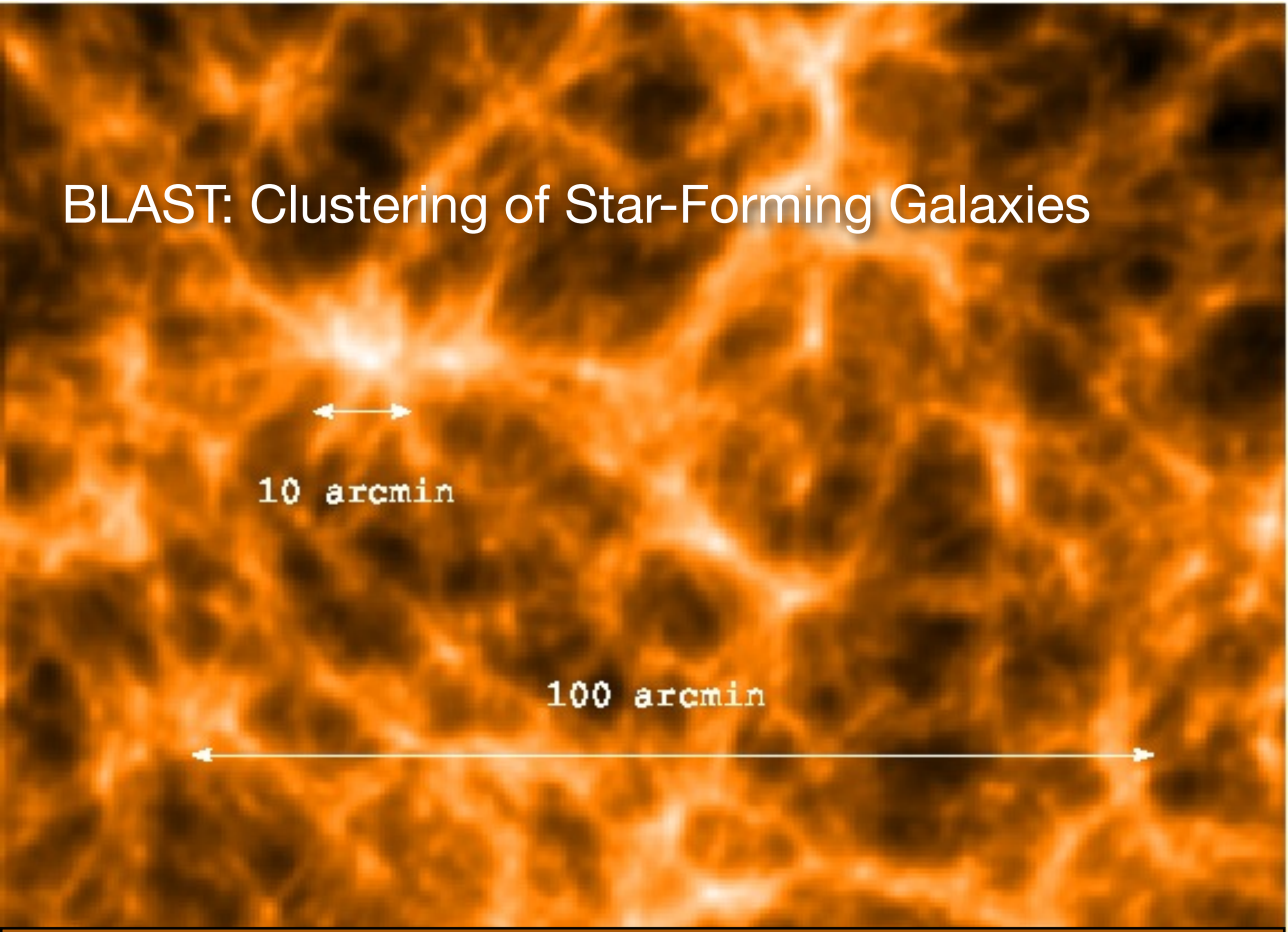
BLAST: Clustering of Star-Forming Galaxies



BLAST TEAM

UBC
Ed Chapin
Mark Halpern
Gaelen Marsden
Douglas Scott
Don Wiebe

CDF (France)
Guillaume Patanchon

U of T
Peter Martin
Barth Netterfield
Marco Viero

JPL
Jamie Bock

UPenn
Simon Dicker
Jeff Klein
Marie Rex
Chris Semisch
Matt Truch

Brown University
Greg Tucker

U of Miami
Josh Gundersen
Nick Thomas

INAOE (Mexico)
David Hughes
Itziar Aretxaga

U Puerto Rico
Luca Olmi

Cardiff University
Peter Ade
Matt Griffin
Peter Hargrave
Phil Mauskopf
Carole Tucker
Enzo Pascale
Lorenzo Moncelsi

Open University
Mattia Negrello

Observing Dusty Galaxies with BLAST

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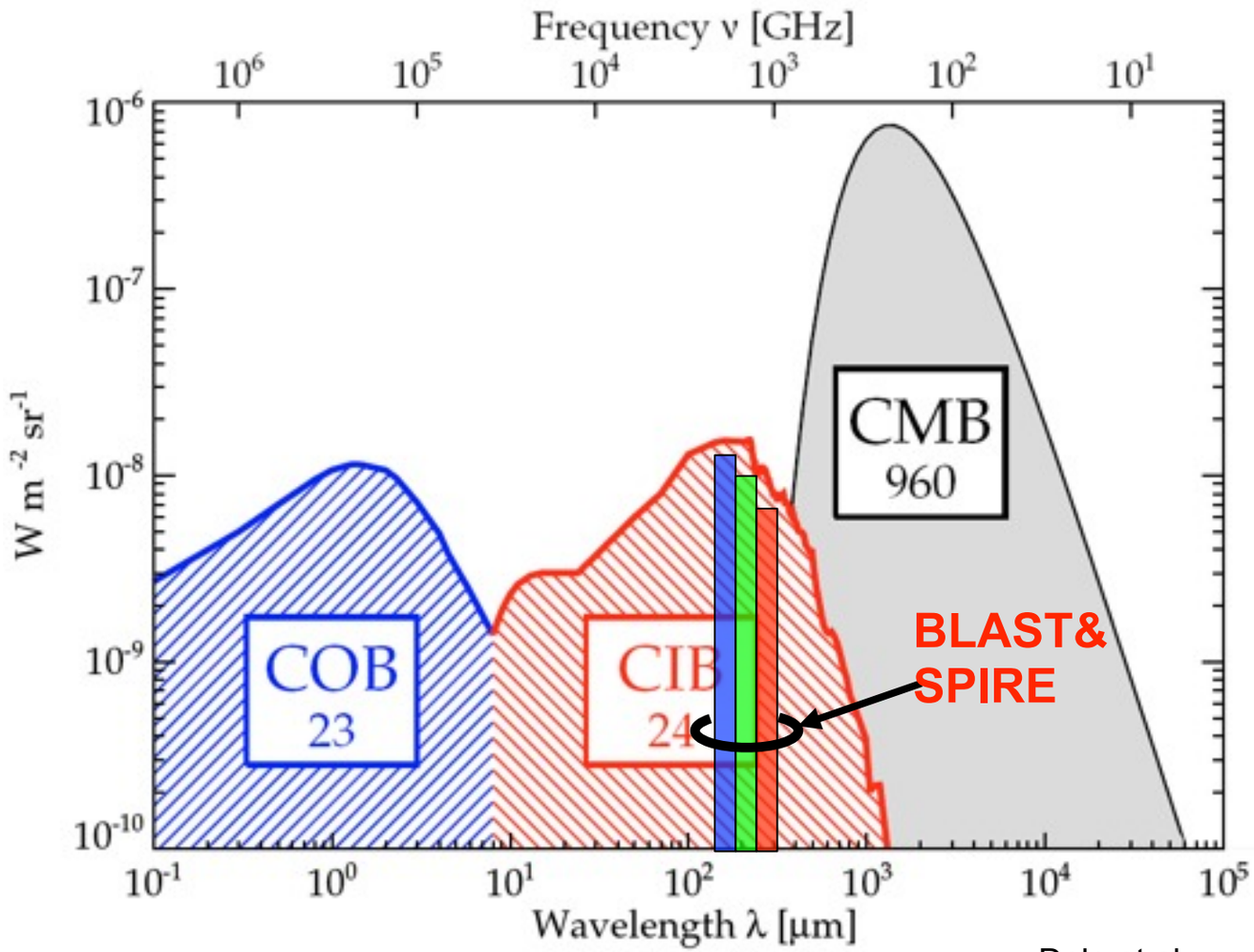
- Half of all light emitted by stars is absorbed and reradiated in the IR



Dole et al.

Observing Dusty Galaxies with BLAST

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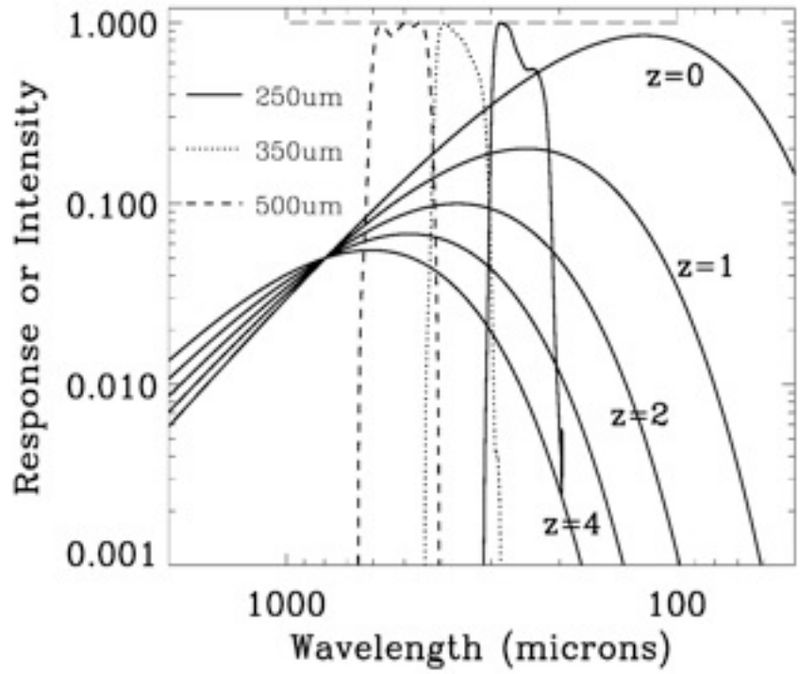

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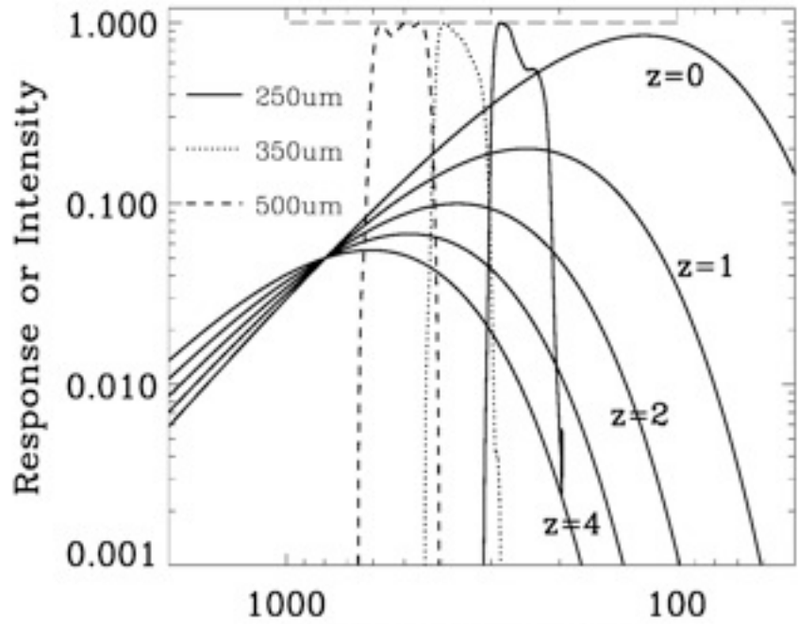

