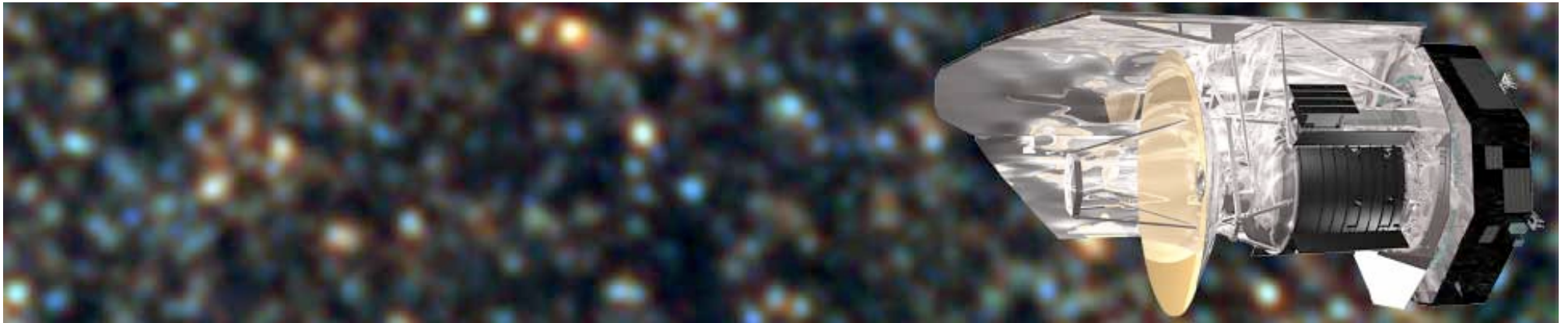




hermes.sussex.ac.uk



HERSCHEL MULTI-TIERED EXTRAGALACTIC SURVEY



ELECTION 2010

Election 2010

Results

Parties and issues

Find your result

Battlegrounds

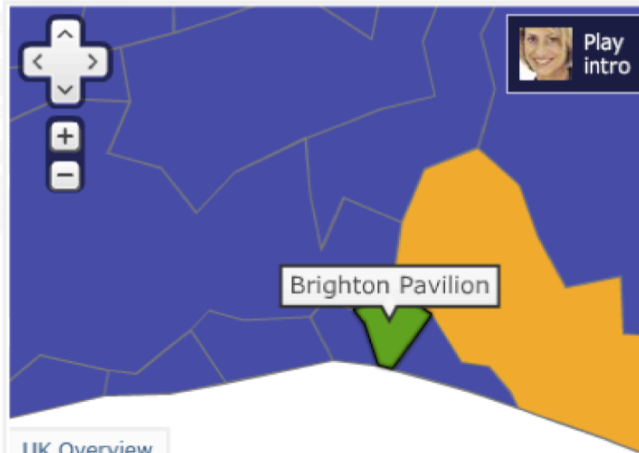
Enter postcode or place name

Go

Constituency List

- Na H-Eileanan An Iar [Western Isles]
- Dorset Mid & Poole North
- Normanton, Pontefract & Castleford
- Castle Point
- Crewe & Nantwich
- Ellesmere Port & Neston
- Enfield Southgate
- Inverness, Nairn, Badenoch & Strathspey

UK > England > South East > Brighton Pavilion



UK Overview



Set Brighton Pavilion as my constituency

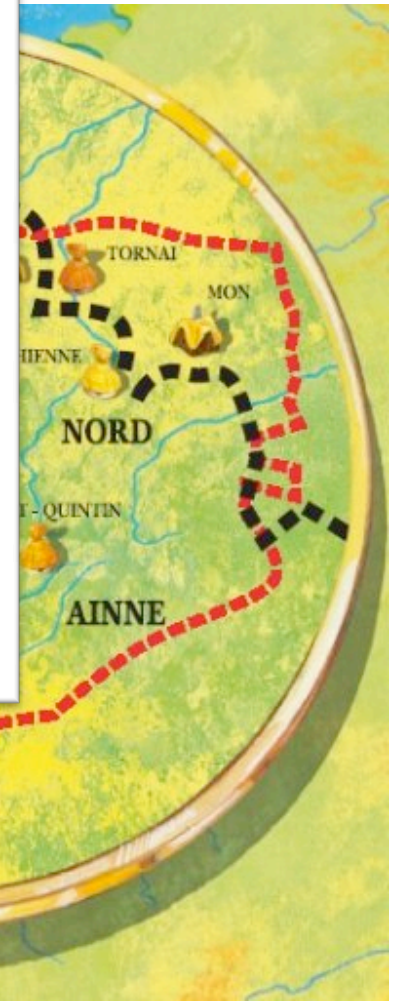
GRN GAIN FROM LAB

TOP THREE PARTIES AT A GLANCE

	VOTE SHARE %
Green	31.3
Labour	28.9
Conservative	23.7

CONSTITUENCY SWING

8.4%
From LAB to GRN





The HERMES Team

Bruno Altieri, Alex Amblard, Vinod Arumugam, Robbie Auld, Herve Aussel, Tom Babbedge, Alexandre Beelen, Matthieu Bethermin, Andrew Blain, Jamie Bock, Alessandro Boselli, Carrie Bridge, Drew Brisbin, Veronique Buat, Denis Burgarella, Nieves Castro-Rodriguez, Antonio Cava, Pierre Chanial, Ed Chapin, Scott Chapman, Michele Cirasuolo, Dave Clements, Alex Conley, Luca Conversi, Asantha Cooray, Emanuele Daddi, Gianfranco DeZotti, Darren Dowell, Naomi Dubois, Jim Dunlop, Eli Dwek, Simon Dye, Steve Eales, David Elbaz, Erica Ellingson, Tim Ellsworth-Bowers, Duncan Farrah, Patrizia Ferrero, Matt Fox, Alberto Franceschini, Ken Ganga, Walter Gear, Elodie Giovannoli, Jason Glenn, Eduardo Gonzalez-Solares, Matt Griffin, Mark Halpern, Martin Harwit, Evanthia Hatziminaoglou, Sebastien Heinis, George Helou, Jiasheng Huang, Peter Hurley, HoSeong Hwang, Edo Ibar, Olivier Ilbert, Kate Isaak, Rob Ivison, Ali Ahmed Khostovan, Martin Kunz, Guilaine Lagache, Louis Levenson, Carol Lonsdale, Nanyao Lu, Suzanne Madden, Bruno Maffei, Georgios Magdis, Gabriele Mainetti, Lucia Marchetti, Elizabeth Marsden, Gaelen Marsden, Jason Marshall, Ketron Mitchell-Wynne, Glenn Morrison, Angela Mortier, HienTrong Nguyen, Brian O'Halloran, Seb Oliver, Alain Omont, Frazer Owen, Mathew Page, Maurillo Pannella, Pasquale Panuzzo, Andreas Papageorgiou, Harsit Patel, Chris Pearson, Ismael PerezFournon, Michael Pohlen, Naseem Rangwala, Jason Rawlings, Gwen Raymond, Dimitra Rigopoulou, Laurie Riguccini, Davide Rizzo, Giulia Rodighiero, Isaac Roseboom, Michael Rowan-Robinson, Miguel SanchezPortal, Rich Savage, Bernhard Schulz, Douglas Scott, Paolo Serra, Nick Seymour, David Shupe, Anthony Smith, Jason Stevens, Veronica Strazzullo, Myrto Symeonidis, Markos Trichas, Katherine Tugwell, Mattia Vaccari, Elisabetta Valiante, Ivan Valtchanov, Joaquin Vieira, Laurent Vigroux, Lingyu Wang, Rupert Ward, Don Wiebe, Gillian Wright, Kevin Xu, Michael Zemcov

Faculty and Researchers PostDocs Students

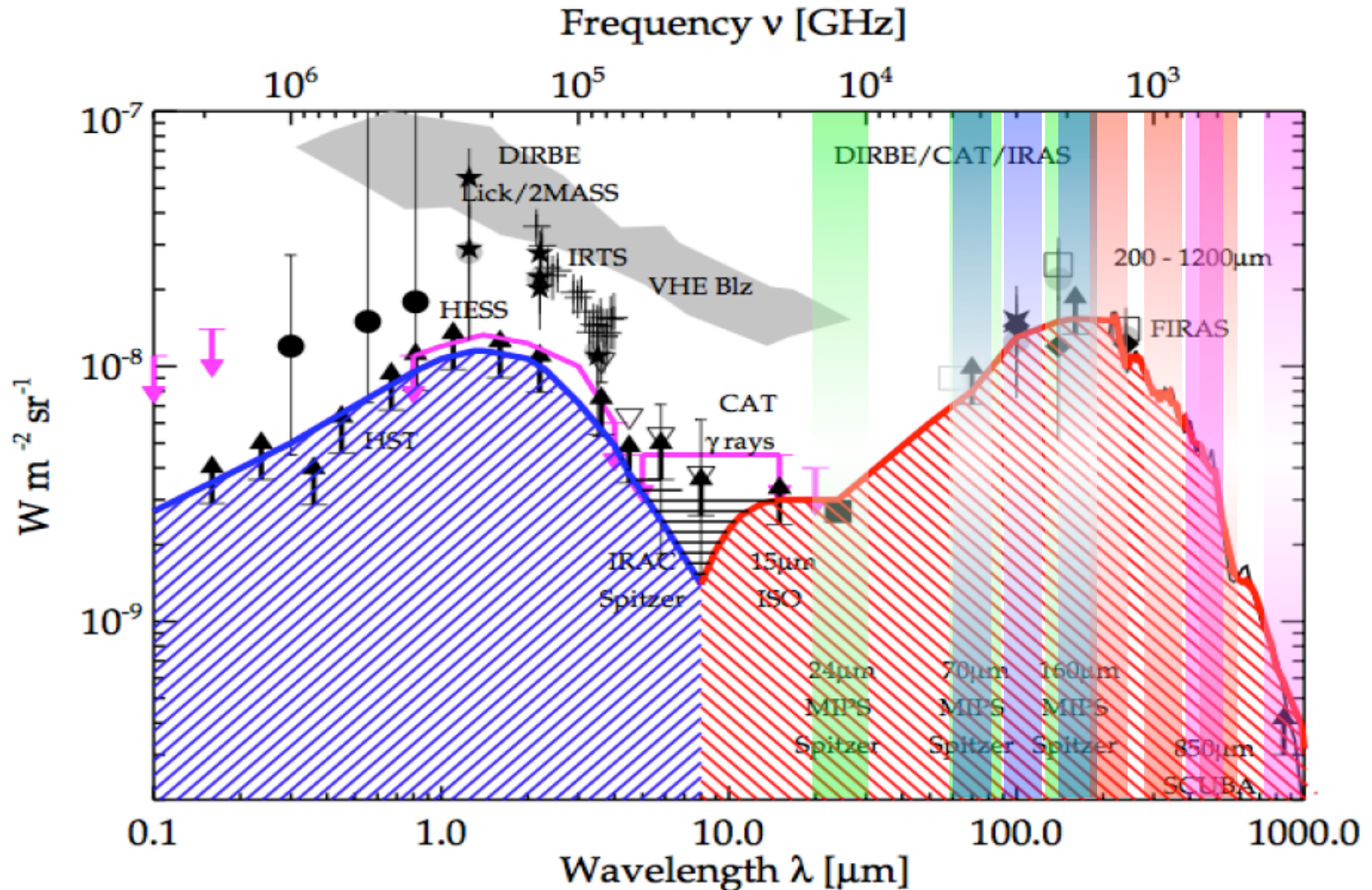
+ engineers, instrument/software,
developers etc.



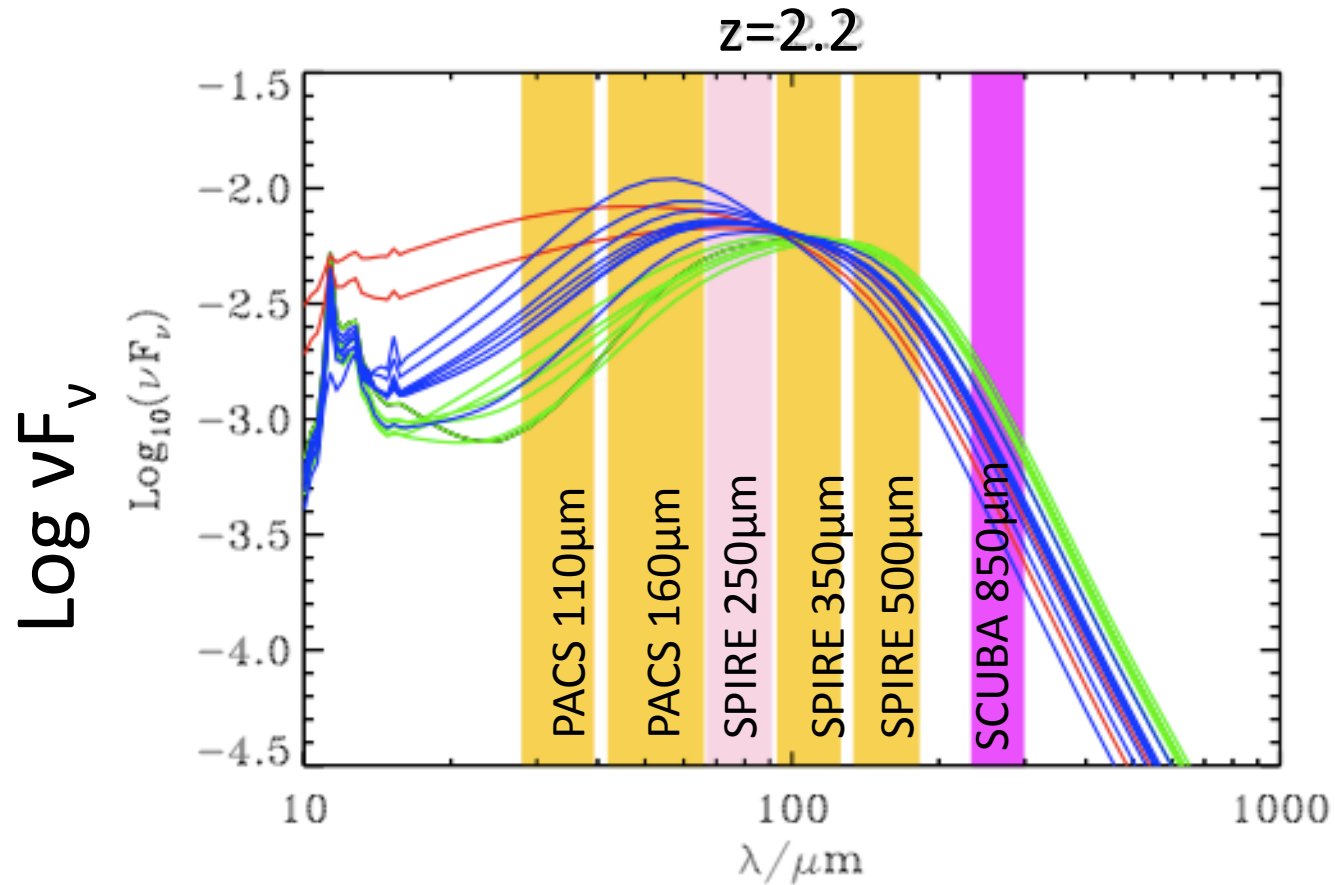
Outline

- Motivation
- SDP Data
- Results
 - Luminosity Functions
 - SEDs
 - Counts
 - Clustering
- Conclusion

