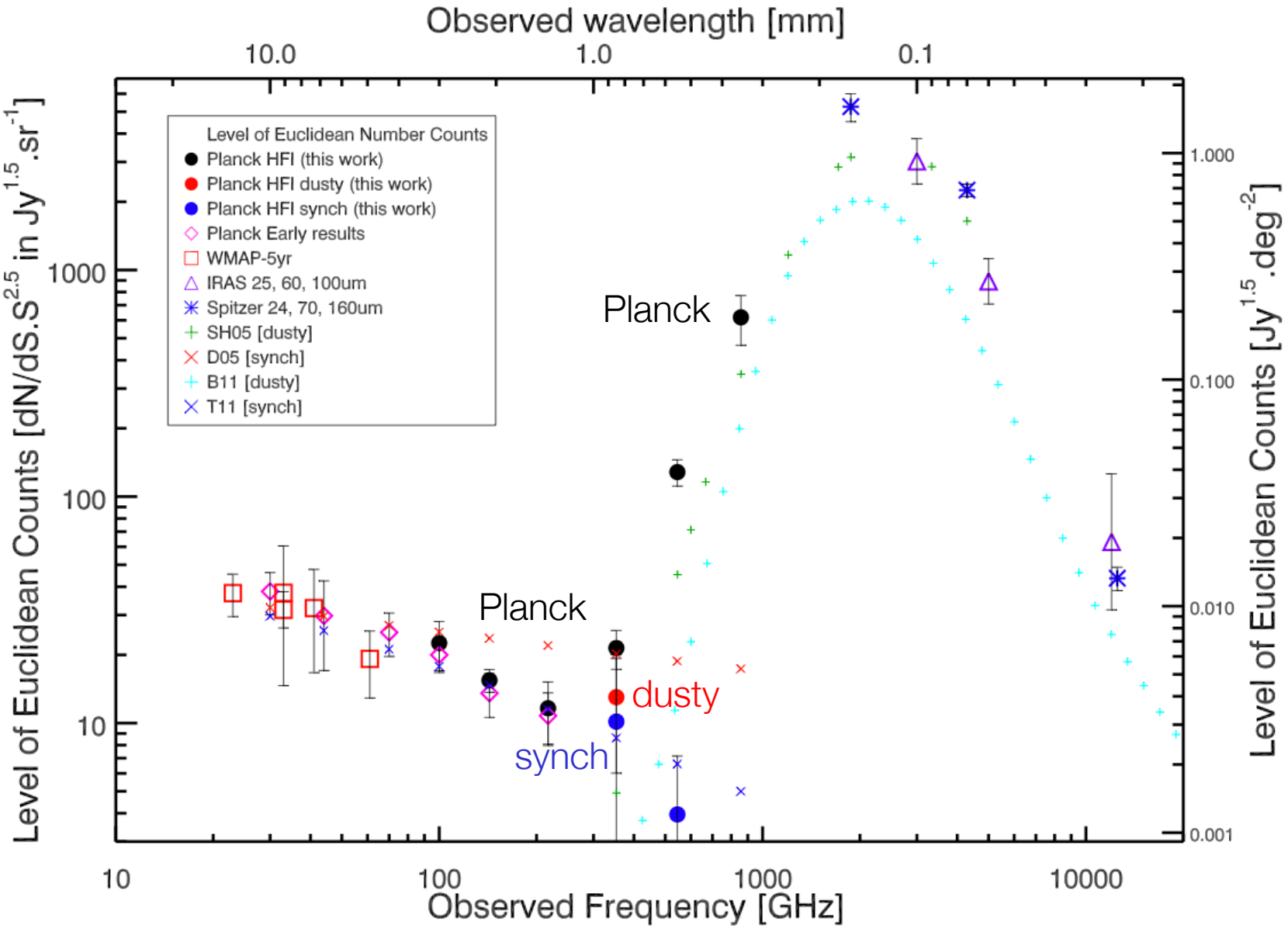
4. multifrequency euclidean level of counts: towards the luminosity density of dusty galaxies

euclidean level of counts



euclidean level of counts

question 2 : luminosity density of dusty sources above 160um ?



5. summary of results

- from the ERCSC sample:
  - 30 to 40% of the sky, 200 to 1000 sources above 100 GHz
  - classification into dusty and synchrotron sources
- ~equal number of dusty & synch sources at 353 GHz (q1)
- we derive number counts: new constraints at bright flux densities: local SEDs are not accurate > 353 GHz (q3)
- we derive the euclidean level: higher than predicted for dusty; in agreement w/ Tucci+2011 (q2)
- we estimate the high-redshift contribution of SPT 220 GHz sources at 353 GHz