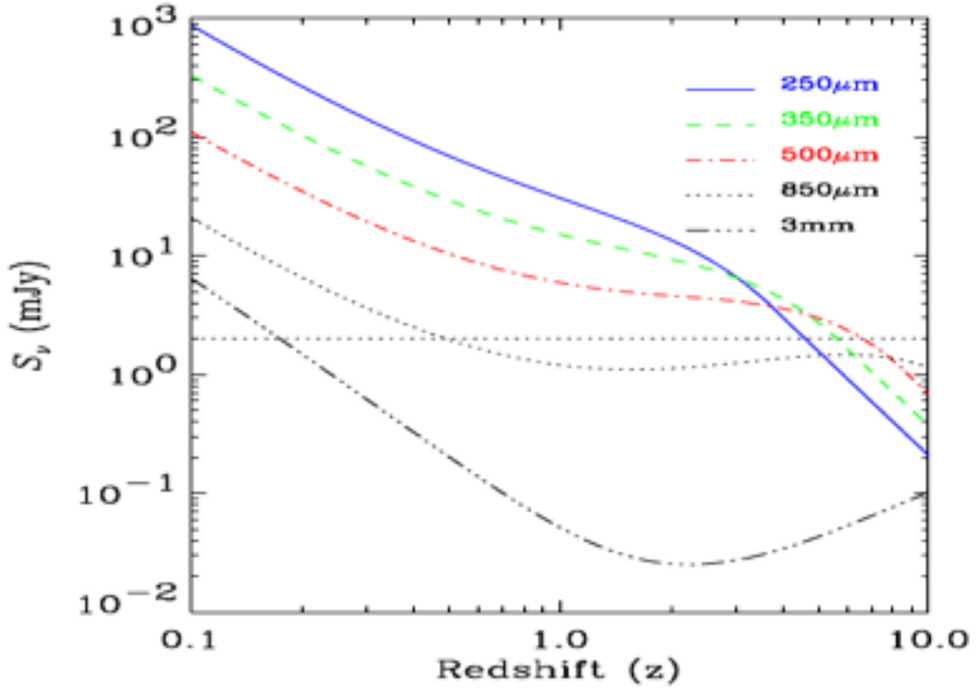

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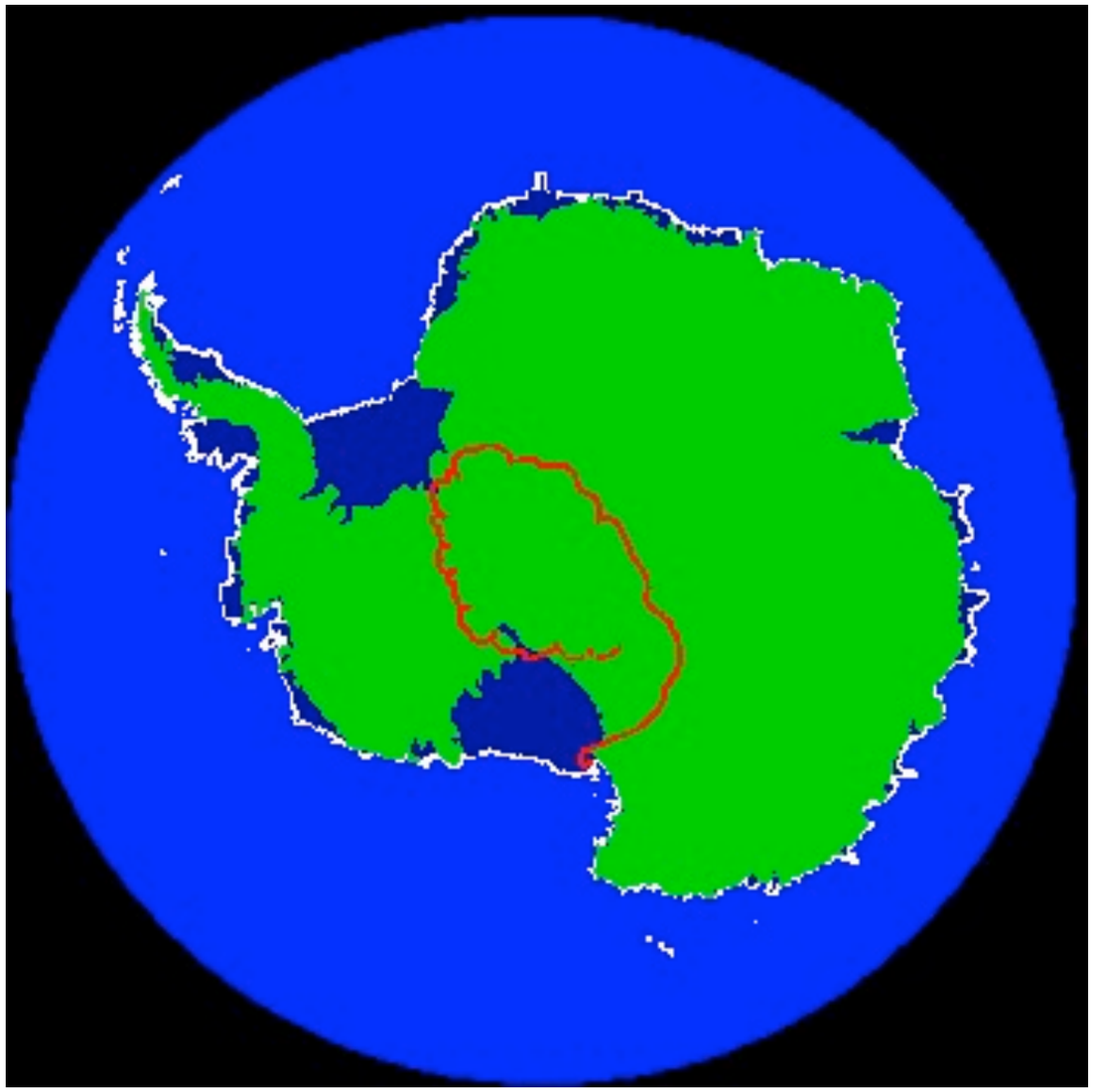

Observing Dusty Galaxies with BLAST

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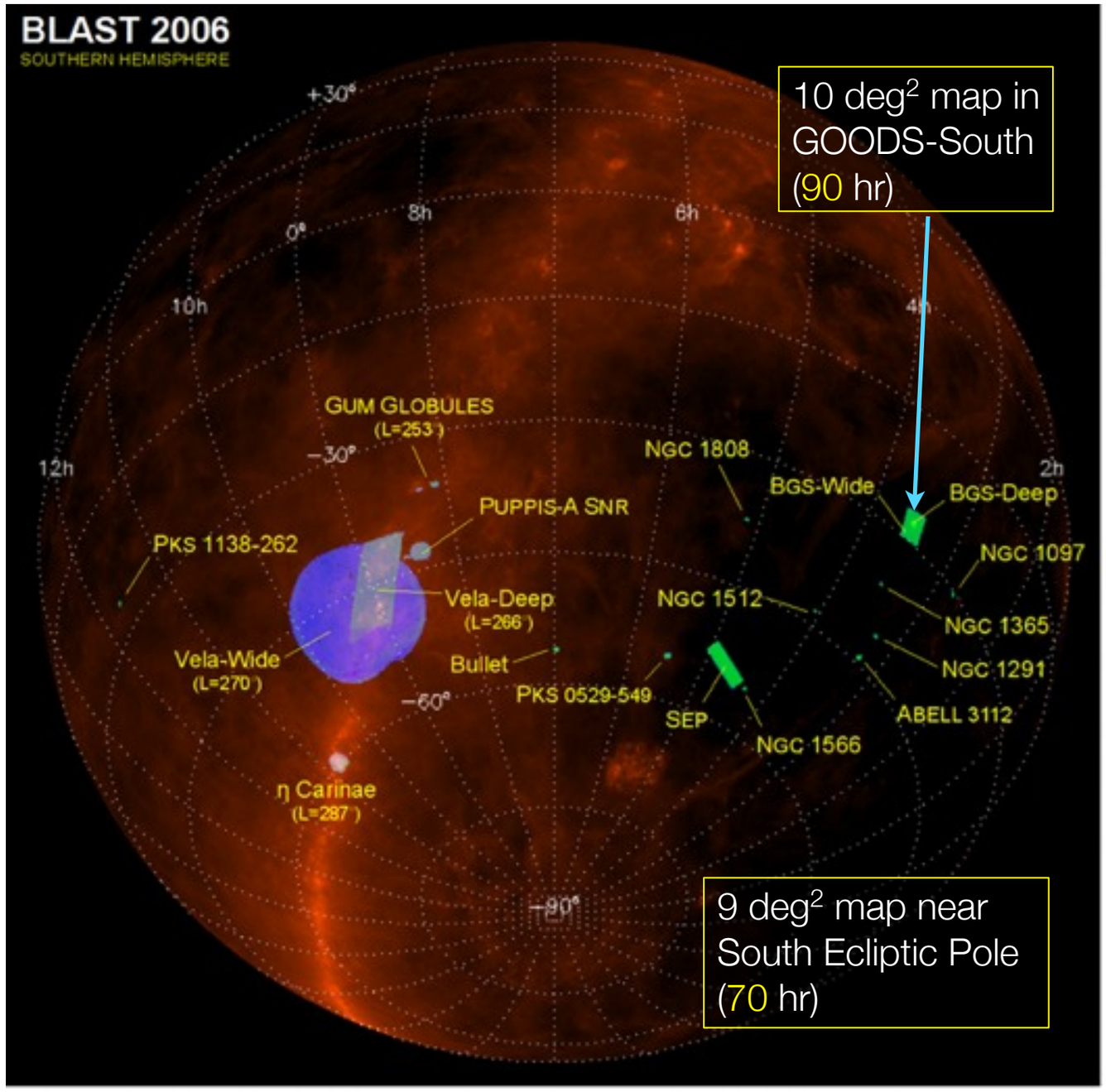
- 10 day flight from Antarctica
- Two ~10 deg^2 extragalactic fields



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2. “BLAST: Resolving the Cosmic Submillimeter Background”, G. Marsden et al. 2009, Astrophysical Journal, 707, 1766

3. “BLAST: A Far-Infrared Measurement of the History of Star Formation”, E. Pascale et al. 2009, Astrophysical Journal, 707, 1740

4. “BLAST: Correlations in the Cosmic Far-Infrared Background at 250, 350, and 500 um Reveal Clustering of Star-Forming Galaxies”, M. P. Viero et al. 2009, Astrophysical Journal, 707, 1766

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11. “The Balloon-borne Large Aperture Submillimeter Telescope (BLAST) 2006: Calibration and Flight Performance”, M. D. P. Truch et al. 2009, Astrophysical Journal, 707, 1824

12. “Temperature Profiles and the Effect of AGN on Submillimeter Emission from BLAST Observations of Resolved Galaxies”, D. V. Wiebe et al. 2009, 707, 1809

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14. “The BLAST Survey of the Vela Molecular Cloud: Physical Properties of the Dense Cores in Vela-D”, L. Olmi et al. 2009, AstrophysicalJournal, 707, 1836

15. “AKARI and BLAST Observations of the Cassiopeia A Supernova Remnant and Surrounding Interstellar Medium”, B. Sibthorpe et al., 2009, Astrophysical Journal, submitted, arXiv:0910.1094

Motivation

- Why Clustering?
  - On large scales:
    - relates galaxy formation to structure formation
    - find typical halo masses which host galaxy populations
  - On small scales:
    - distribution of galaxies within halos
  - Link galaxy populations through cosmic time

Outline

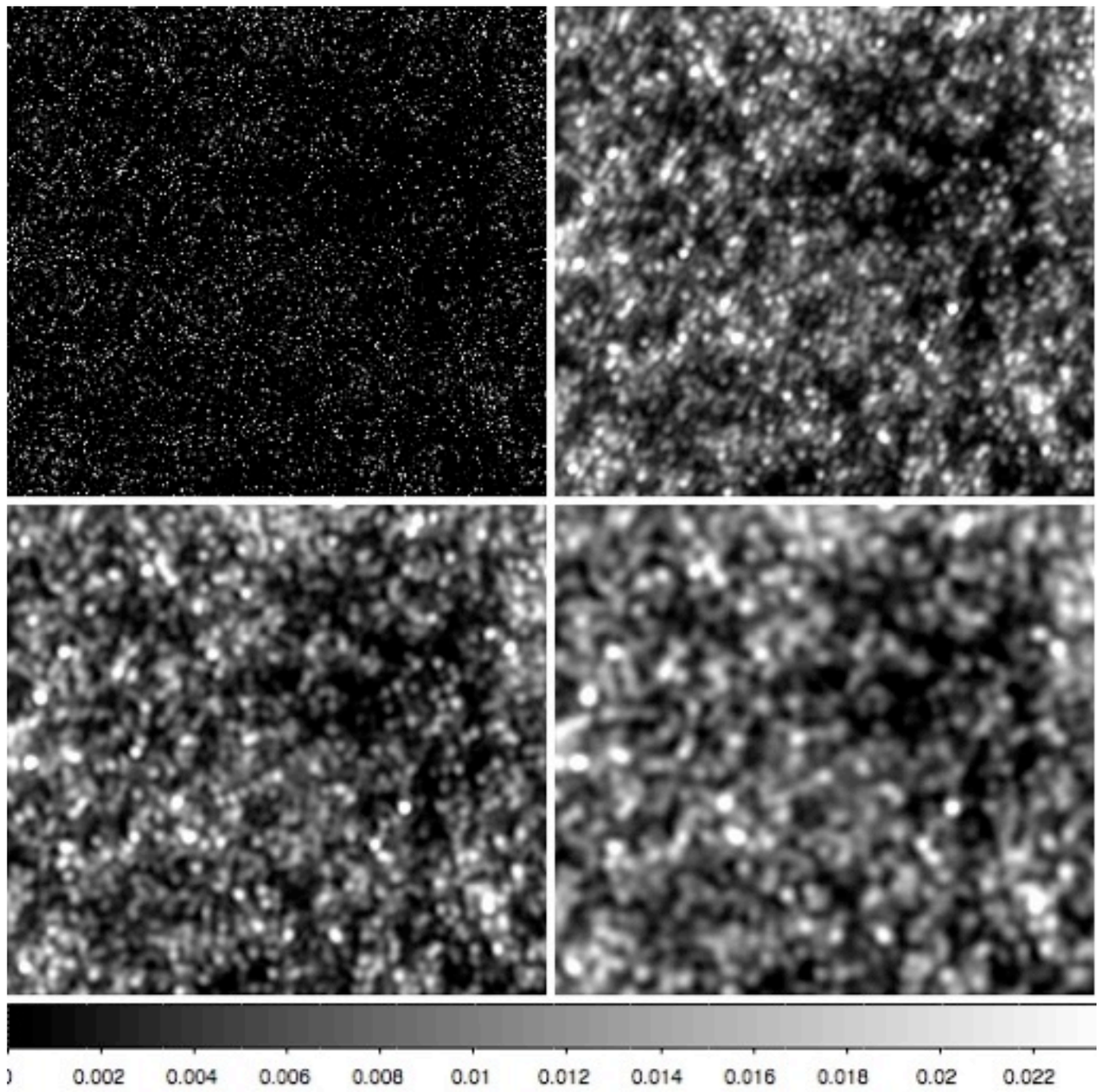
- Measurements - maps vs. catalogues
  - Complications
  - Maximizing information
- BLAST
  - Clustering from correlations of background fluctuations
  - Physical Interpretation
- Implications