Cosmic Far-Infrared Background Radiation



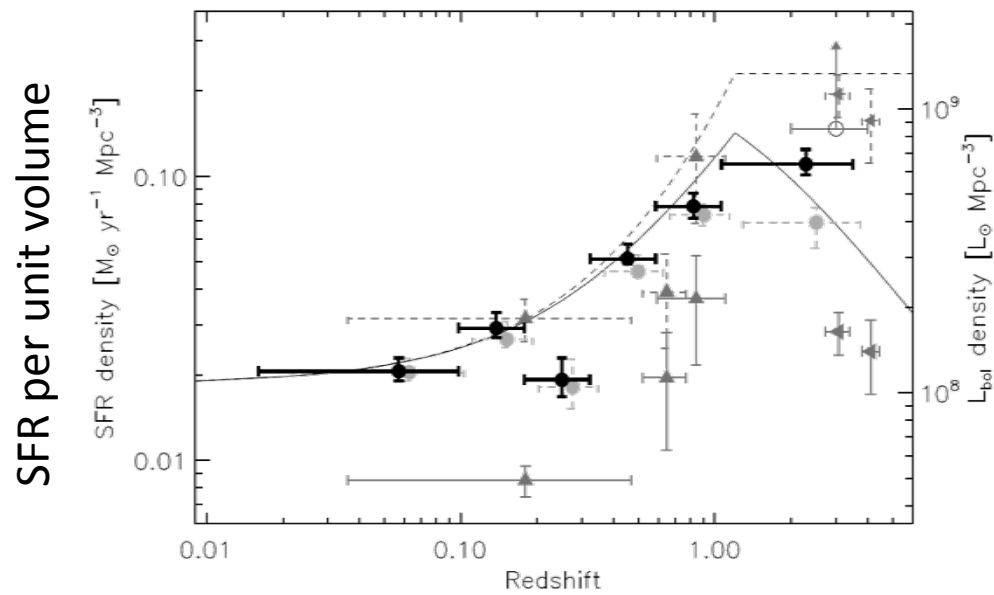
Constraining Bolometric Luminosity



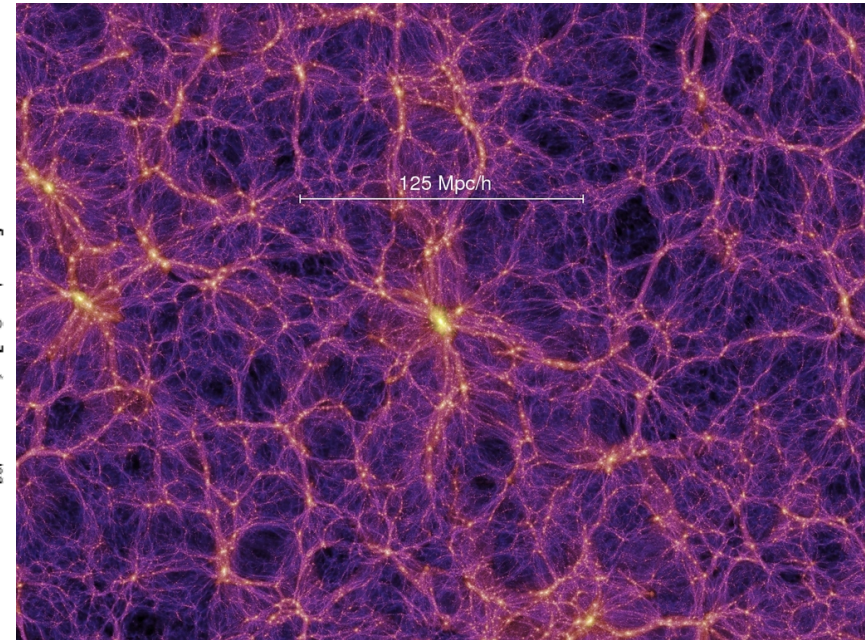
Normalised to
have same FIR
Luminosity

Rest-frame wavelength

Mapping SFH



Pascale et al. 2009



Millennium simulation

Galaxy Formation Models

- A complete picture of galaxy evolution requires a testable theory/model
- Phenomenological models
 - Luminosity functions, SEDs, evolution
 - Halo models
- Semi-Analytic models
- Testing requires samples of galaxies over representative luminosities and environments.



Clusters

Level1 0.11 \square°

Level2 0.36 \square°

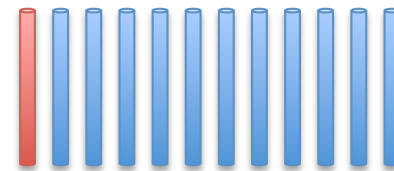
Level3 1.25 \square°

Level4 ~ 4 \square°

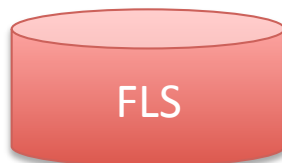
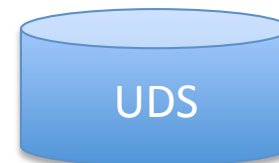
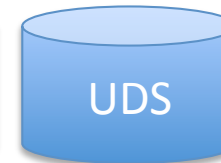
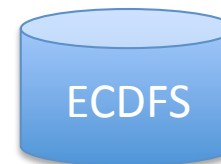
Level5 ~ 30 \square°