Measurements

Complications

Complications

- While *large scales* well traced



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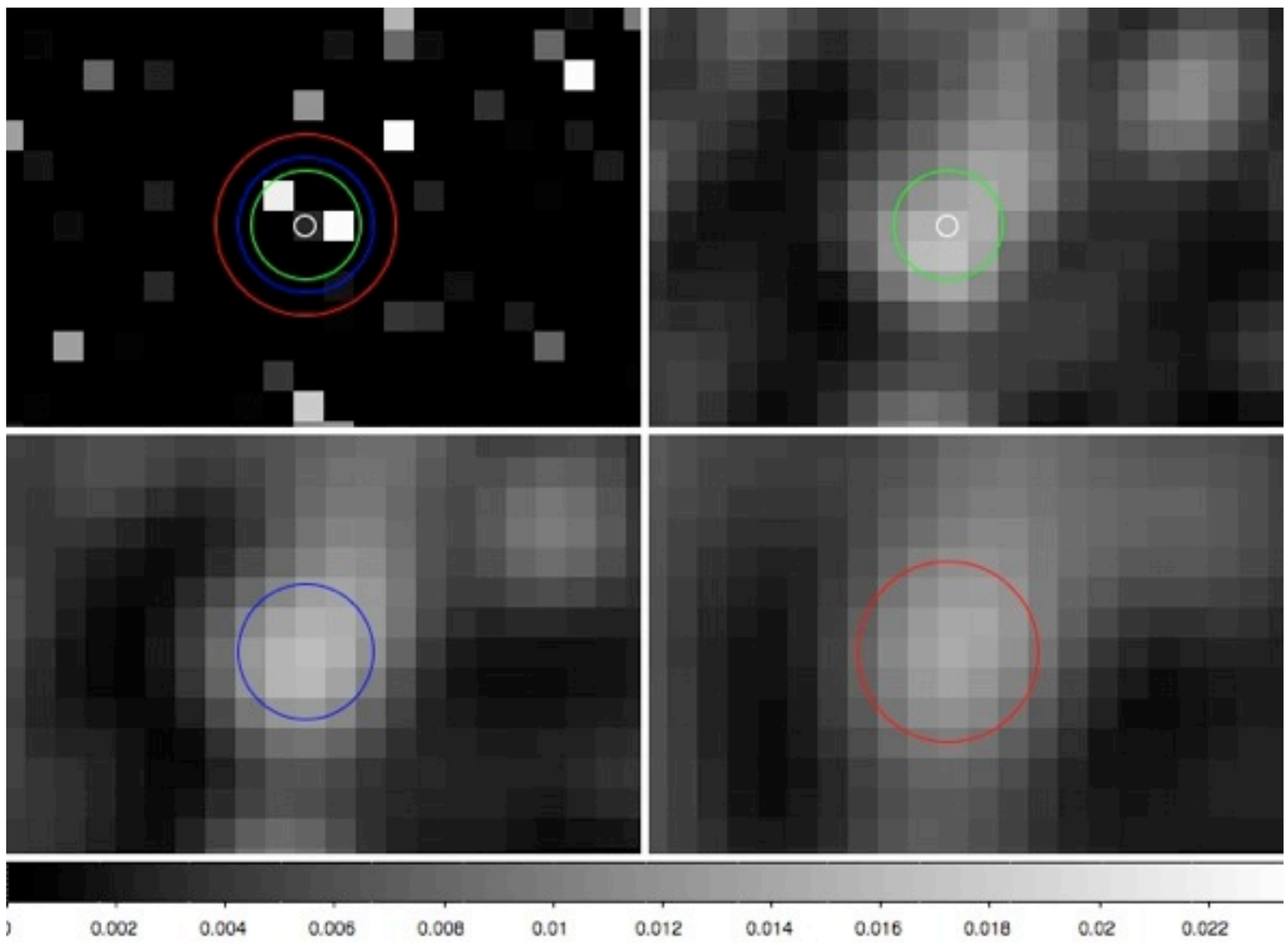

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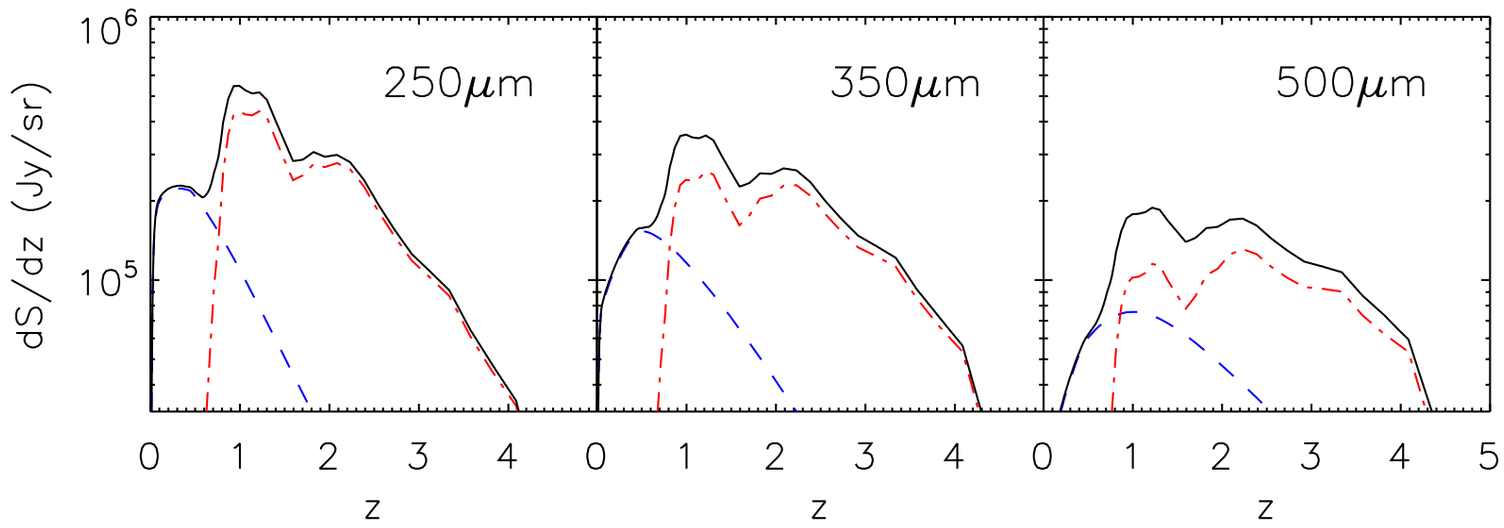

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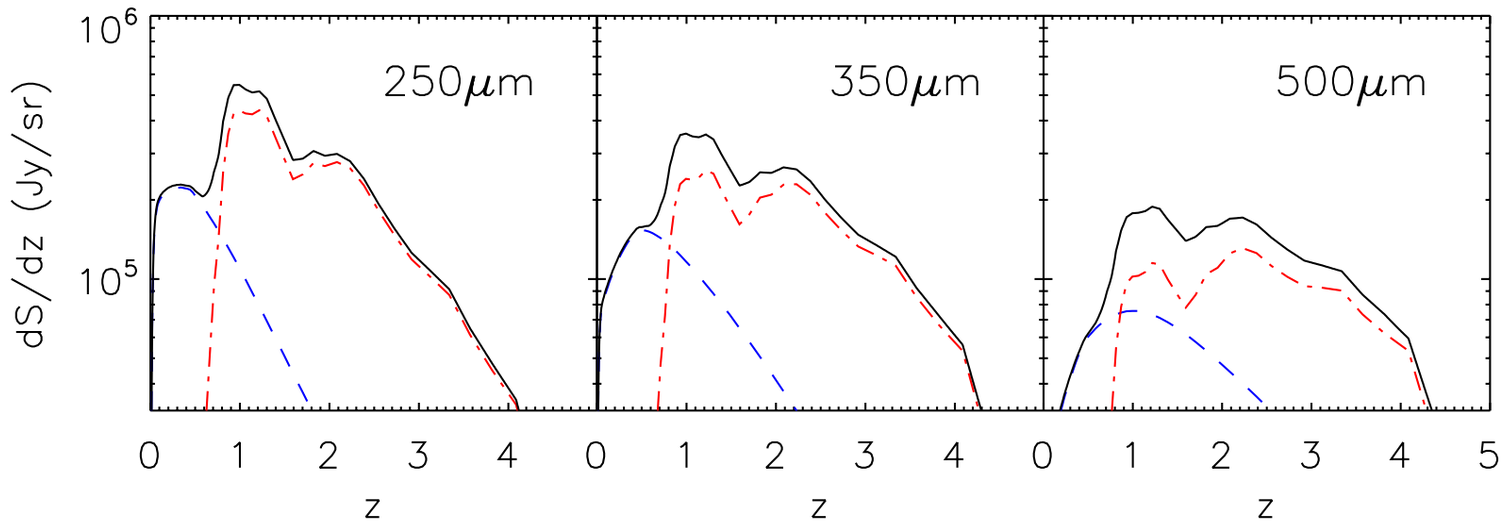
- Confusion limits number of sources / area, i.e., **more sources = more area**



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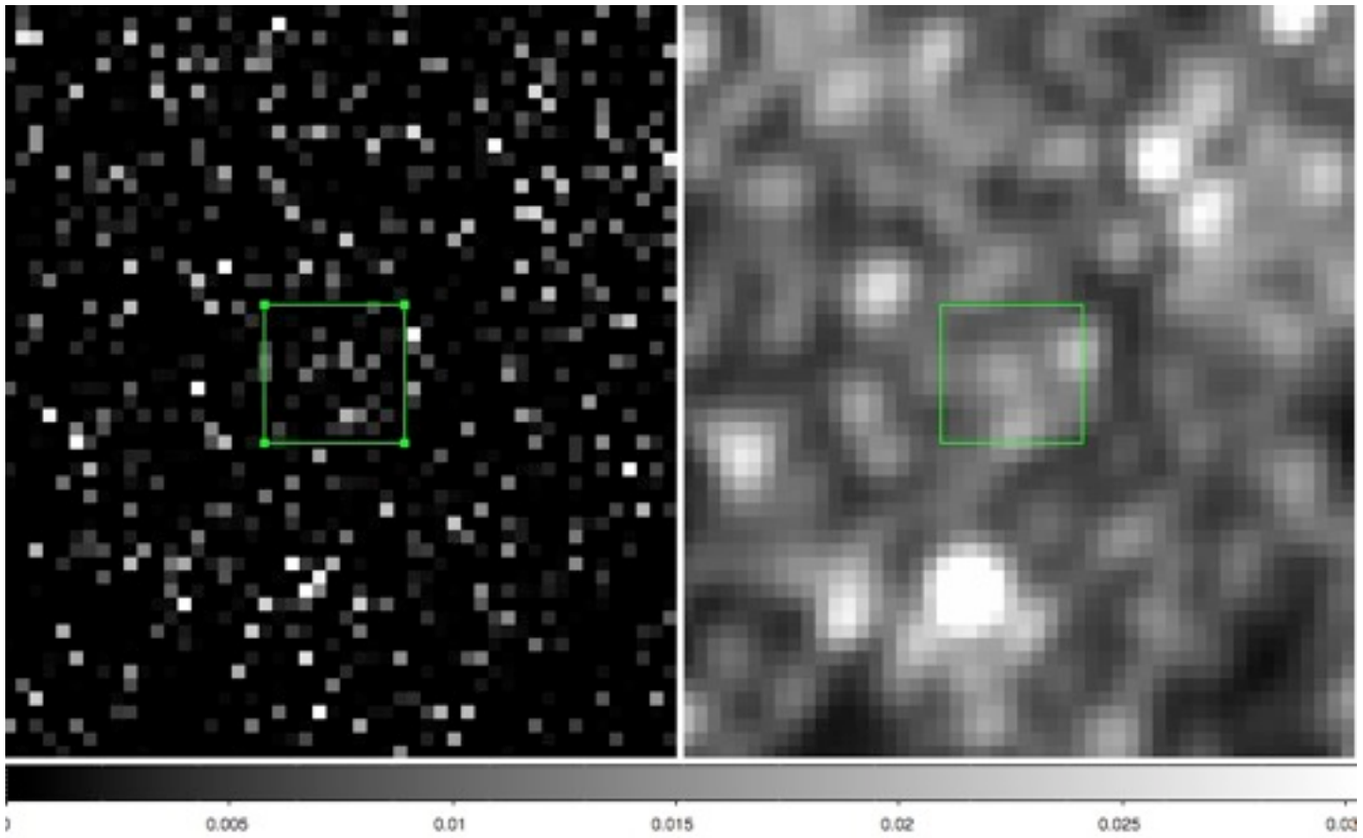

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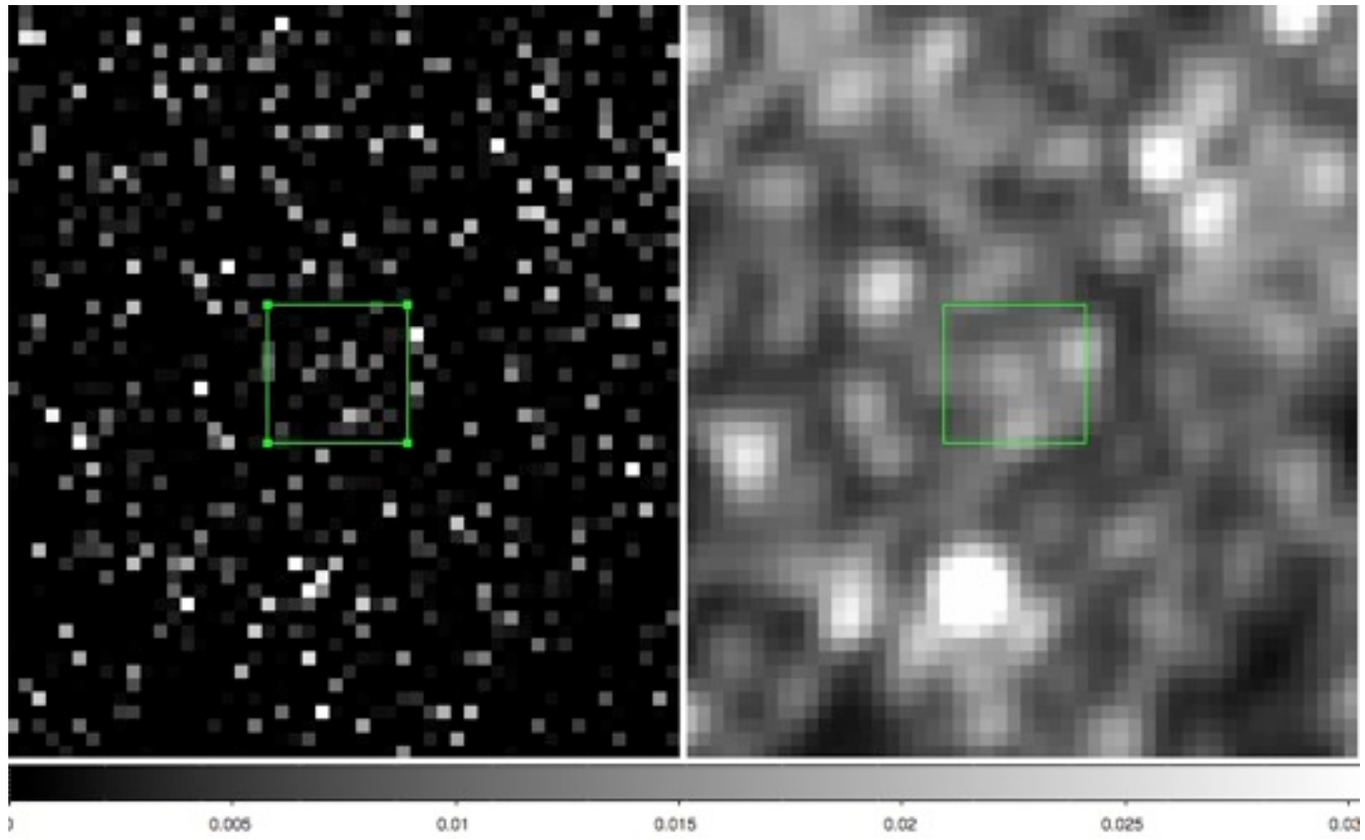