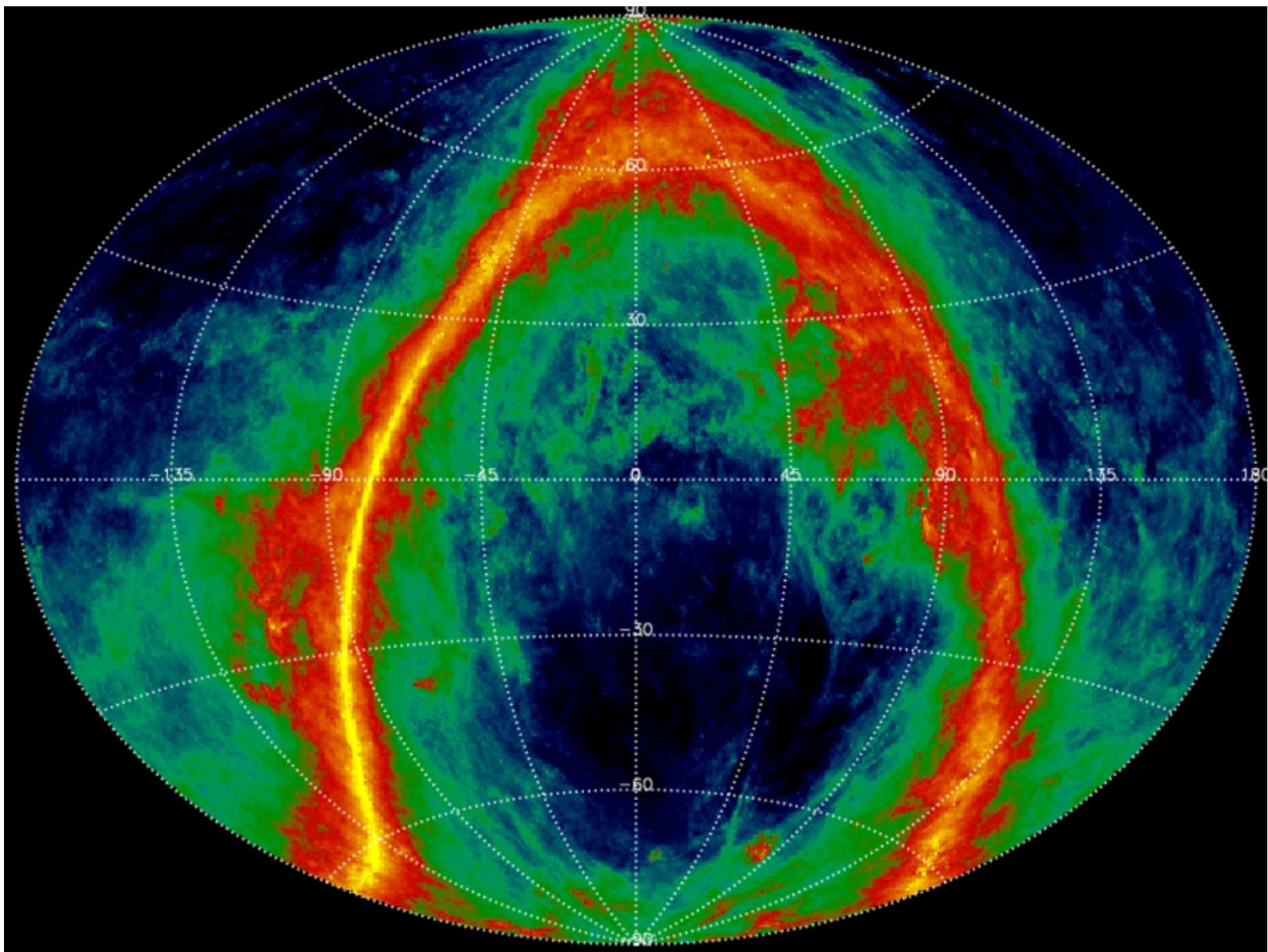
Level6 ~ 40 \square°

Faint,
low luminosity,
typical galaxies

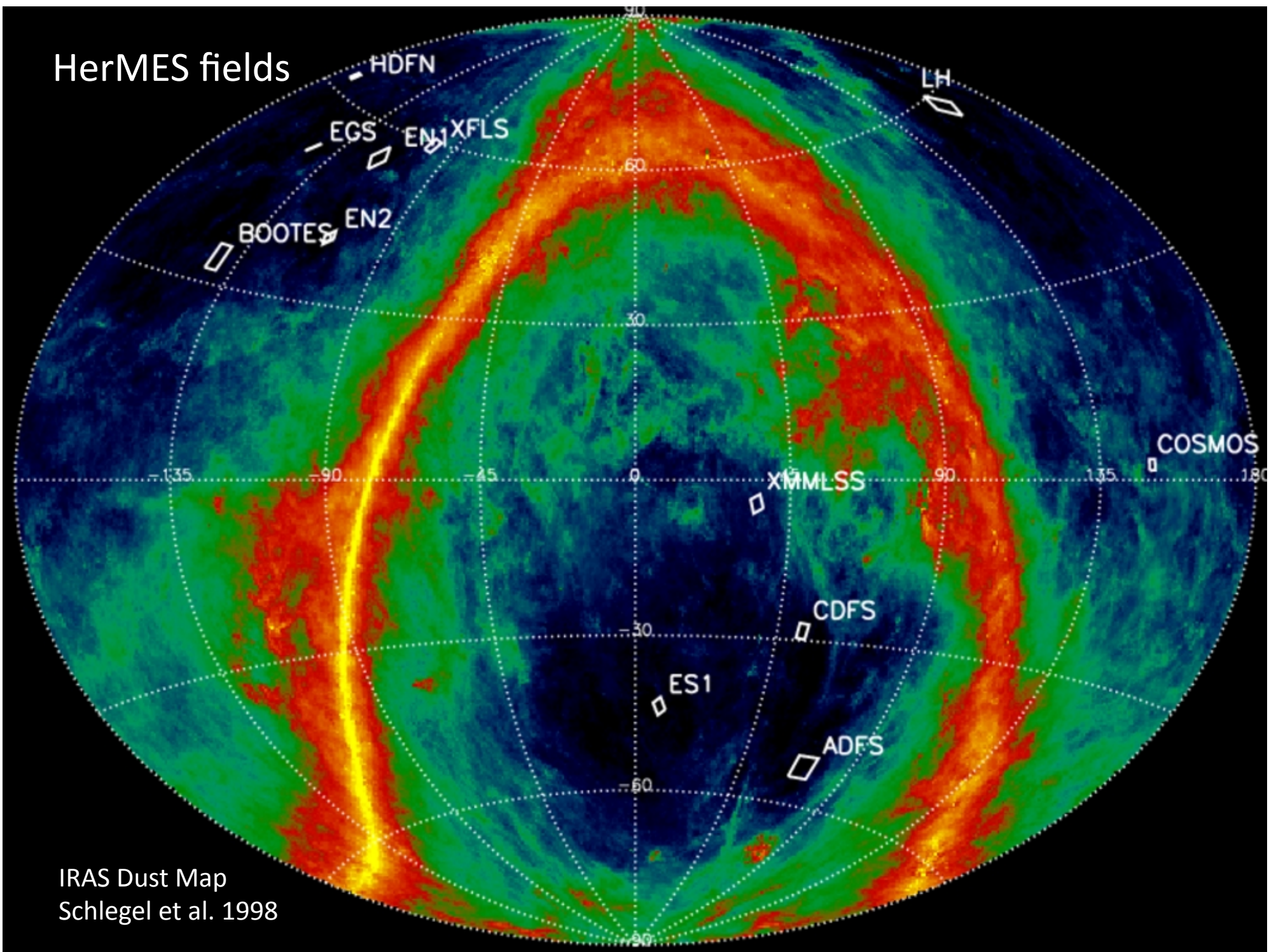


Bright,
high luminosity,
rare galaxies





HerMES fields



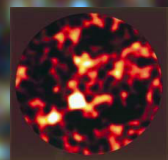
IRAS Dust Map
Schlegel et al. 1998

250 μ m

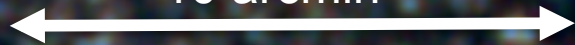
350 μ m

500 μ m

GOODS-N

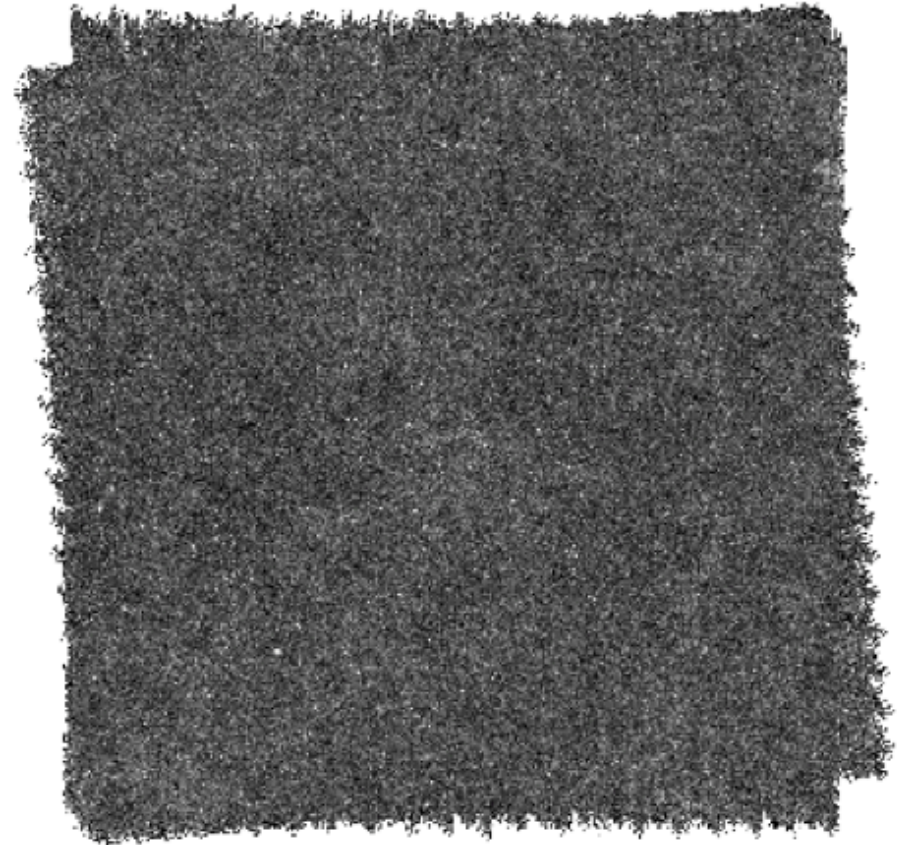


10 arcmin



Fields

FLS



Lockman-North



GOODS-N




1 deg



Science Demonstration Obs.

A2218	9' × 9'
GOODS-N	30' × 30'
Lockman-North	35' × 35'
FLS	2.6° × 2.3°
Lockman-SWIRE	3.6° × 3.6°

27,113 sources

Flux(250 μ m) >20mJy

about 7% of our final time

9 papers to A&A



Hermes: ESLAB 2010 posters

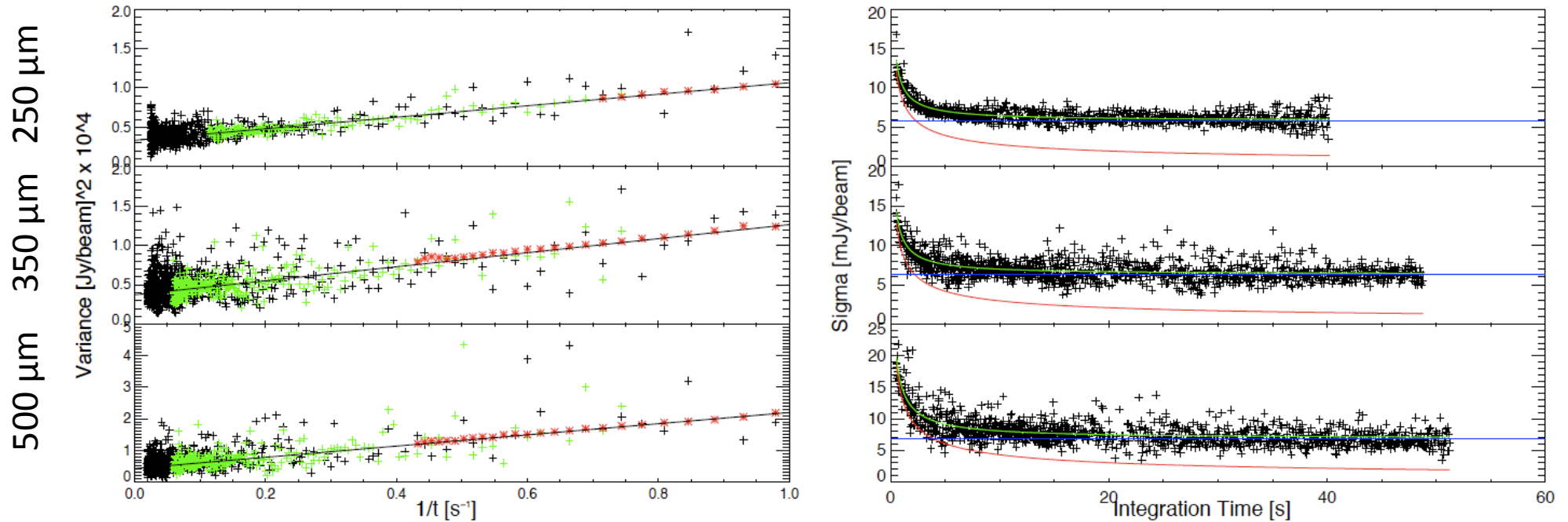
- **P1.47** HerMES, the Herschel Multi-tiered Extragalactic Survey: FIR Properties of known AGN *Hatziminaoglou, E. & HerMES*
- **P1.49** Deep Galaxy Number Counts: A Fluctuation Analysis of SPIRE Science Demonstration Phase Observations *Glenn, J. & HerMES*
- **P1.51** Spectral Energy Distributions, Luminosities, & Star-Formation Rates in GOODS-North Galaxies *Brisbin, D. & HerMES*
- **P1.52** HerMES the Herschel multi-tiered Extragalactic Survey: The Herschel View of Star Formation *Buat, V. & HerMES*
- **P1.53** HerMES, the Herschel Multi-Tiered Extragalactic Survey: A Comparison of Mid and Far-Infrared Star Formation Indicators using Herschel and Spitzer IRS *Castro-Rodríguez, N. & HerMES*
- **P1.61** Wide Field Extragalactic Surveys at 100 and 160 μm from HerMES: Number Counts and Contribution of PACS Sources to the SPIRE Population *Aussel, H. & HerMES*
- **P1.63** HerMES Observation of SMG *Chanial, P. & HerMES*
- **P1.65** HerMES, the Herschel Multi-Tiered Extragalactic Survey: Candidate High-Redshift Galaxies discovered with SPIRE *Dowell, C. & HerMES*

- **P2.47** HerMES the Herschel Multi-tiered Extragalactic Survey: Aggregate FIR Properties of 3.6 micron, 24 micron and Radio-Selected Galaxies *Vieira, J. & HerMES*
- **P2.49** HerMES, the Herschel Multi-Tiered Extragalactic Survey: The Far-Infrared Properties of Type-2 Quasi-Stellar Objects *Stevens, J. & HerMES*
- **P2.55** PACS/SPIRE Properties of IRAC Selected Star-Bursts at $z \sim 2$ *Magdis, G.E. & HerMES*
- **P2.56** HerMES, the Herschel Multi-tiered Extragalactic Survey: Star Formation in Powerful Radio and X-ray AGN *Seymour, N. & HerMES*
- **P2.59** HerMES the Herschel Multi-tiered Extragalactic Survey: Dust and Star Formation around Distant X-Ray selected AGN. *Page, M. & HerMES*
- **P2.63** The FIR/SMM Local Luminosity Density : The HerMES Local Luminosity Function at 100-500 micron *Vaccari, M. & HerMES*
- **P2.65** The Submillimeter Colors of Herschel/SPIRE-Detected Galaxies *Schulz, B. & HerMES*
- **P2.67** The SPIRE Confusion Limit *Nguyen, T. & HerMES*



Publications

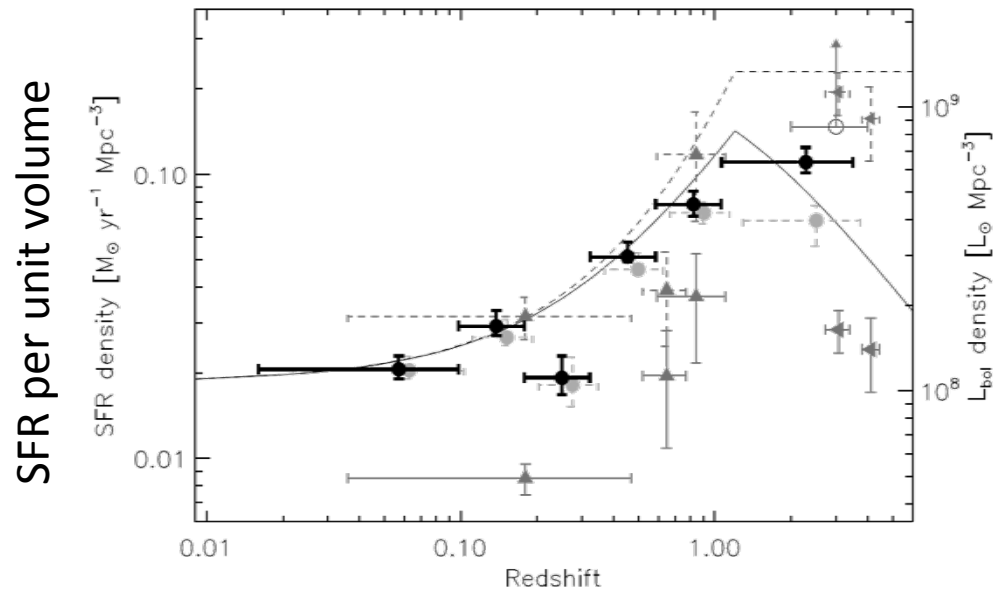
- SPIRE Counts: Oliver et al. 2010 A&A
- Confusion: Nguyen et al. 2010 A&A
- P(D): Glenn et al. 2010 MNRAS (in prep) Poster
- PACS Counts: Aussel et al. 2010 MNRAS (in prep) Poster
- Stacking: Vieira et al. 2010 MNRAS (in prep) Poster
- Local LF: Vaccari et al. 2010 A&A
- High-z LF: Eales et al. 2010 A&A
- Clustering: Cooray et al. 2010 A&A
- UV/FIR: Buat et al. 2010 MNRAS (in prep) Poster
- FIR SEDs: Rowan-Robinson et al. MNRAS (submitted)



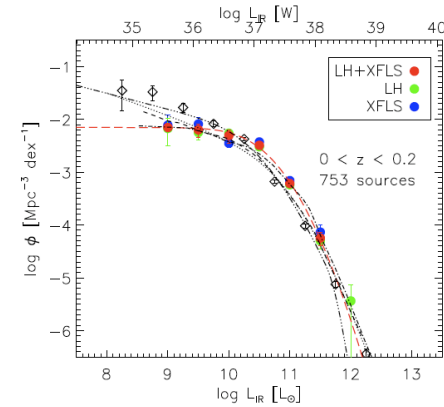
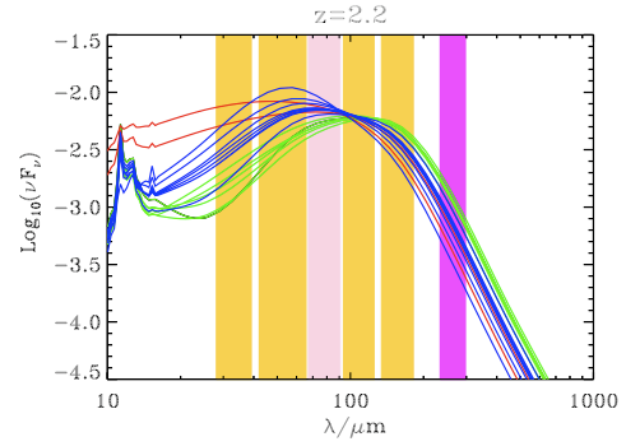
confusion noise of 5.8 ± 0.3 , 6.3 ± 0.4 and 6.8 ± 0.4 mJy/beam

instrument noise of 8.5 ± 0.4 , 9.4 ± 0.5 and 13.3 ± 0.7 $\text{mJy}/\text{beam} \sqrt{s}$.