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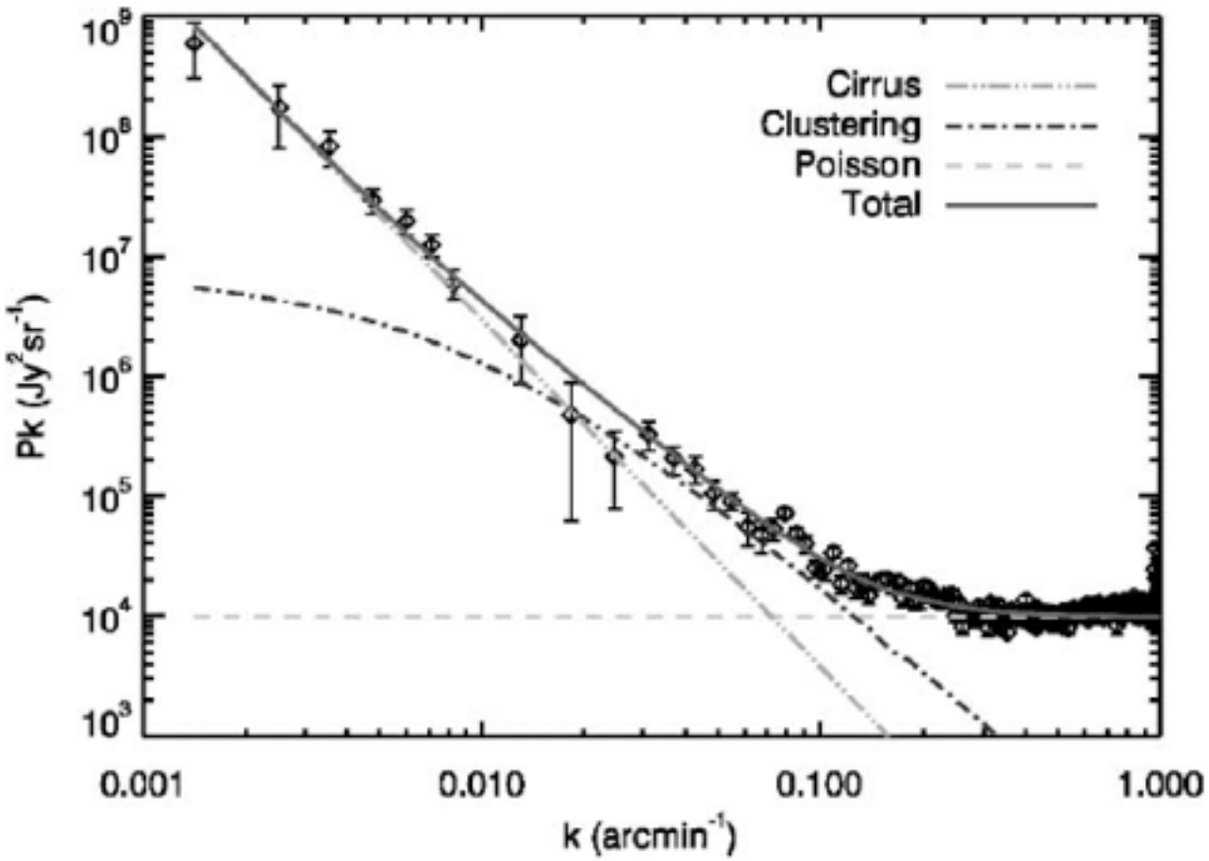
  - Grossan & Smoot 2007 (Spitzer 160um)



Lagache+ 2007

BLAST

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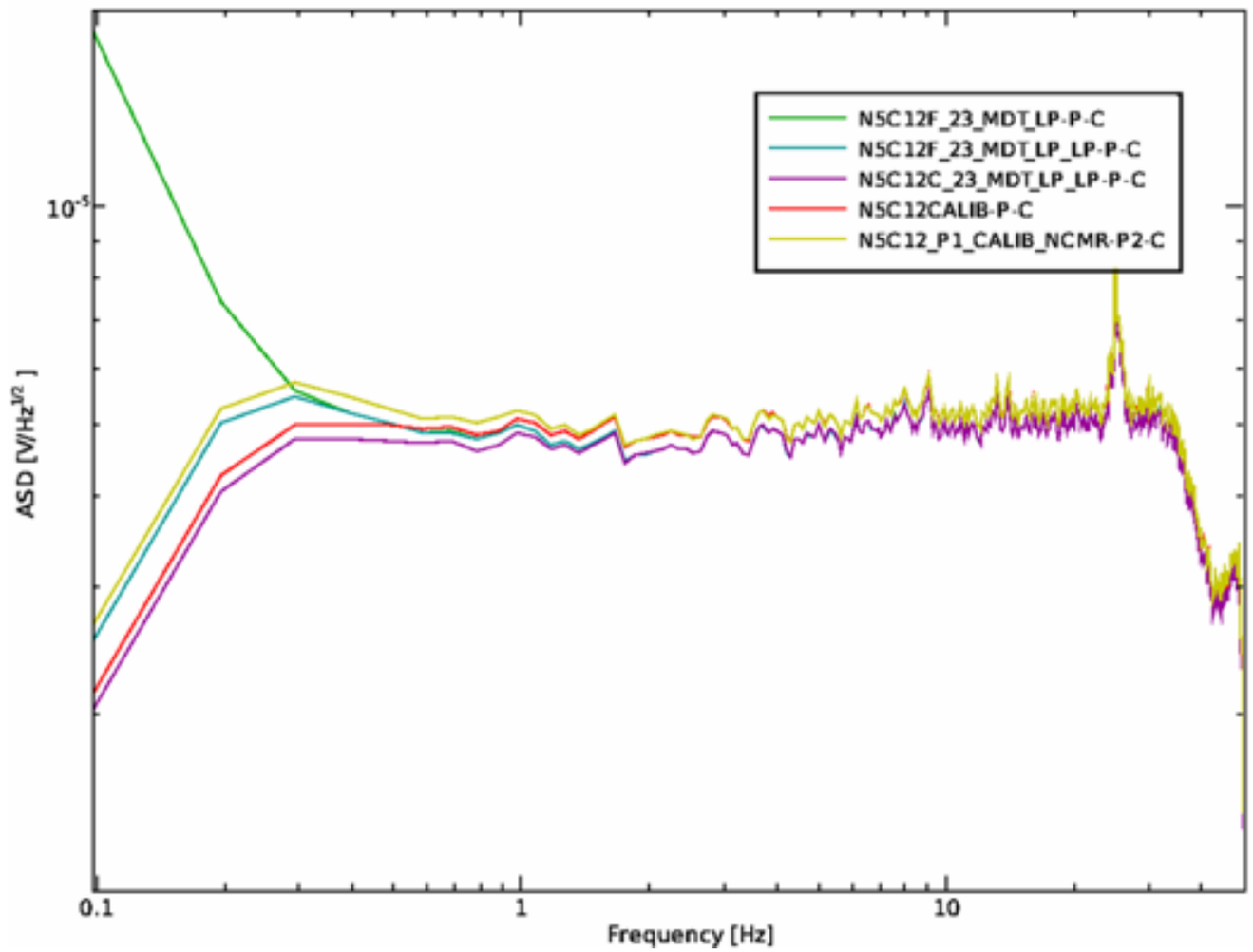

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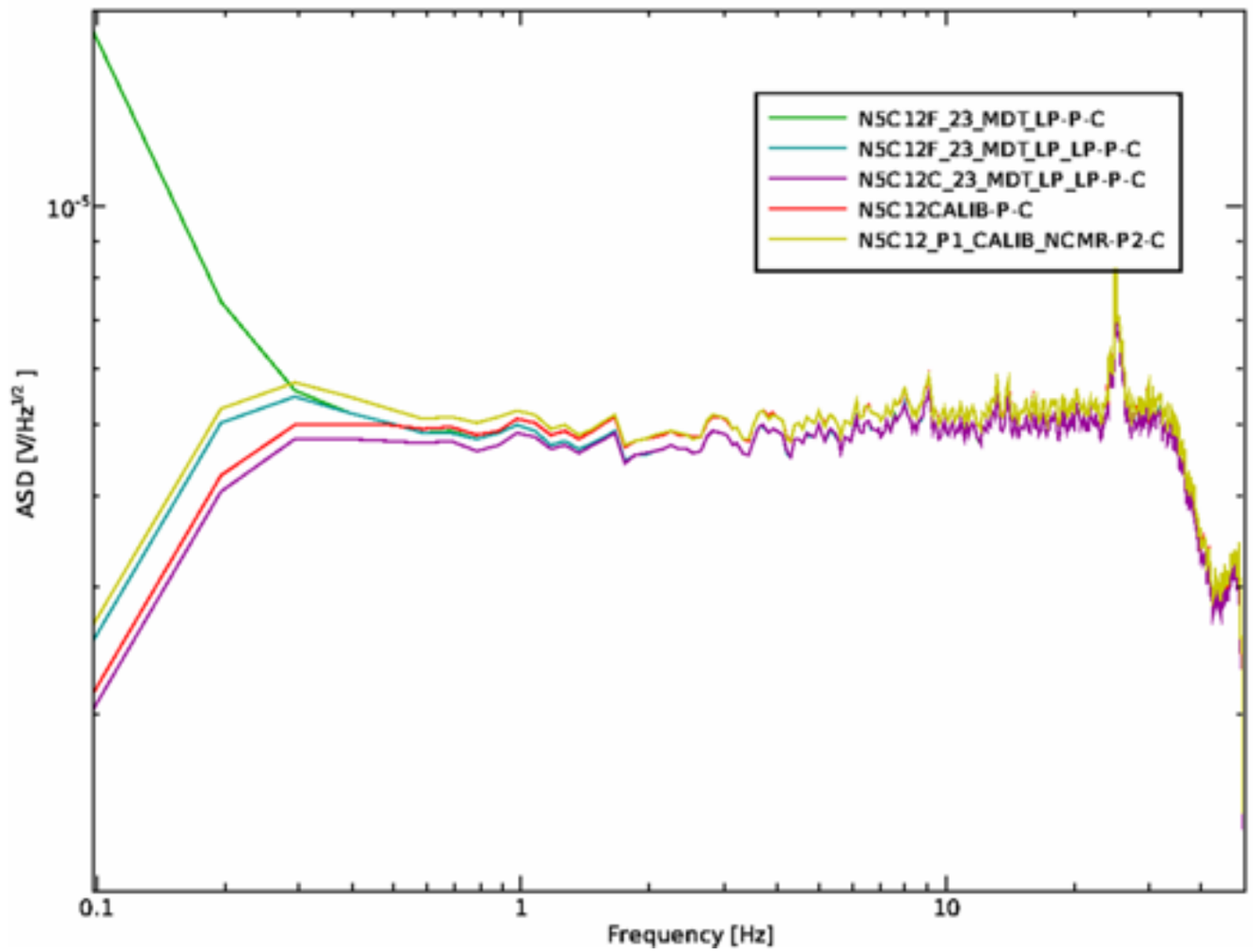

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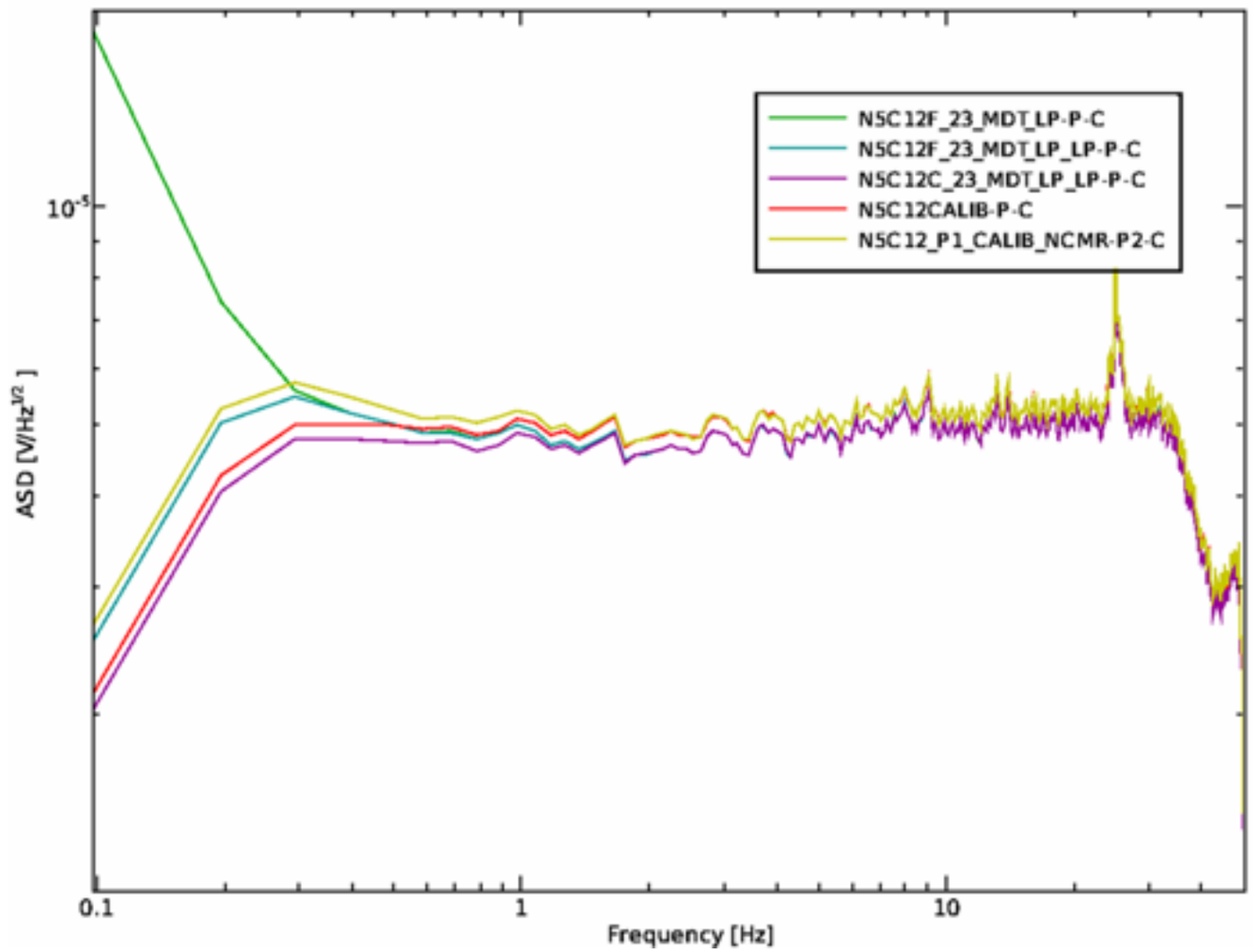