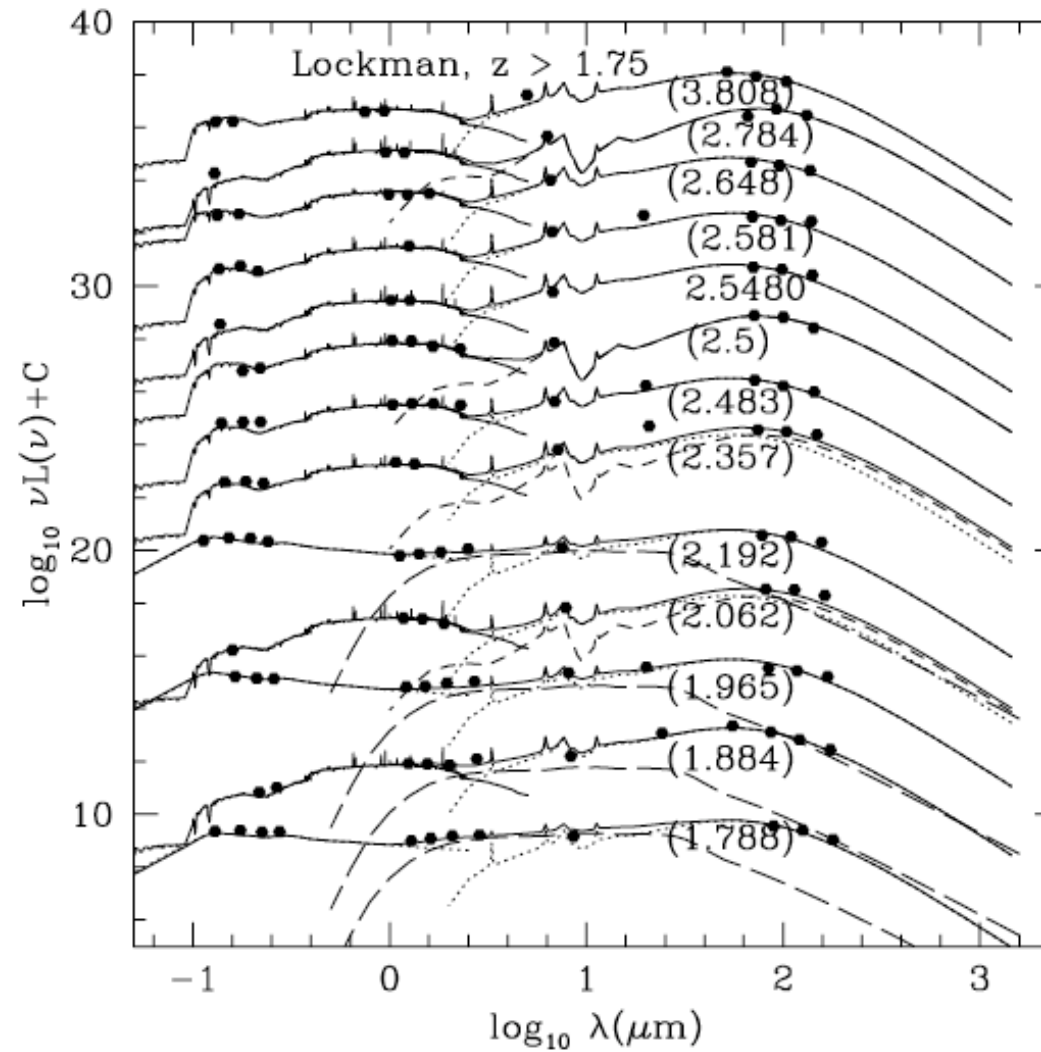
Phenomenological model



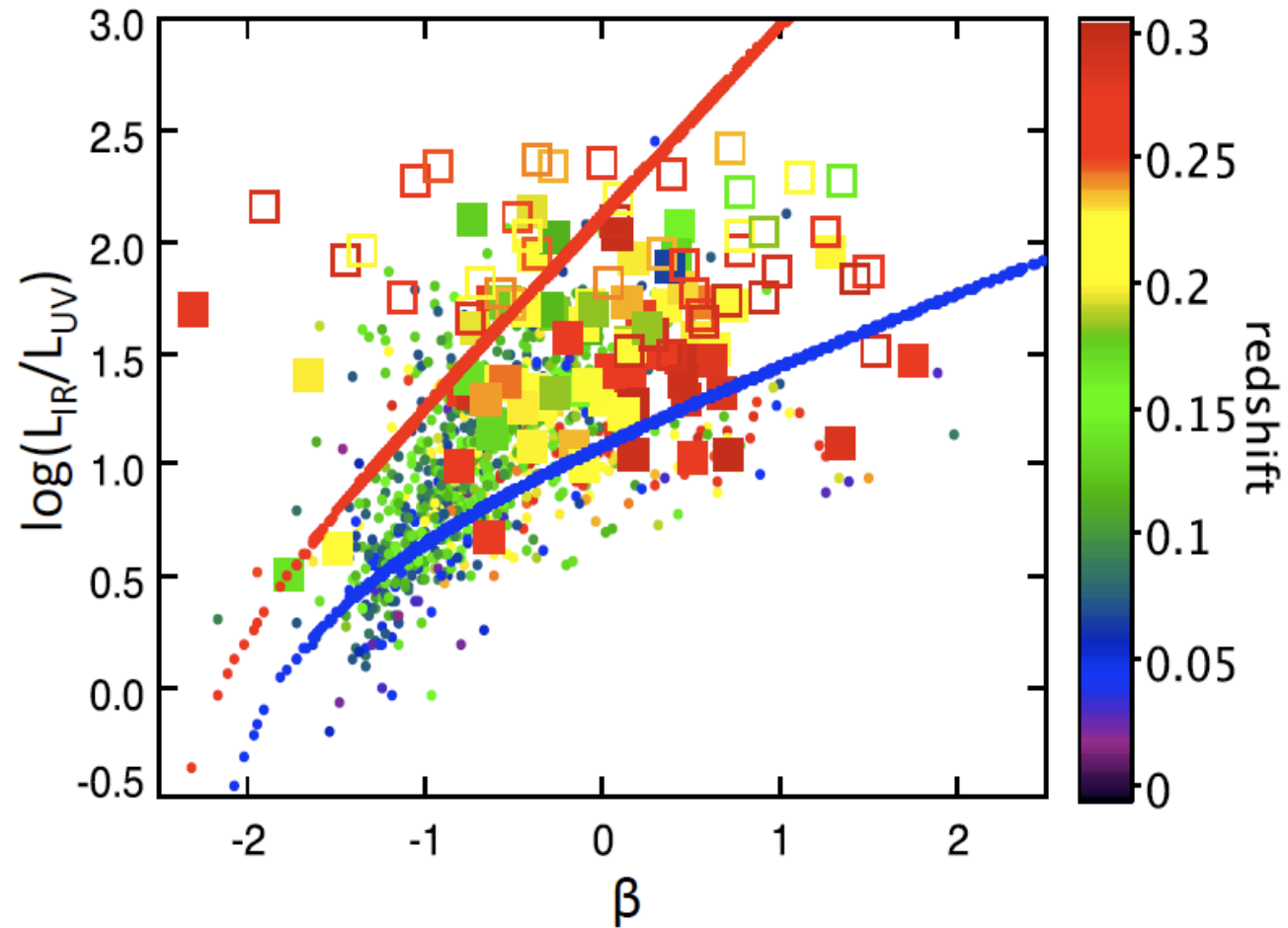
Pascale et al. 2009



SEDs

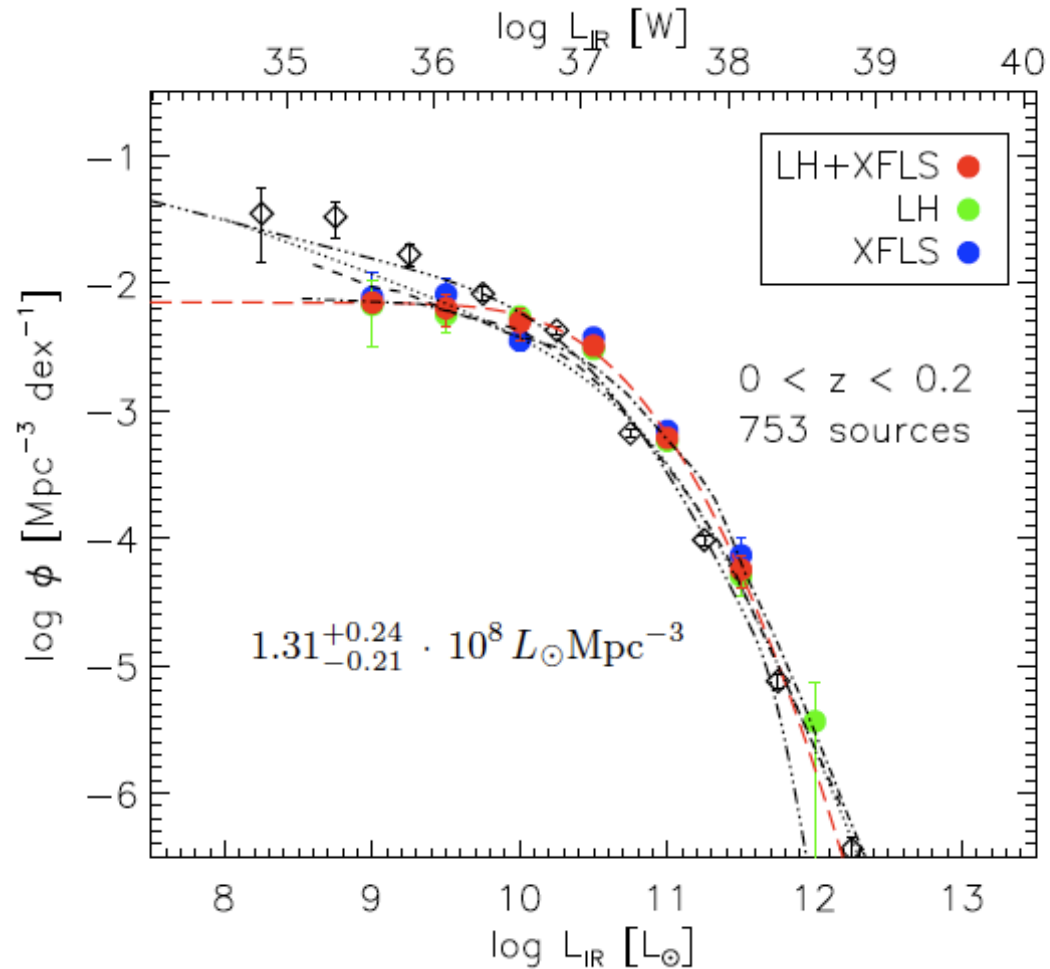
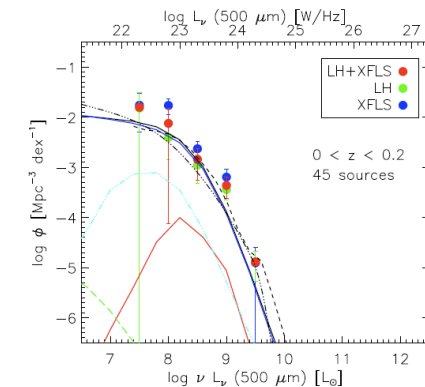
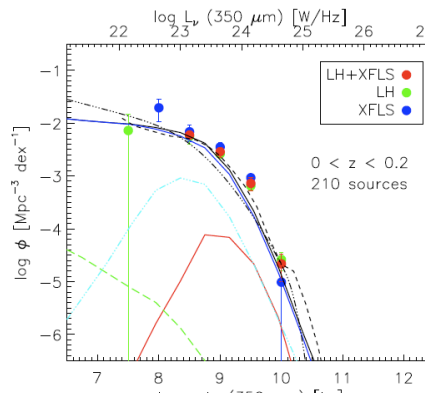
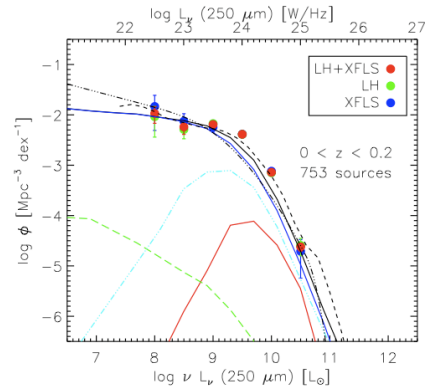