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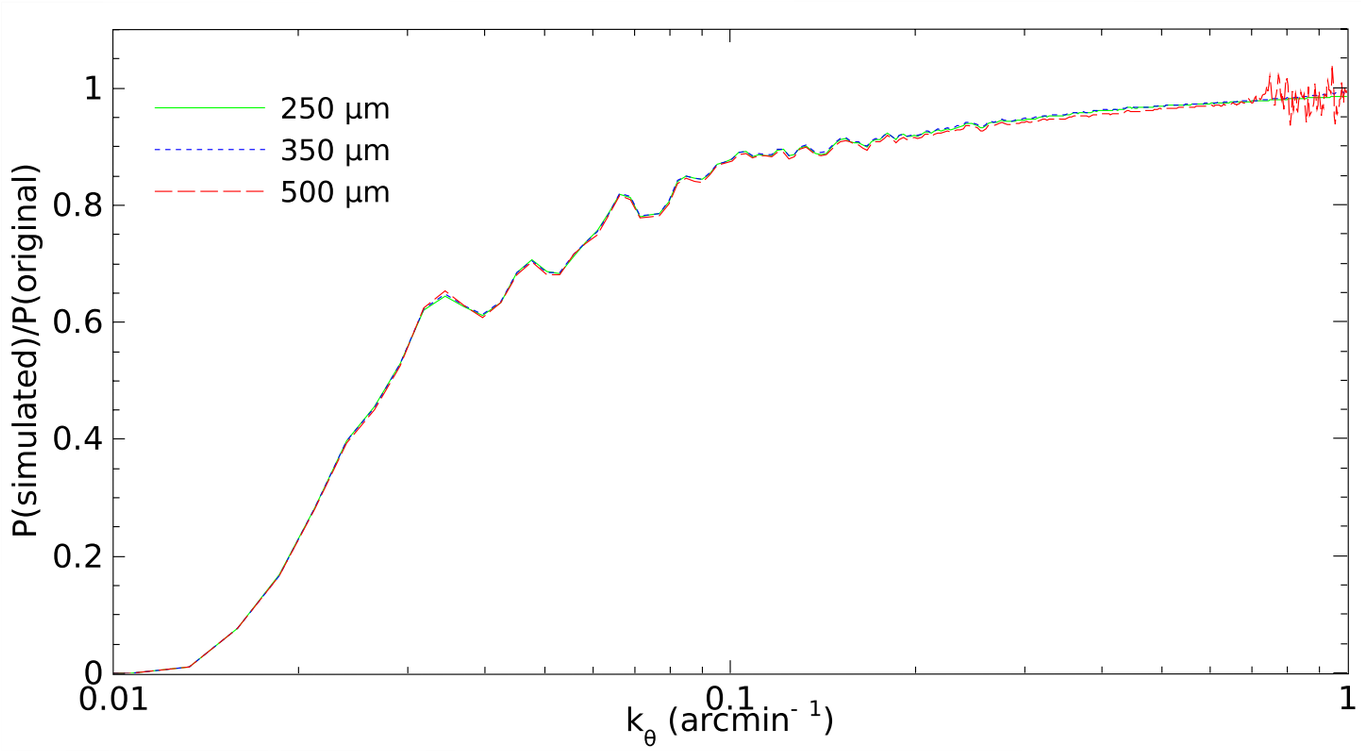

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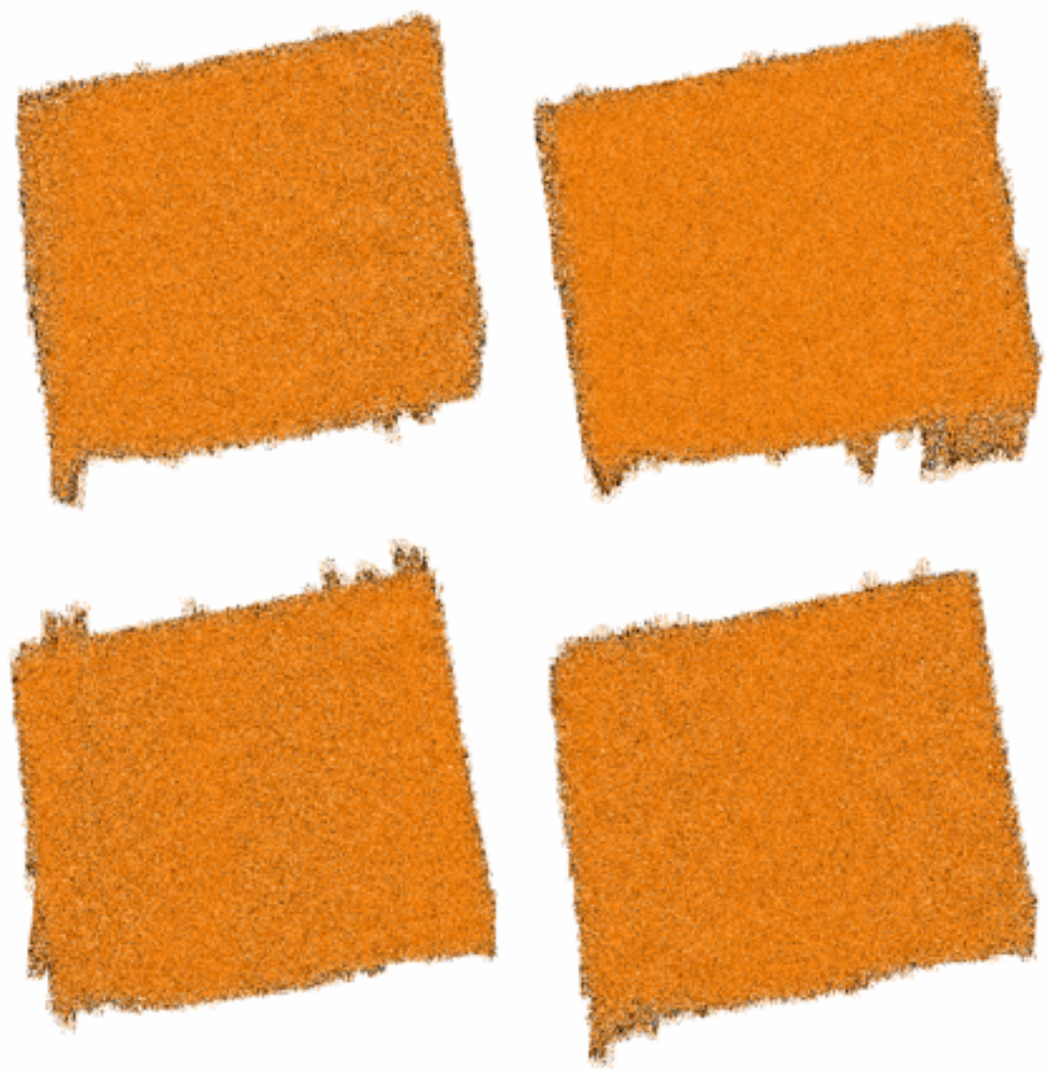

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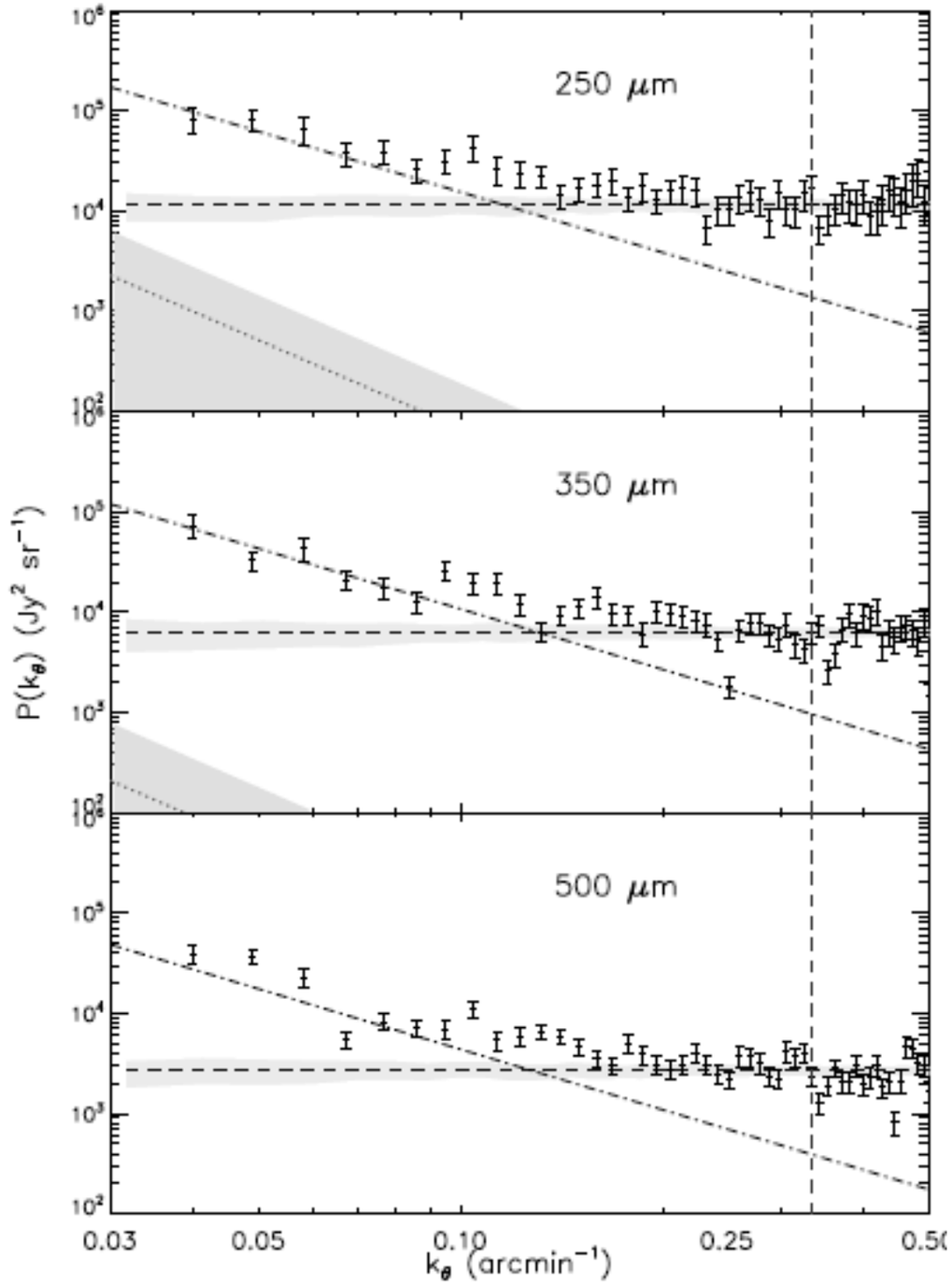

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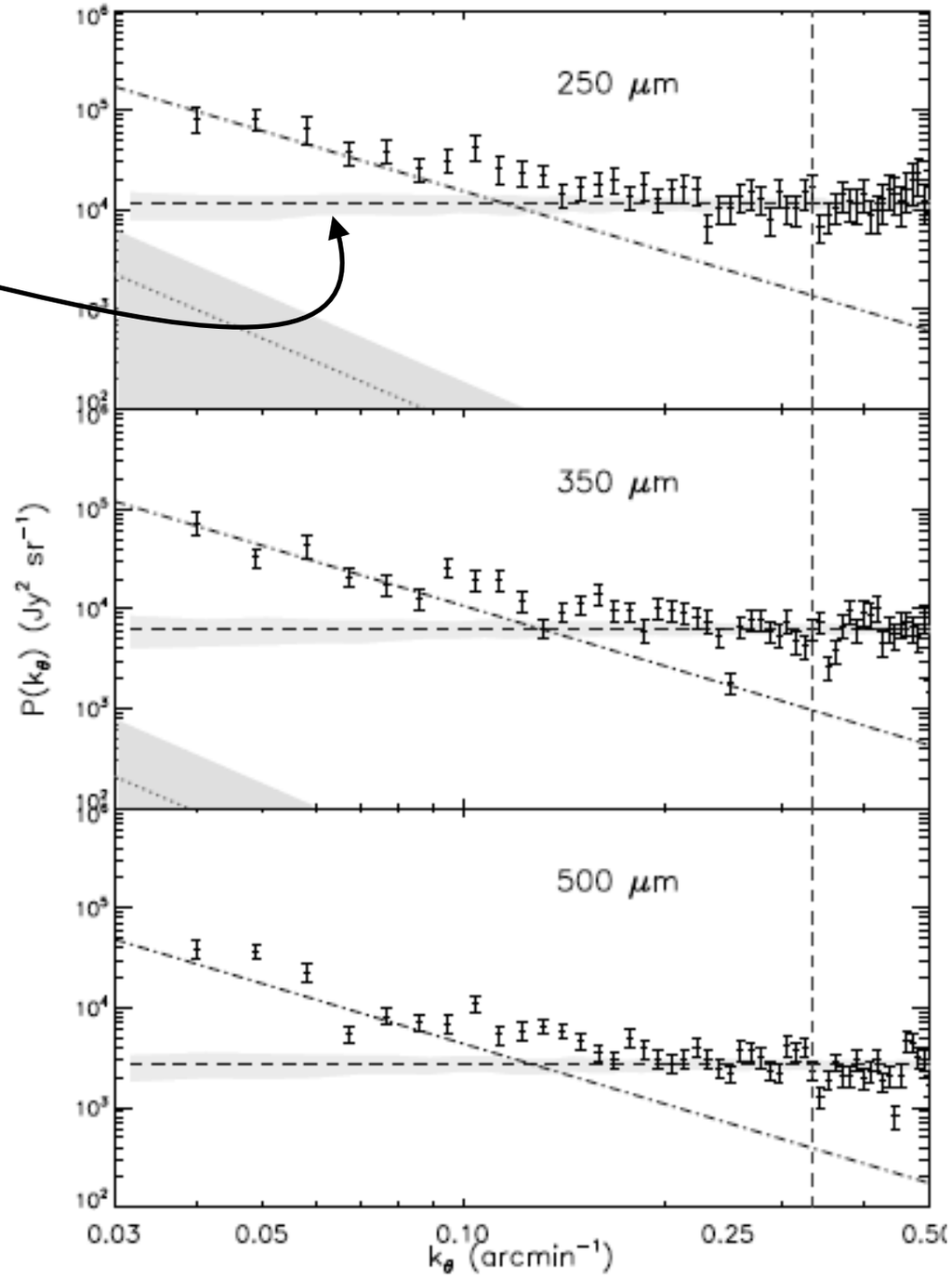