SFRs



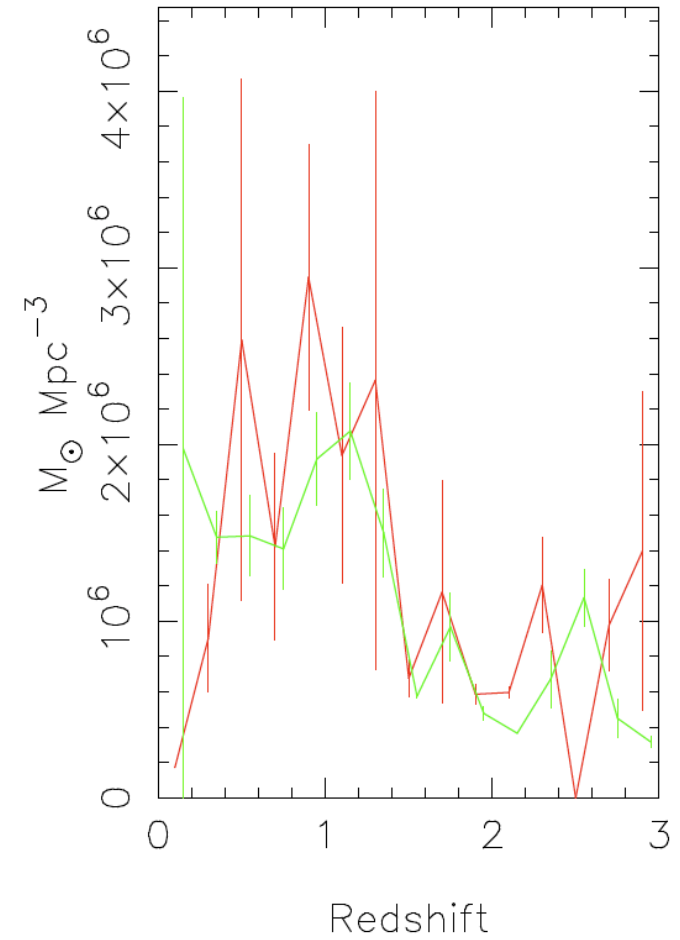
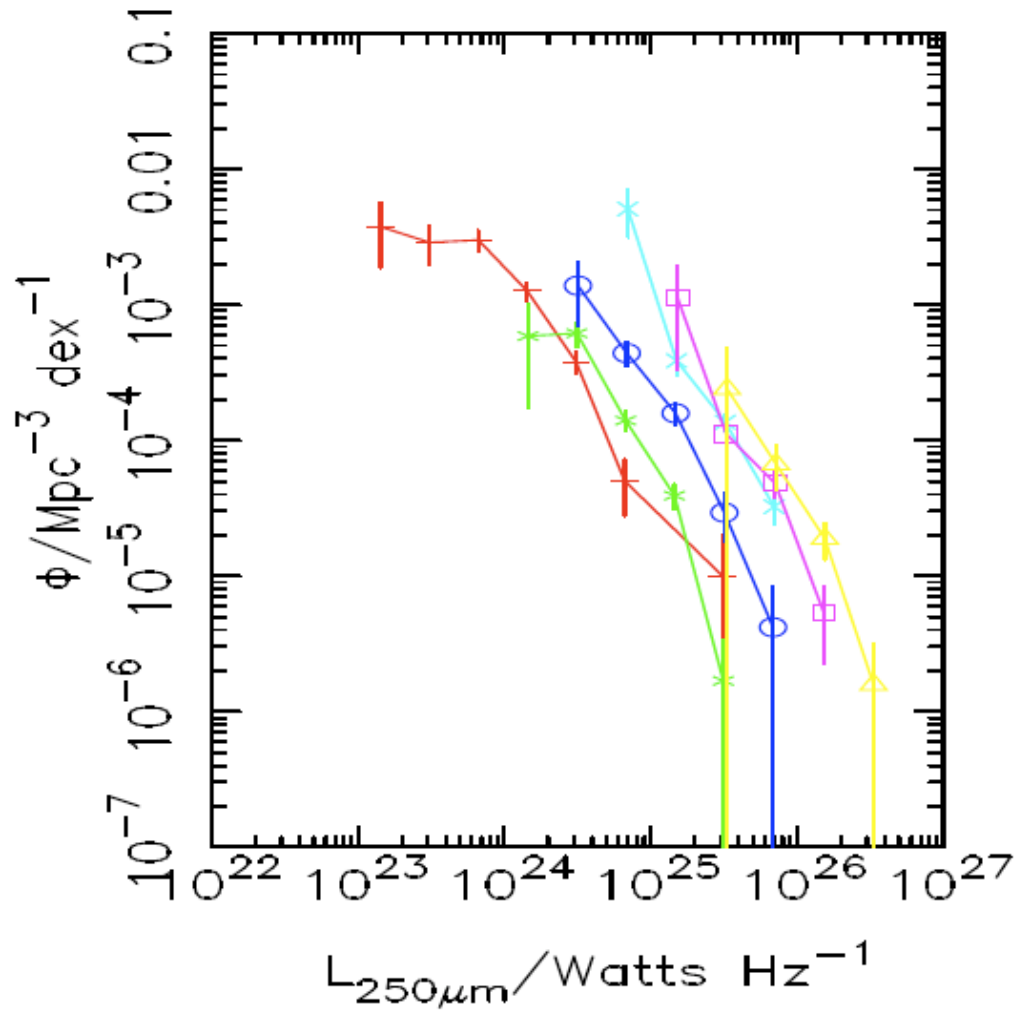
Buat et al. 2010, MNRAS in prep

FIR Luminosity Function



slightly more abundant local submillimeter population than predicted

SPIRE LFs

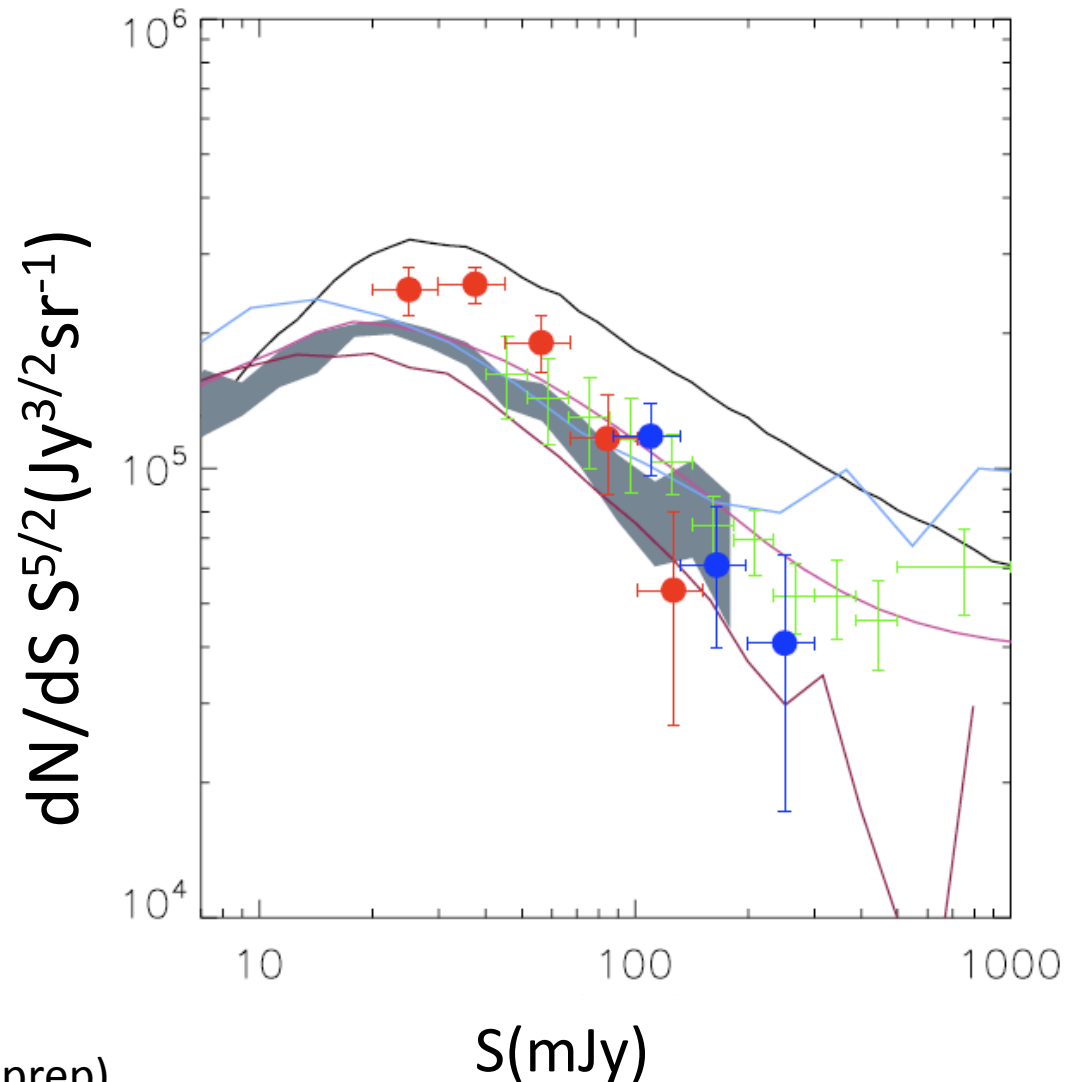


PACS Number counts 160 μ m

- Lockman North
- FLS
- FIDEL Bethermin et al (2010)

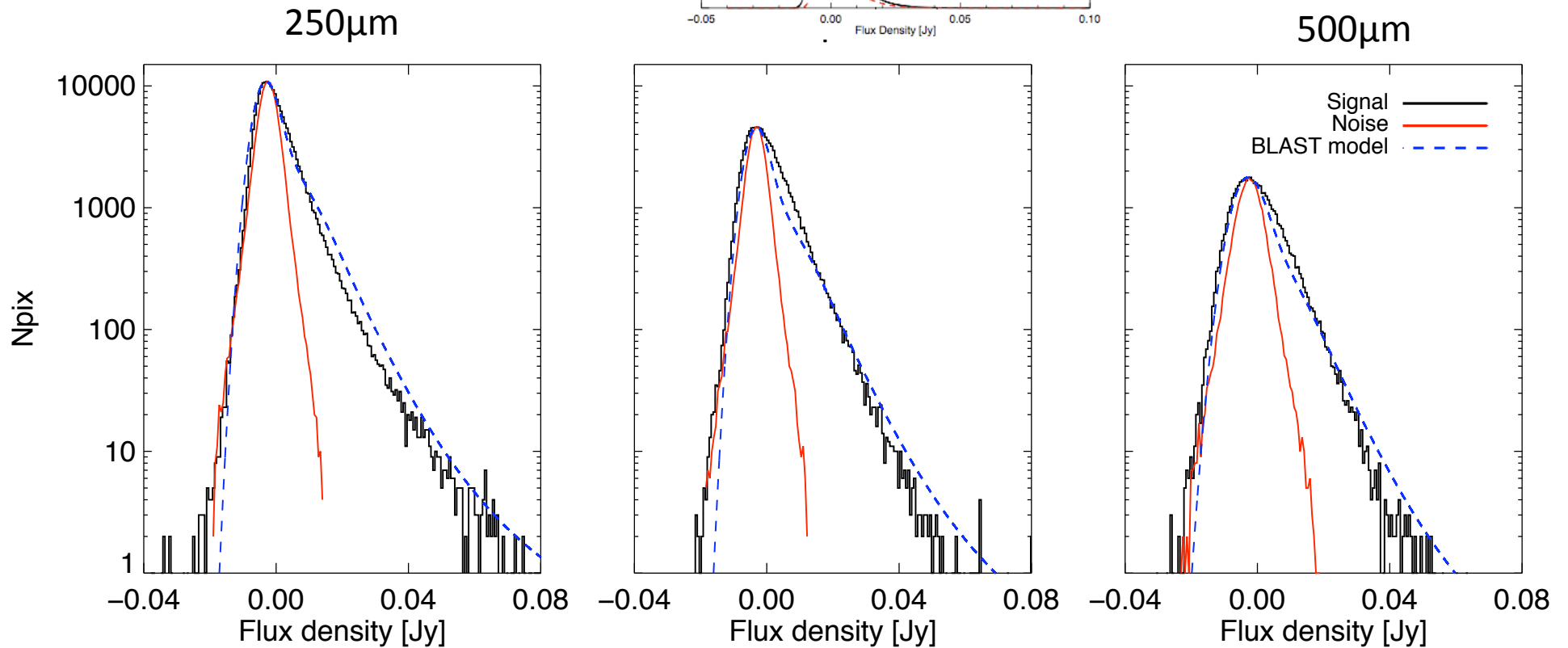
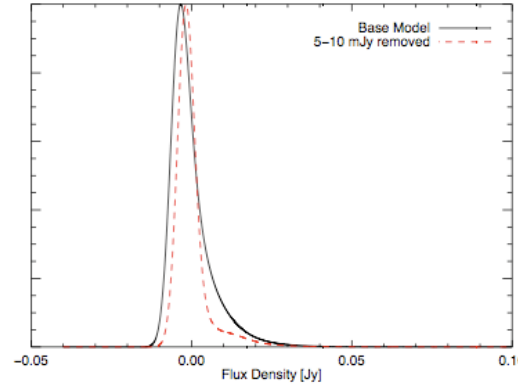
- Lagache, Dole, Puget 2004 (black)
- Leborgne et al. 2009 (blue)
- Valiante et al. 2009 (maroon)
- Rowan-Robinson (plum)
- Franceschini (Coral)

Aussel et al. 2010 (MNRAS in prep)

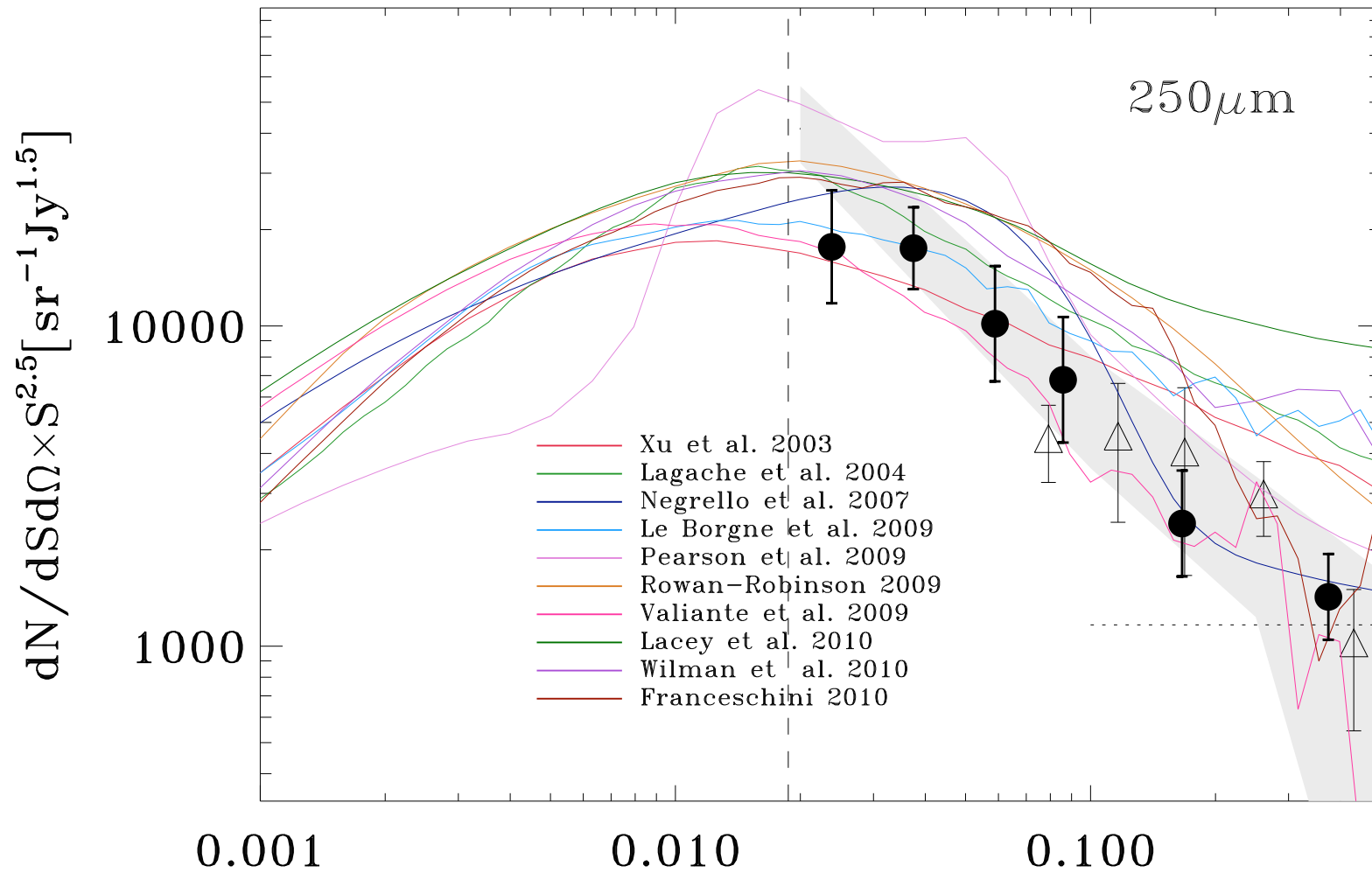


GOODS-N P(D) analysis

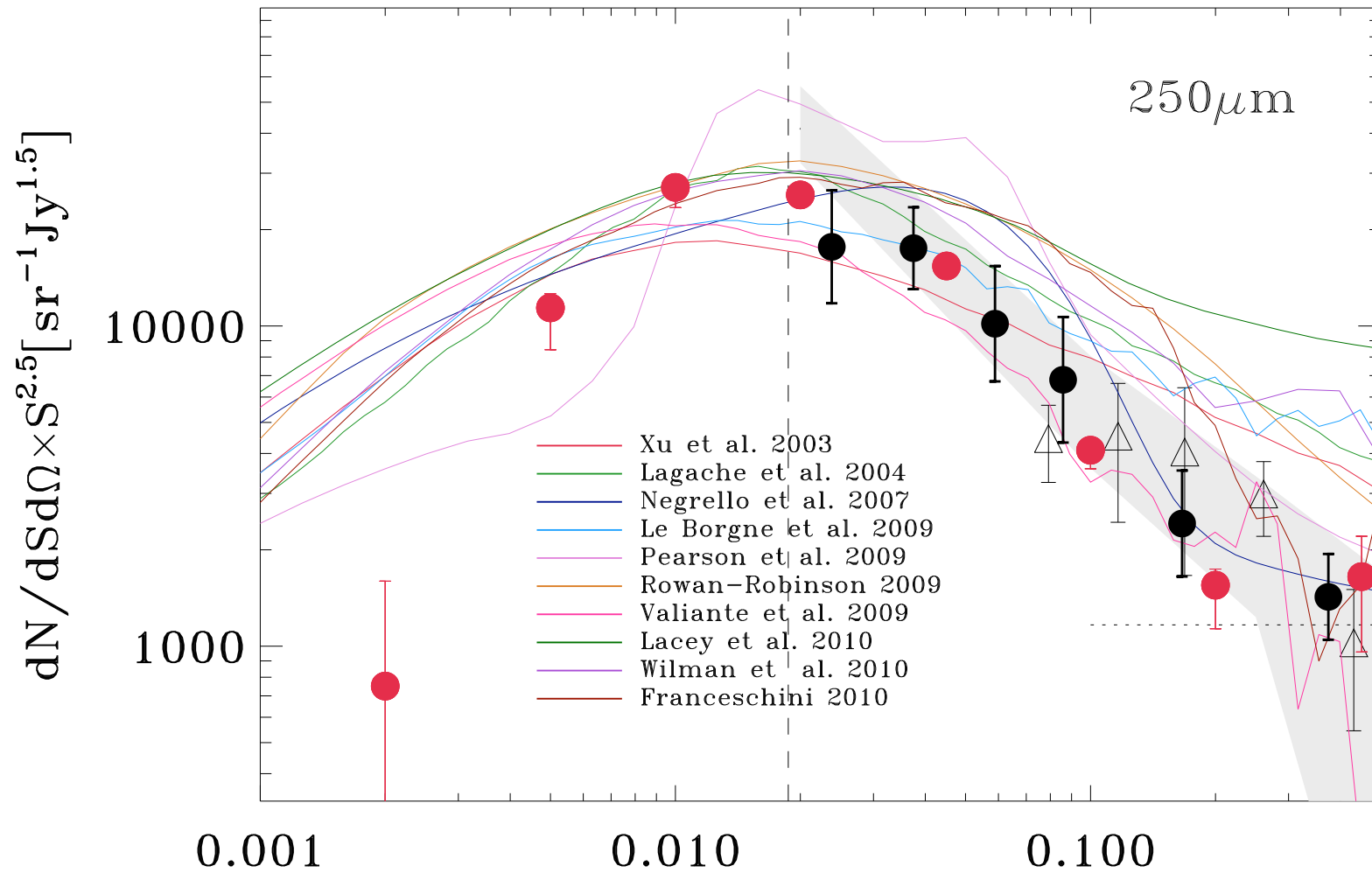
- Signal
- Instrumental Noise (jack-knife)
- - - Model from BLAST