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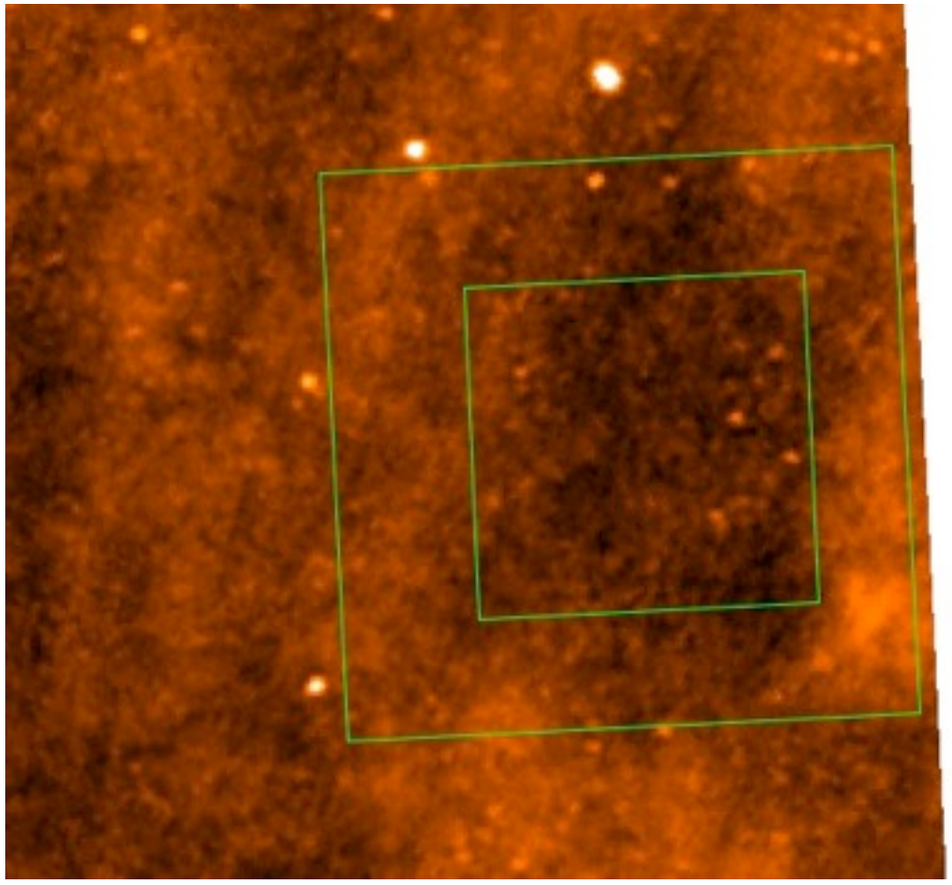

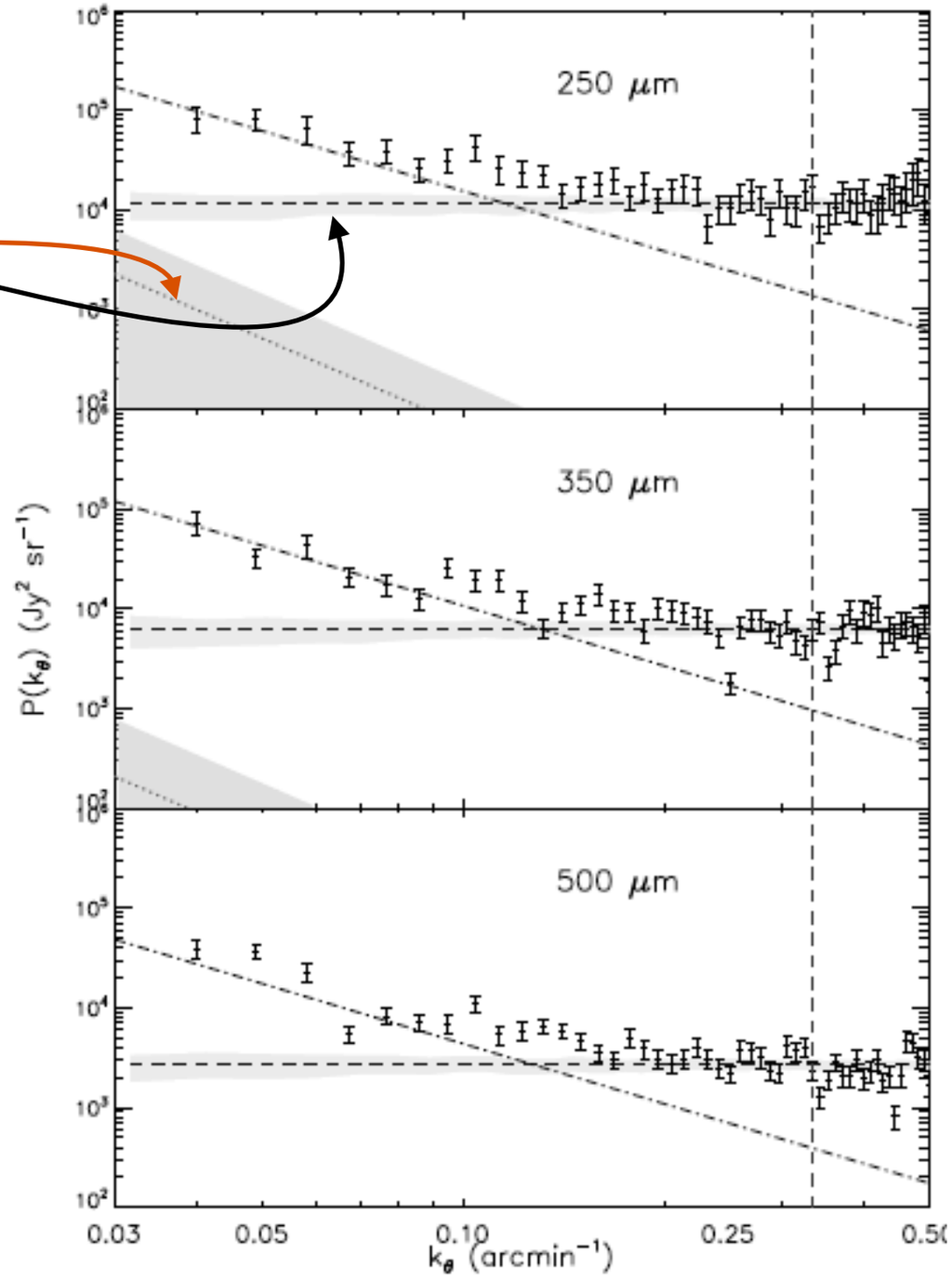

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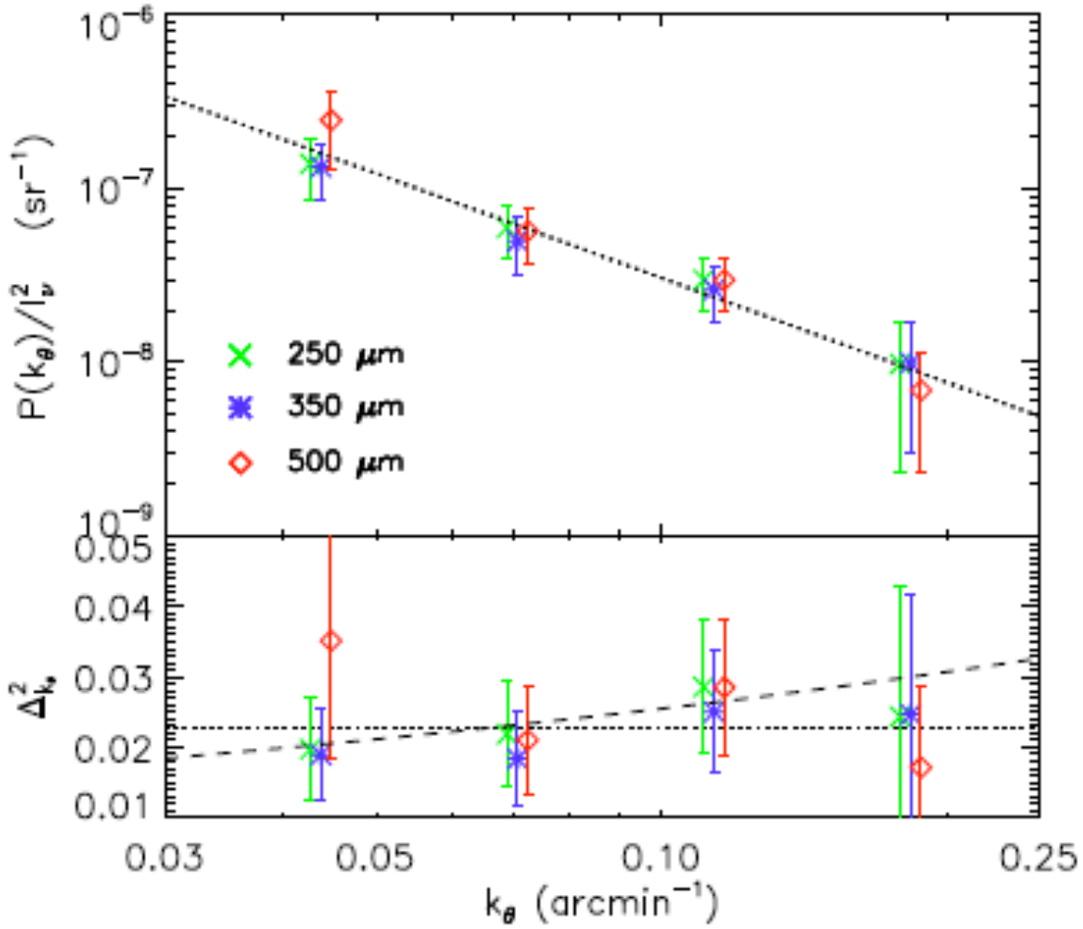

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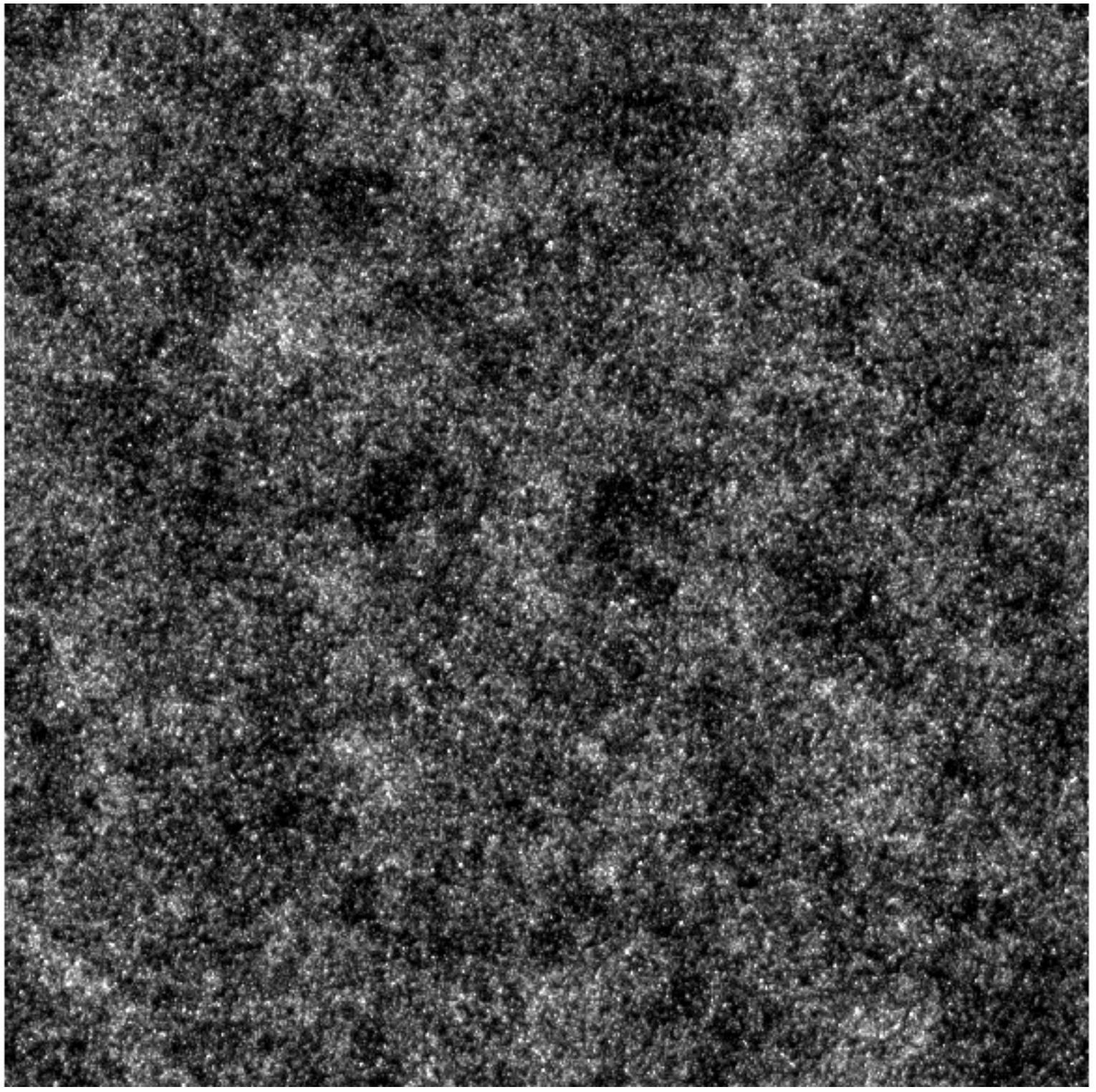