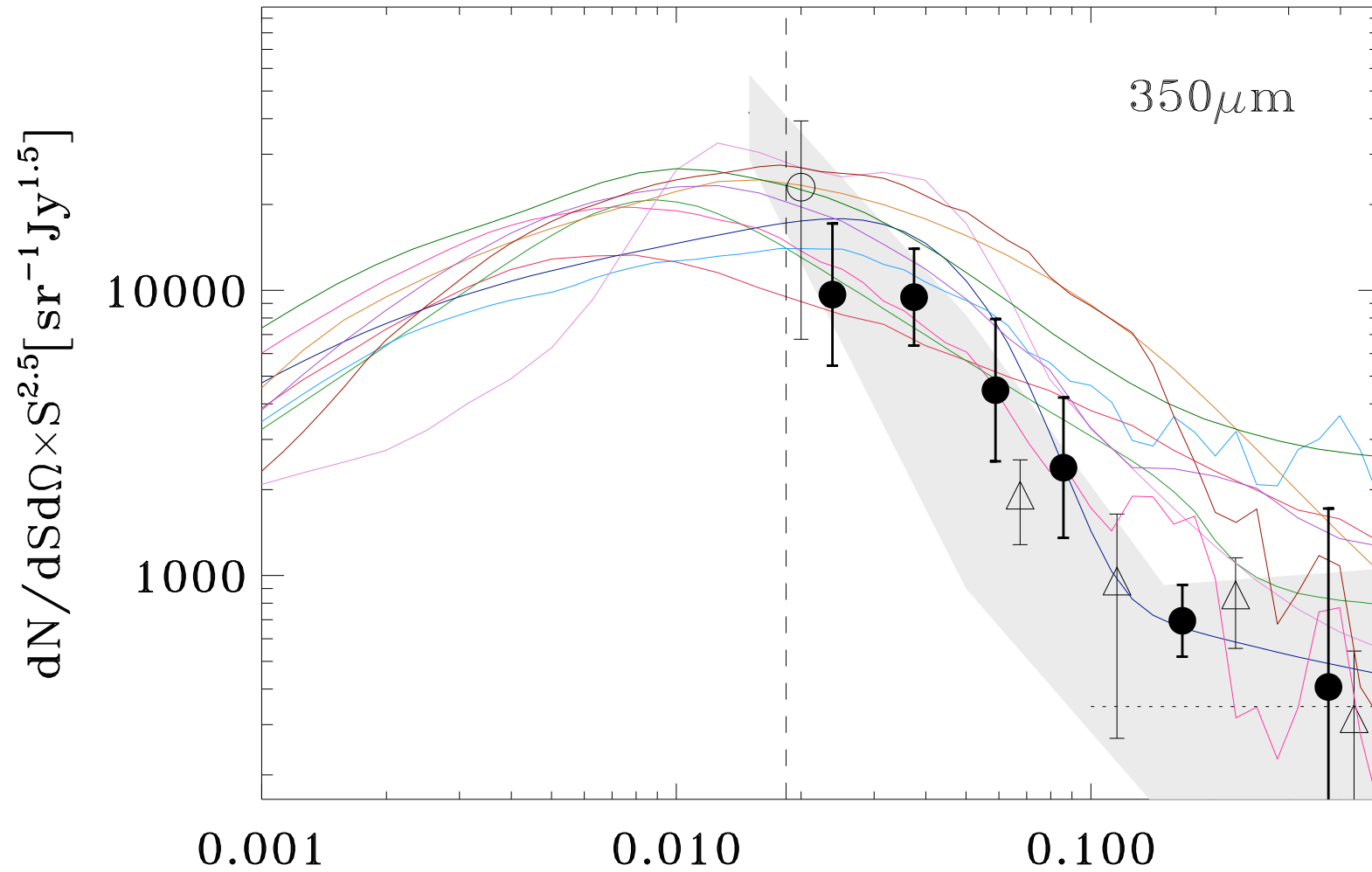
Resolved Sources



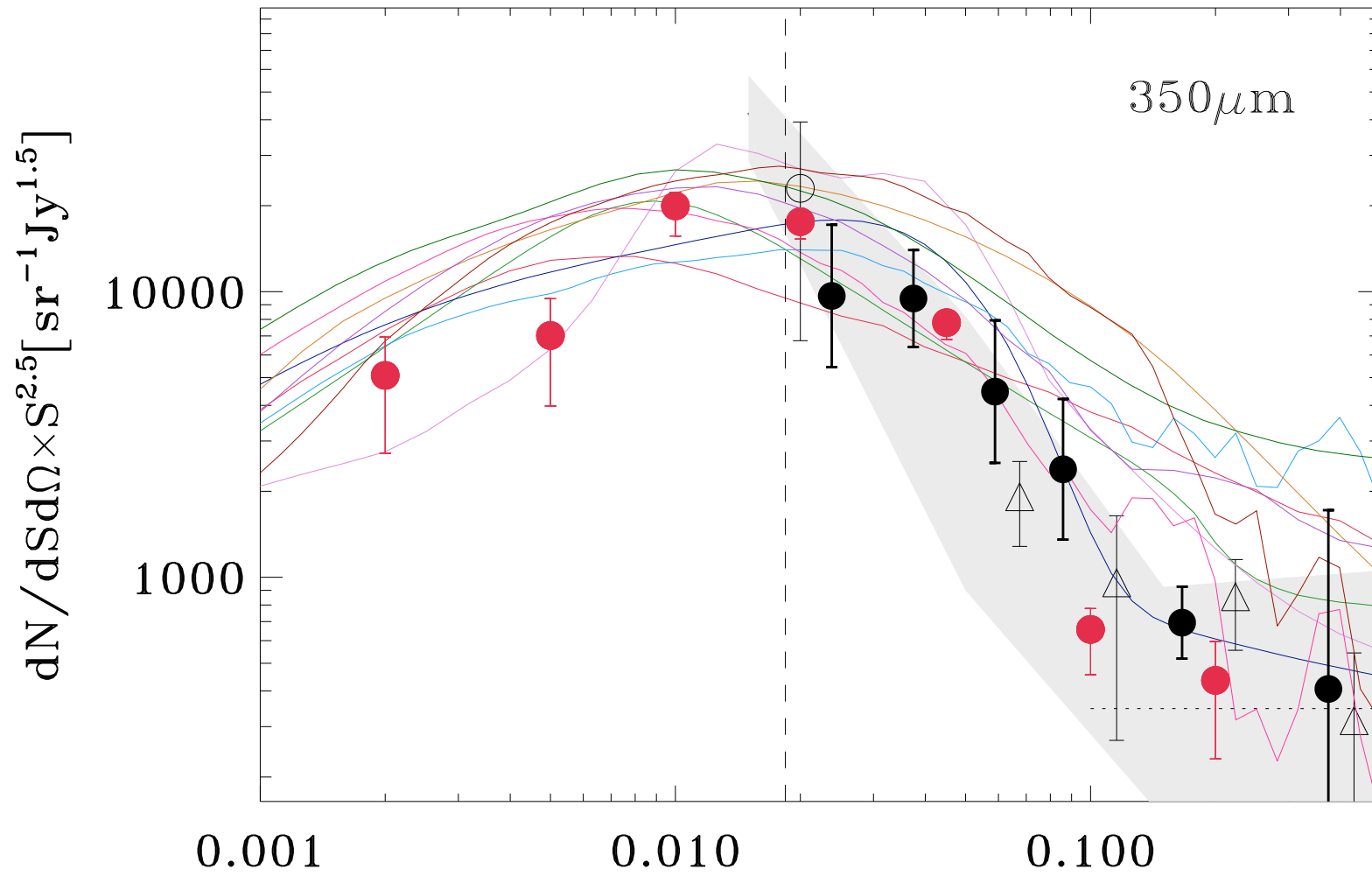
v. Preliminary P(D) results



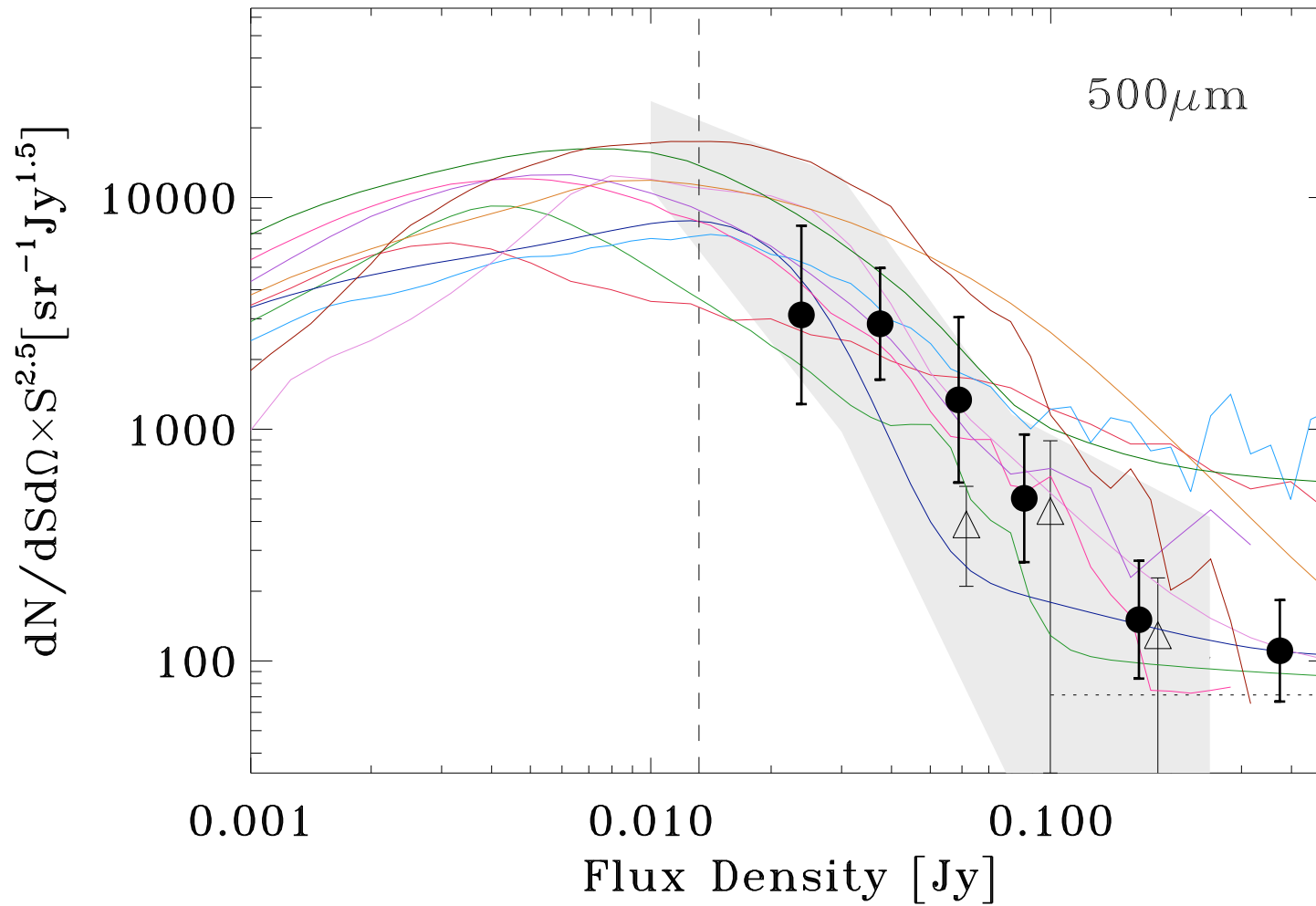
Resolved Sources



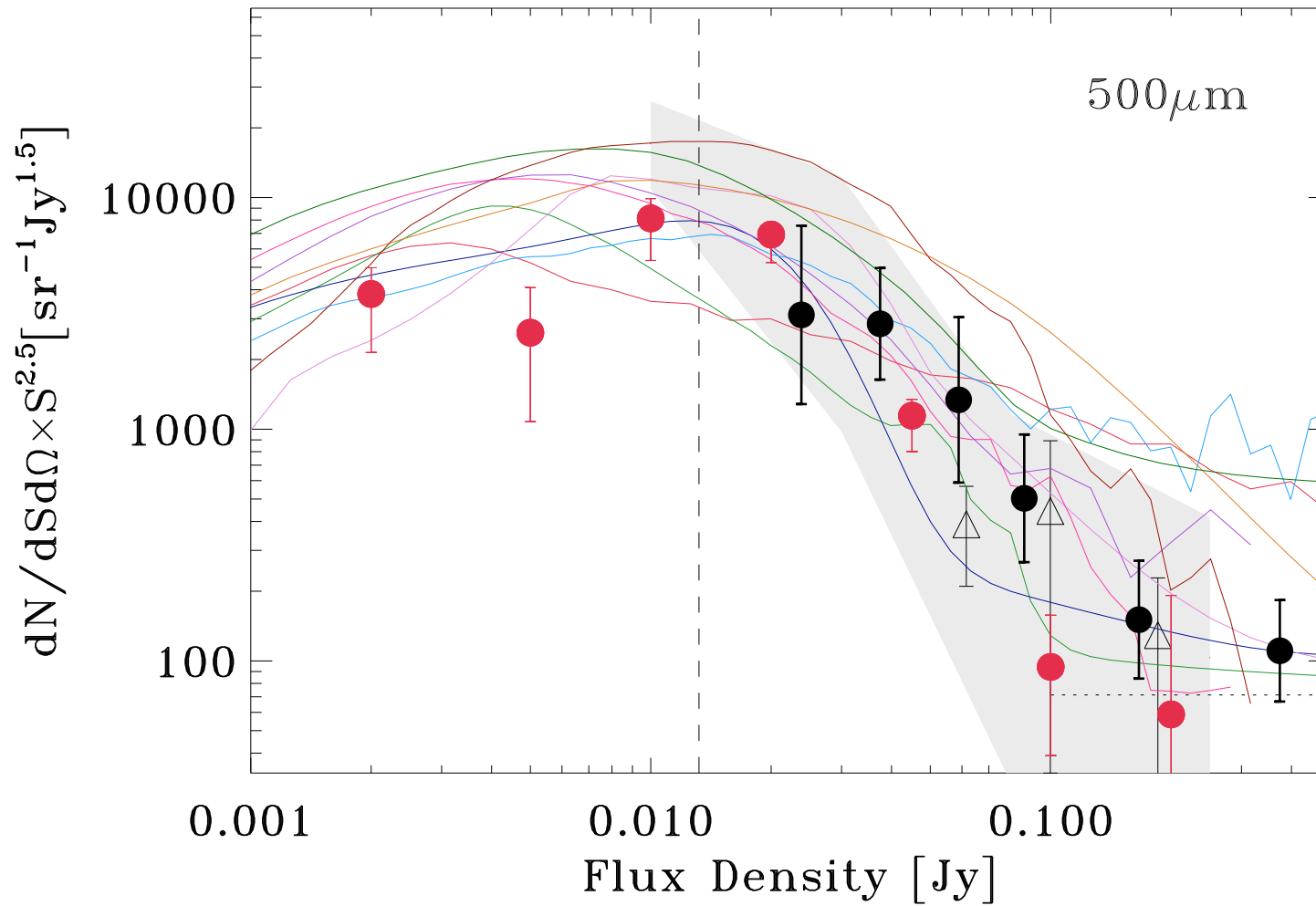
v. Preliminary P(D) results



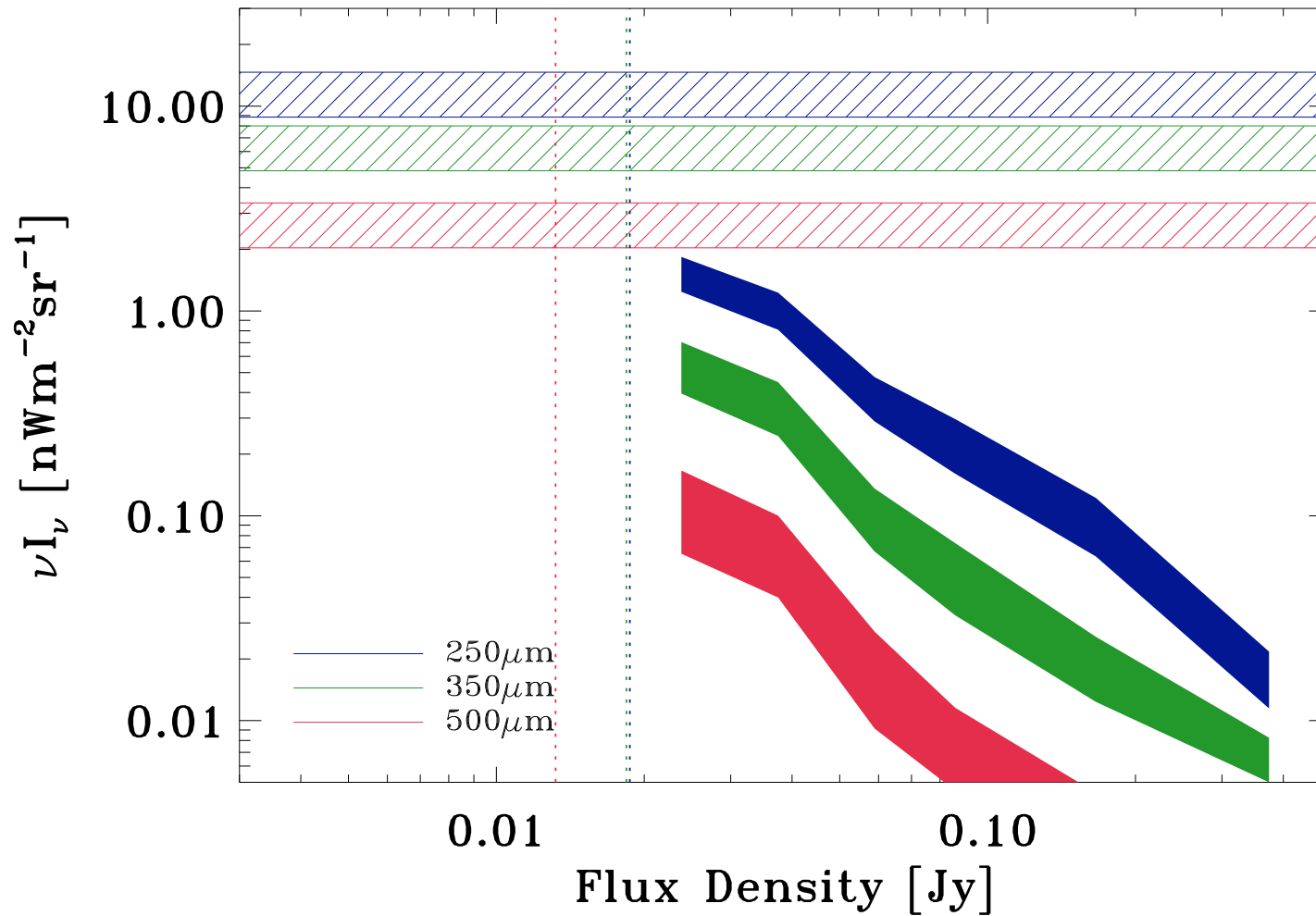
Resolved Sources



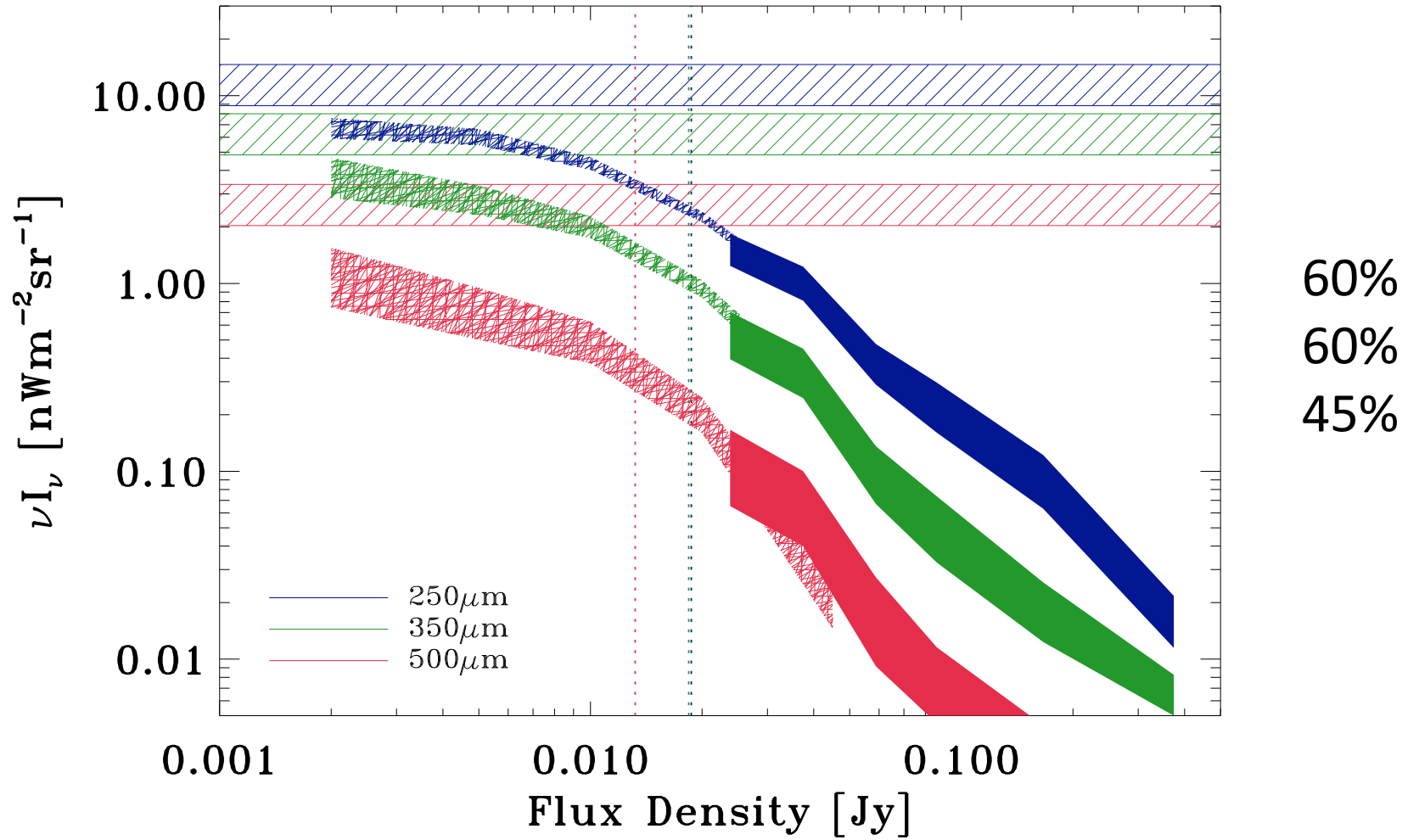
v. Preliminary P(D) results



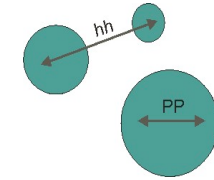
Resolving Background



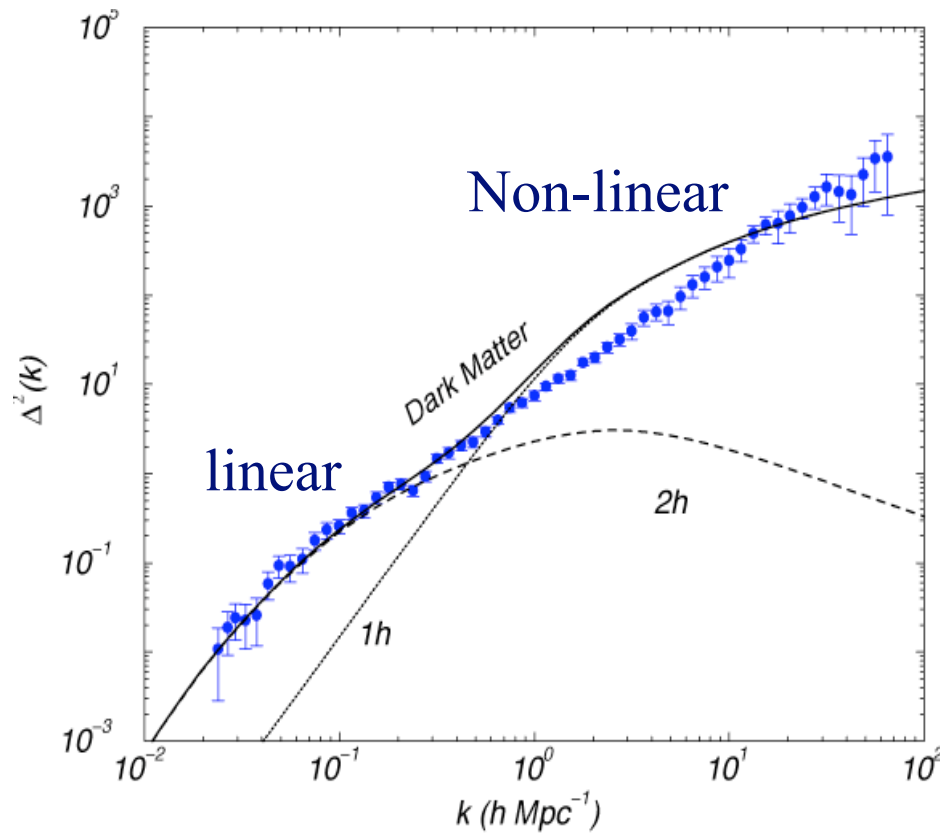
Background



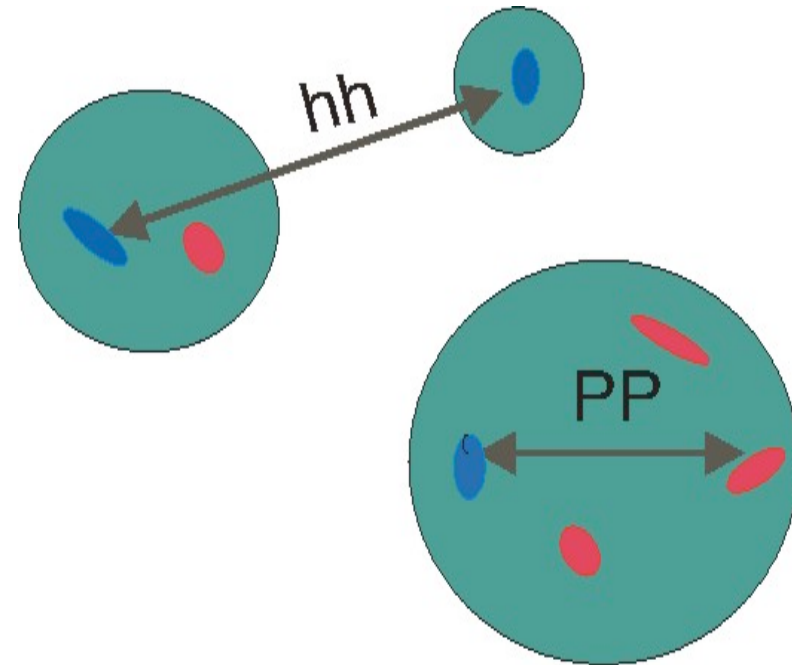
Dark Matter Statistics



Galaxy power spectrum:



How to construct galaxy statistics?

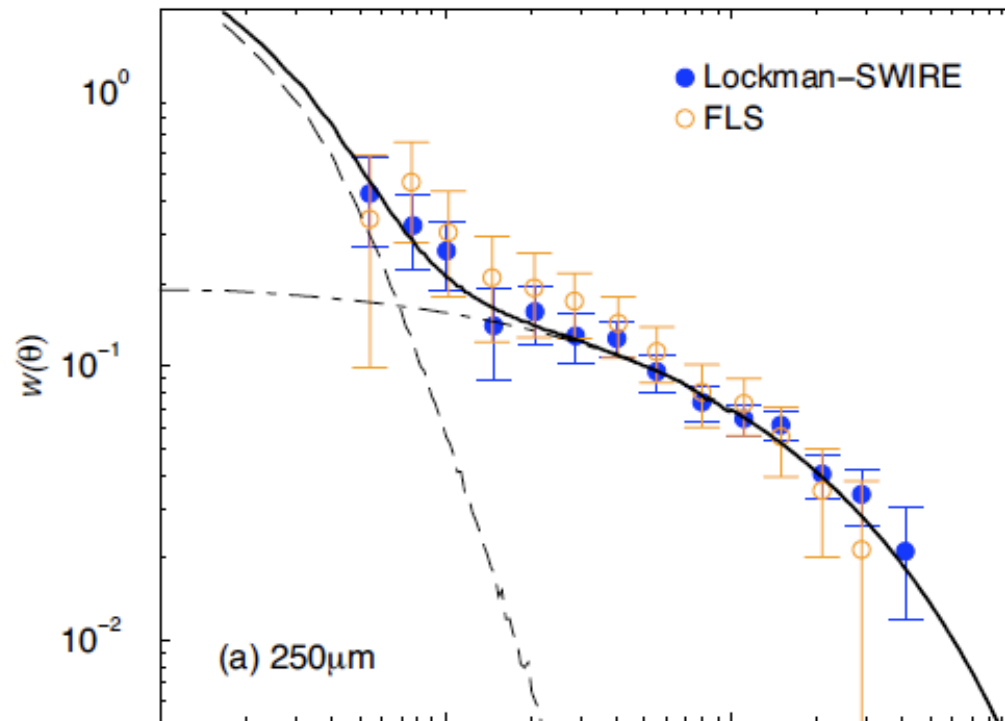


Dark matter power spectrum compared to galaxy Power spectrum from PCSZ Survey (Hamilton & Tegmark 2000)

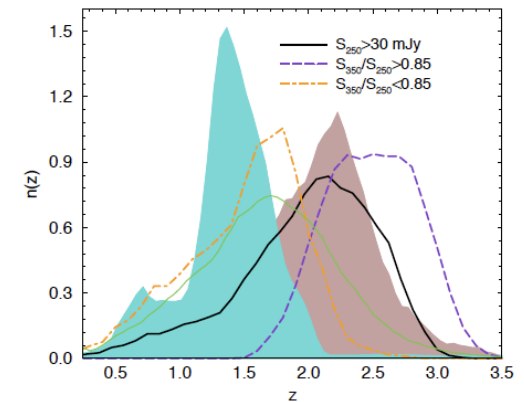
Need a scheme to populate dark matter halos with galaxies
(e.g. average number of galaxies per halo as a function of mass of the halo)

Correlation function

Resolved Sources in
Lockman-SW field



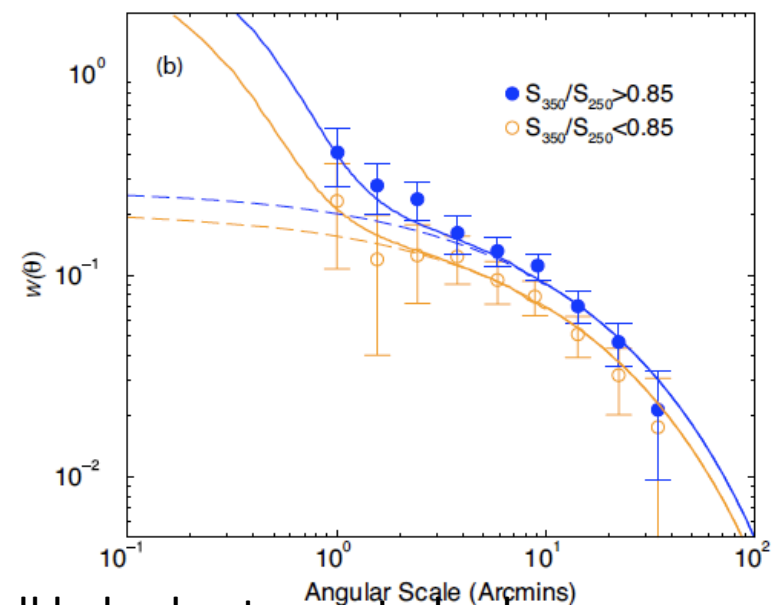
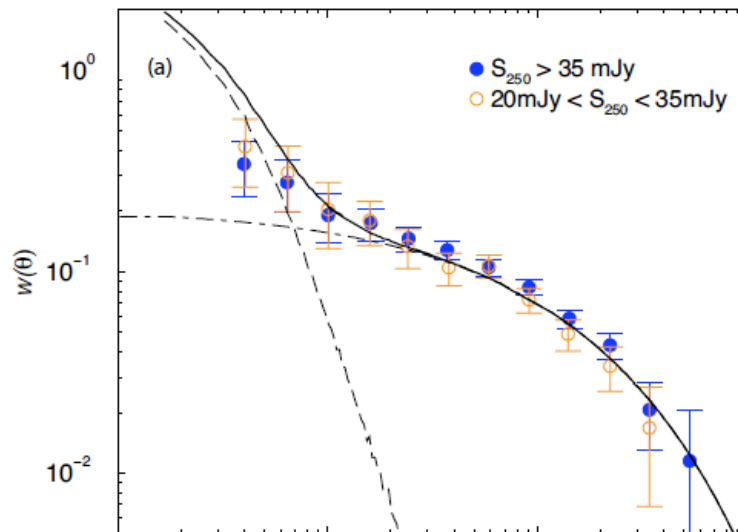
With sources
~8,000 in PSW
~5,000 in PMW
~1,700 in PLW



Previously sub-mm clustering
with SCUBA ~73 sources

Where are the galaxies?

Band	Flux density	N_{gal}	$\langle z \rangle$	$\log[M_{\text{min}}/M_{\odot}]$	$\log[M_{\text{sat}}/M_{\odot}]$	α_s	$\langle b \rangle_z$	f_s
250 μm	$S \gtrsim 30\text{mJy}$	8154	$2.1^{+0.4}_{-0.7}$	$12.6^{+0.3}_{-0.6}$	$13.1^{+0.3}_{-0.5}$	1.3 ± 0.4	2.9 ± 0.4	0.14 ± 0.08
350 μm	$S \gtrsim 30\text{mJy}$	4899	$2.3^{+0.4}_{-0.7}$	$12.9^{+0.4}_{-0.6}$	> 13.1	< 1.8	3.2 ± 0.5	< 0.20