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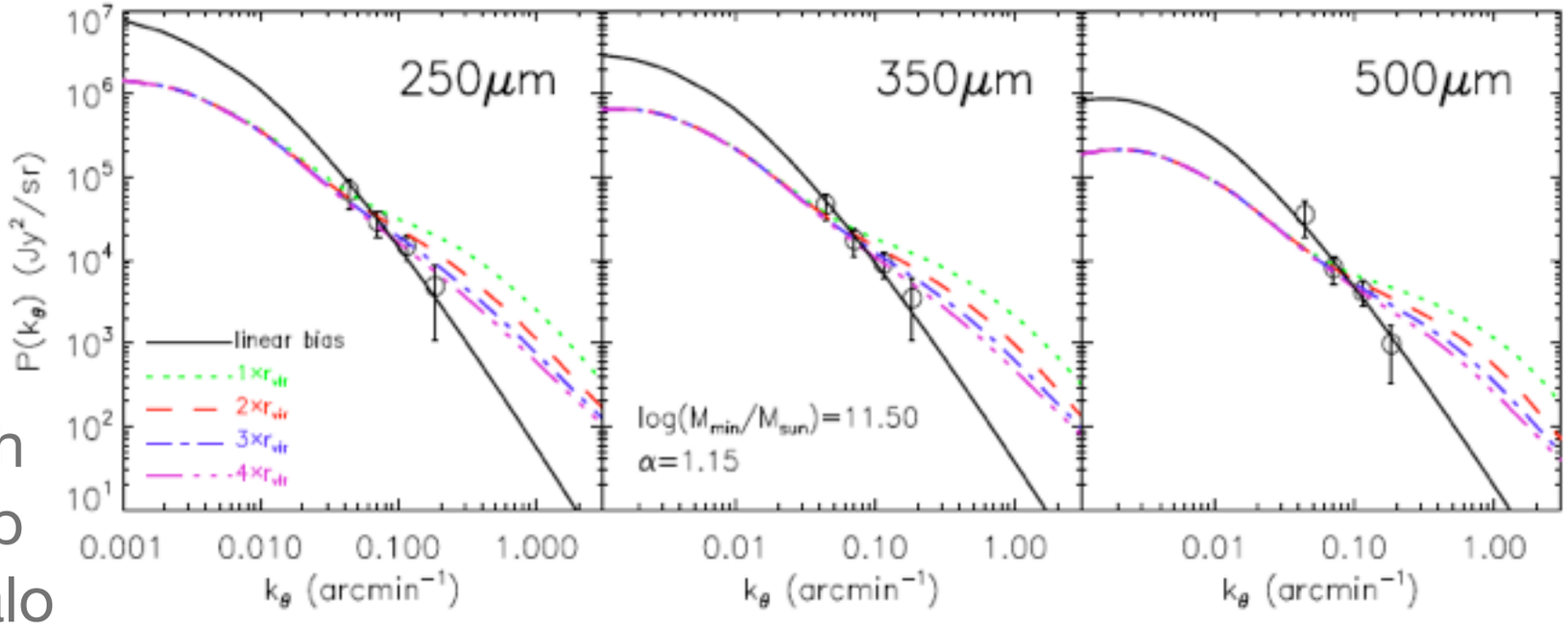

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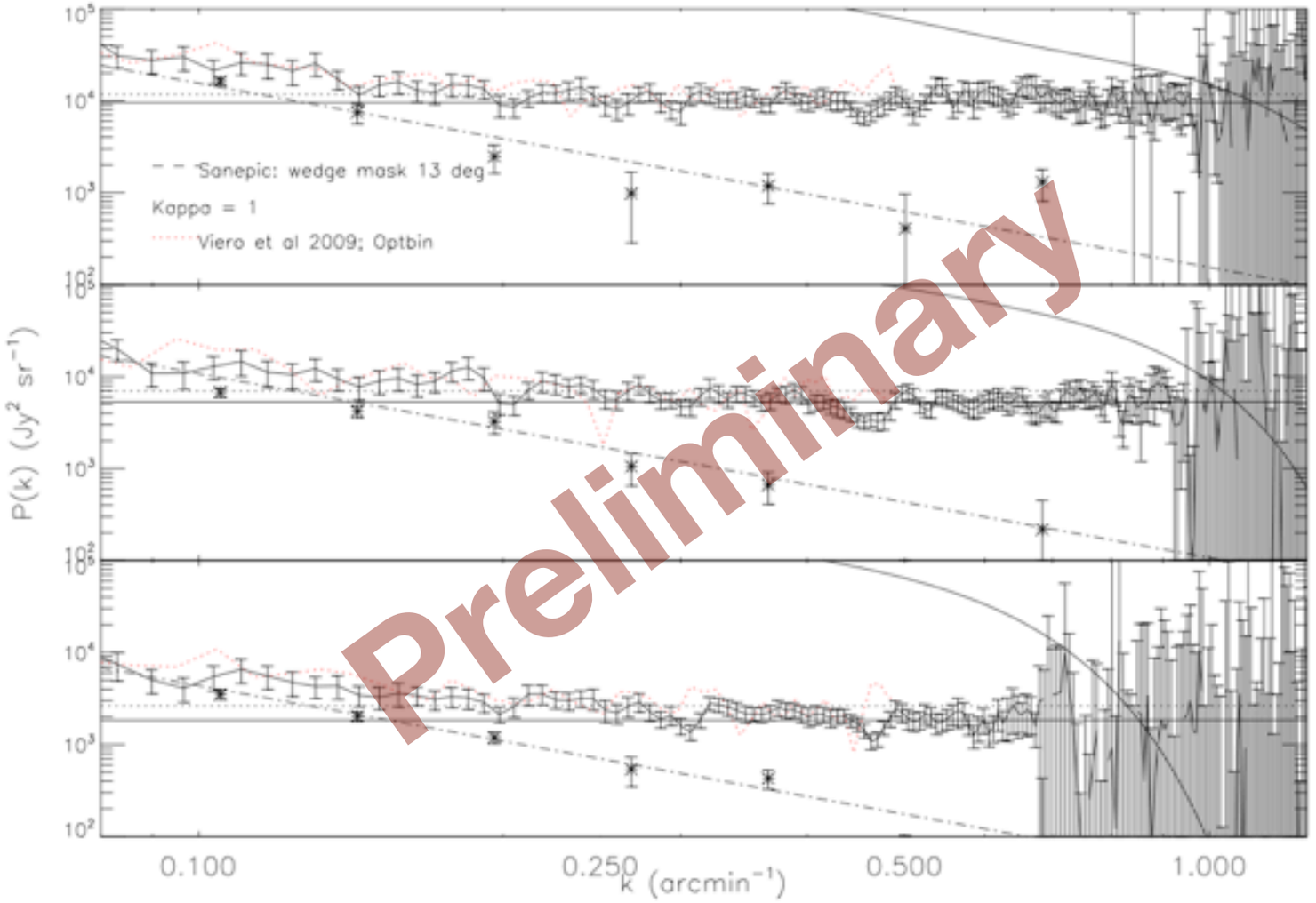
- Further (ongoing) analysis with twice the data confirm this behaviour on small scales



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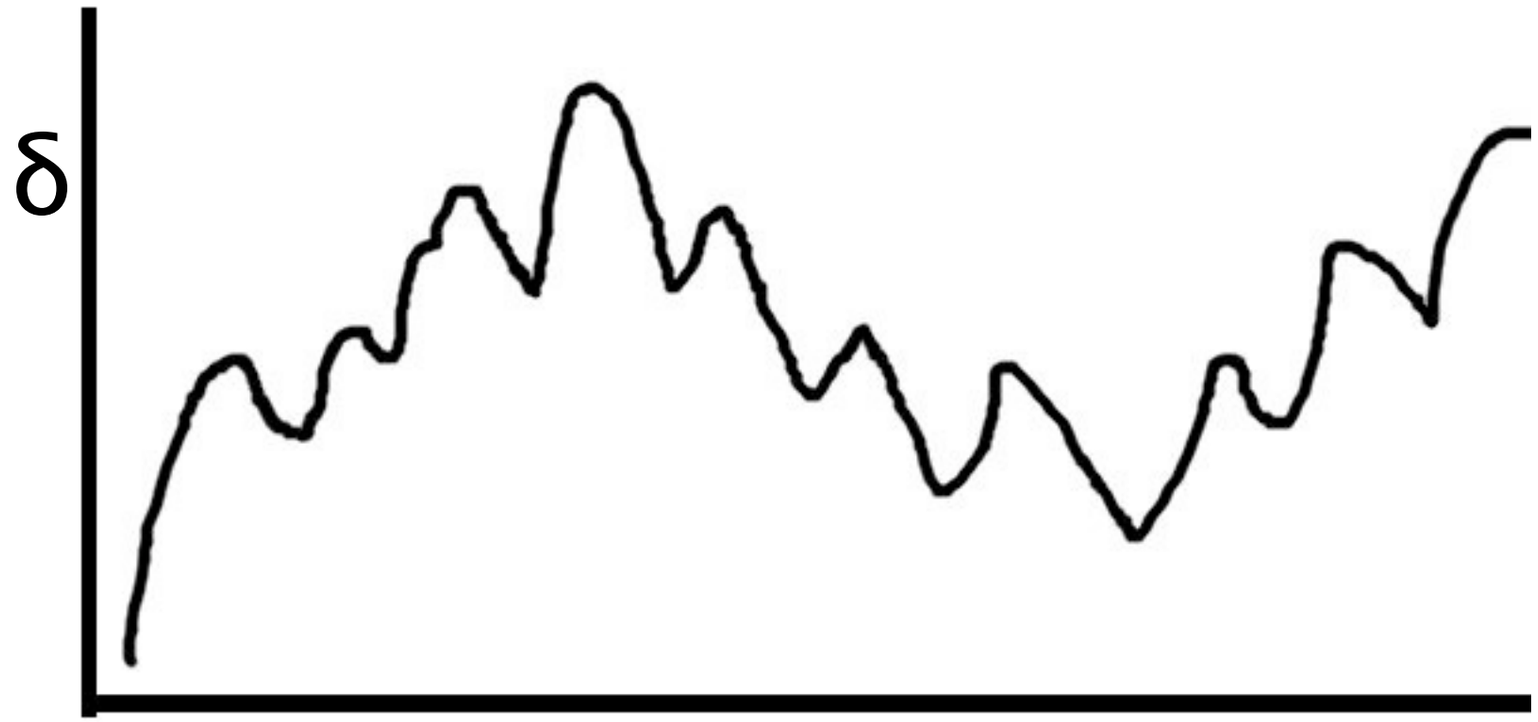

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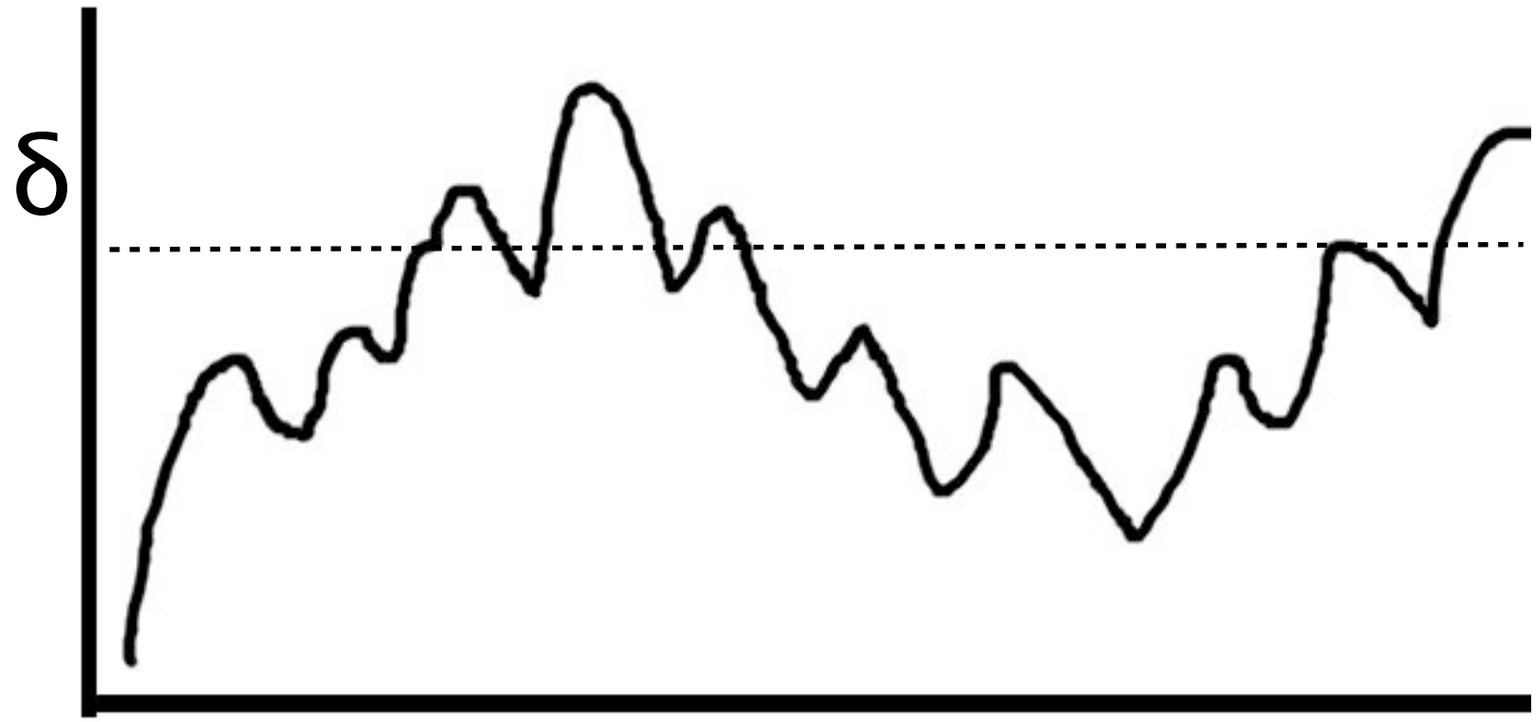