500 μm	$S \gtrsim 30\text{mJy}$	1680	$2.6^{+0.3}_{-0.7}$	$13.5^{+0.3}_{-1.0}$	> 13.5	< 1.6	3.6 ± 0.8	< 0.24
Combined	$S_{350}/S_{250} \gtrsim 0.85$	3333	2.5 ± 0.4	$13.4^{+0.2}_{-0.3}$	> 13.4	< 1.8	3.4 ± 0.6	< 0.19
Combined	$S_{350}/S_{250} \lesssim 0.85$	3194	$1.7^{+0.5}_{-0.6}$	$12.8^{+0.3}_{-0.5}$	> 12.9	< 1.9	2.6 ± 0.6	< 0.26



M_{min} is the minimum halo mass above which all halos host a central galaxy

M_{sat} is the mass scale at which one satellite galaxy per halo is found,

α_s is the power-law slope of the satellite occupation number with halo mass

$\langle b \rangle_z$ average bias factor of the source sample given the redshift distribution

f_s the fraction of sources in a given sample that appear as satellites in massive dark matter halos

250 μm

350 μm

500 μm

Draft Schedule

- Launch 14th May 2009
- Dec 2009 ESA First Science workshop
- May 2010 ESA SDP Conference
- May-June 2010 EDR
- 22nd July OT AO due.
- ~July 2010 A&A issue
- Nov. 2010 (ROS+12) DR1
- Nov. 2012 (End of Mission) DR2

1 arcmin



250 μ m

350 μ m

500 μ m

Conclusions

GOODS-N

- So far ~ 20 sq. deg. of data at or near confusion limit at 250, 350, 500 μ m
- $>27,000$ galaxies today
- First luminosity functions, evolution and SEDs
- Count models need revision, cooler galaxies, or higher redshift
- Accounted for 50-60% of CIRB from 250-500 μ m
- Galaxies reside in dark matter halos with mass above $5 \pm 4 \times 10^{12} M_{\odot}$, $14 \pm 8\%$ are satellites in more massive halos.
- Will provide an important legacy

10 arcmin