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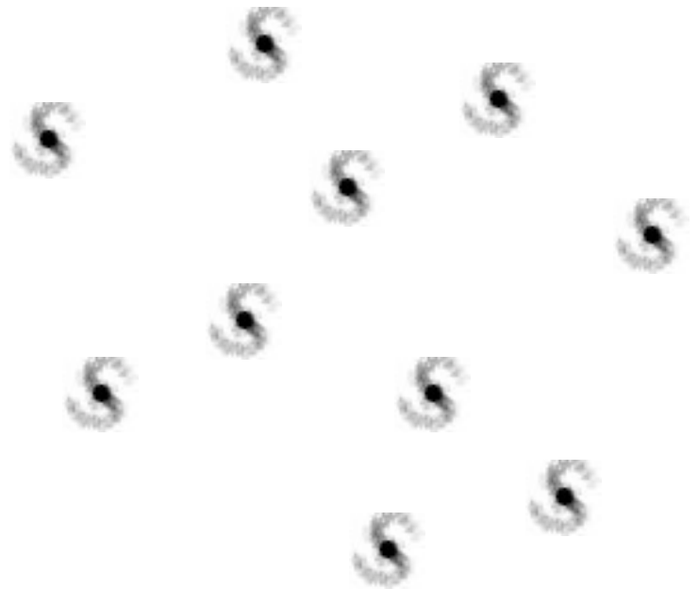

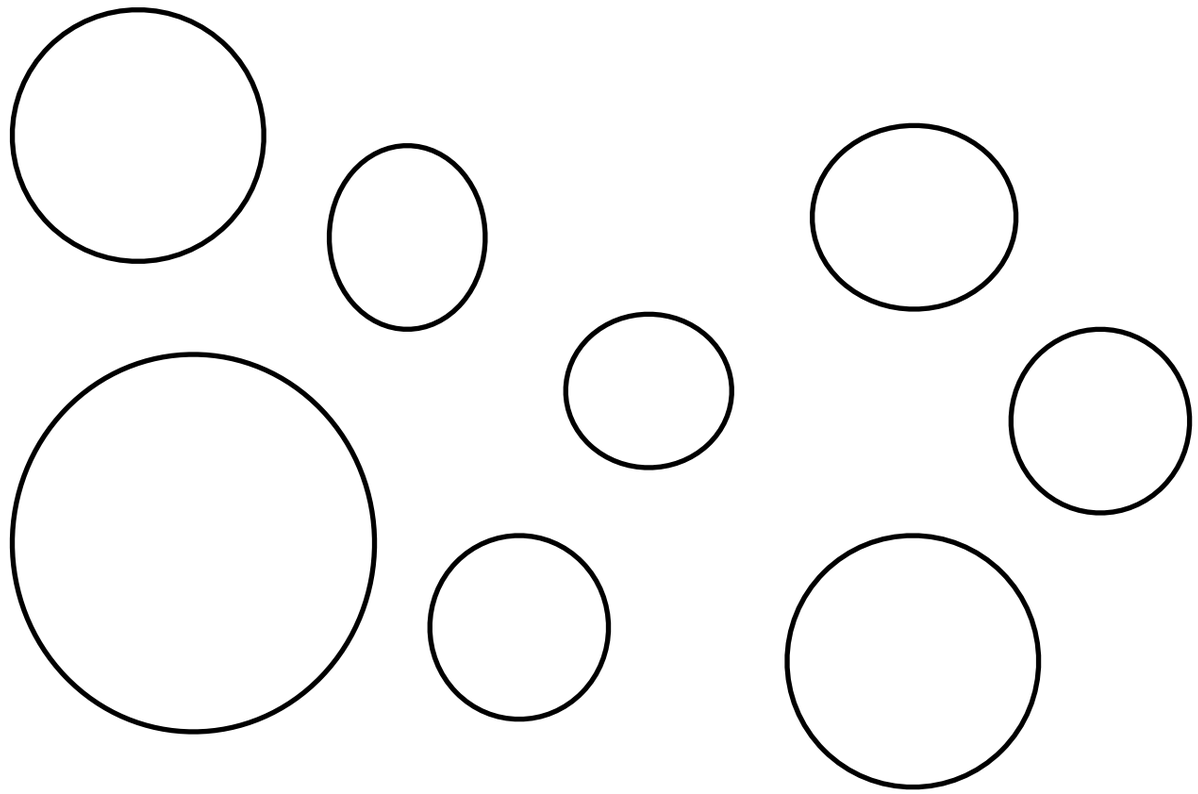

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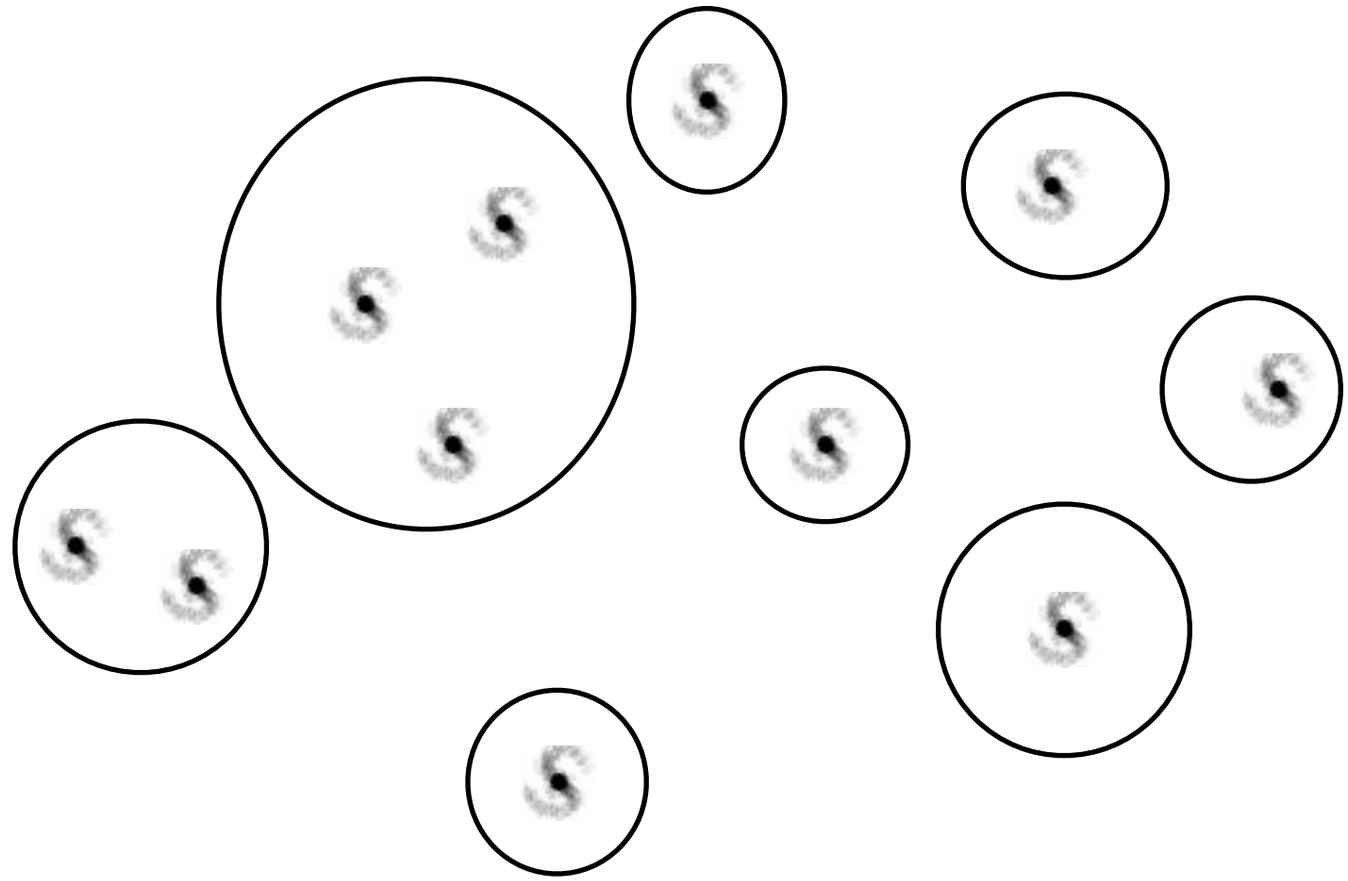

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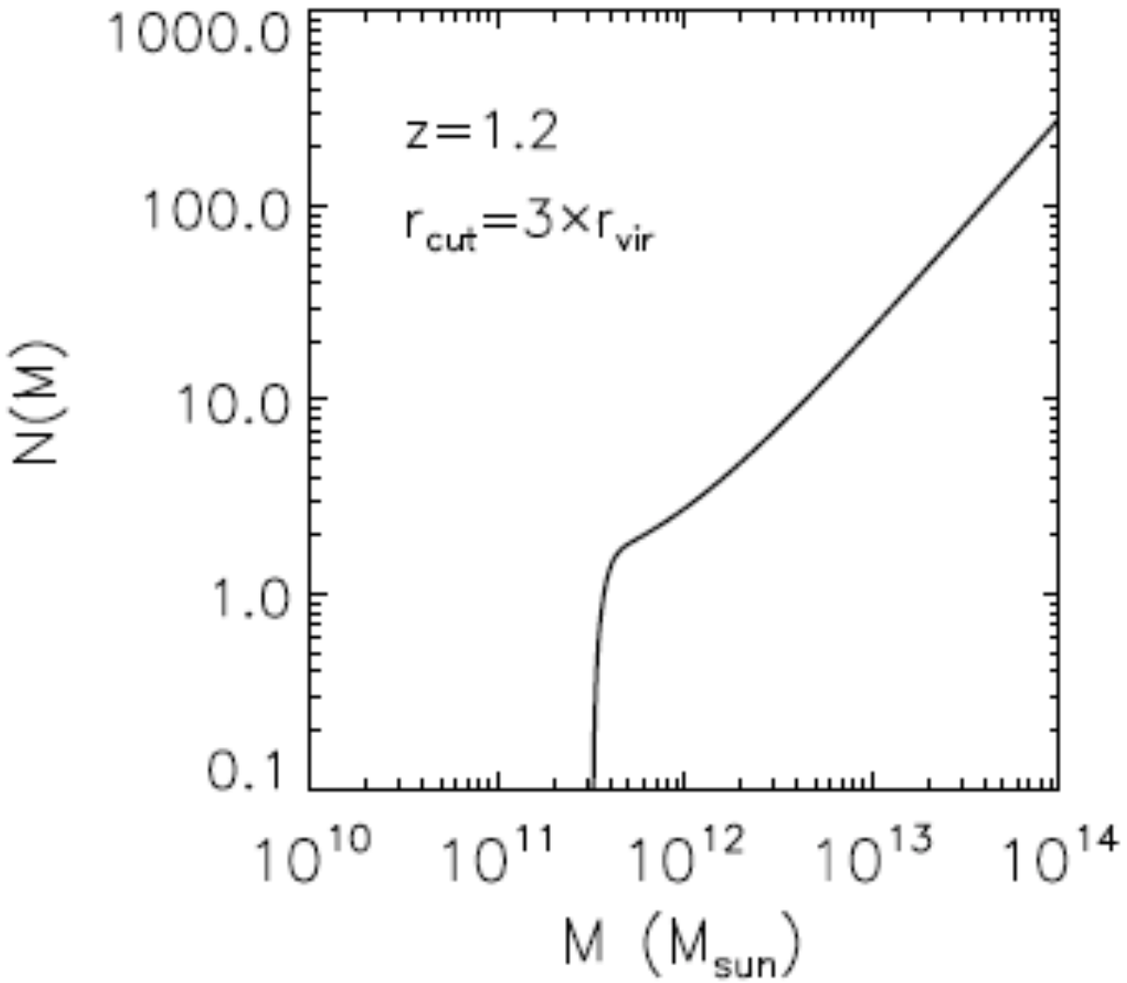
- Prescription for assigning Galaxies to Halos as Function of Mass (aka HON):
  - $N = (M/M_1)^{\alpha}$



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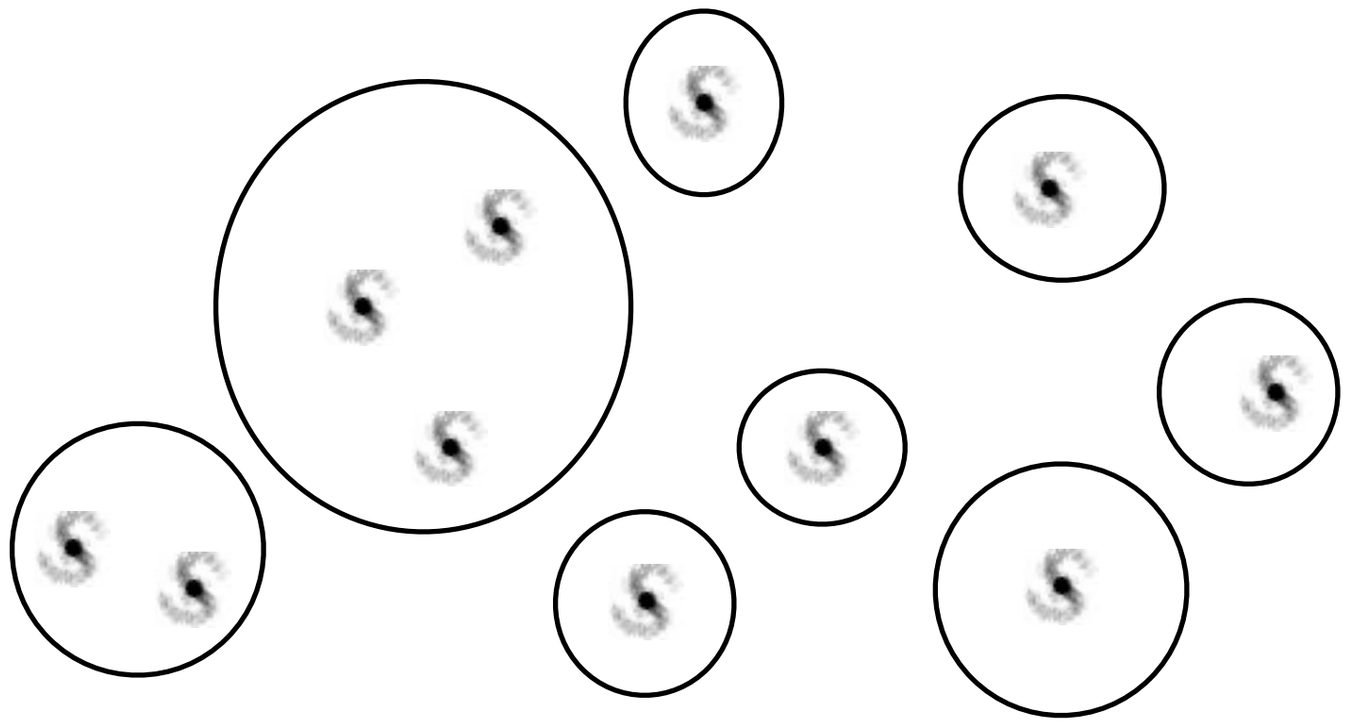

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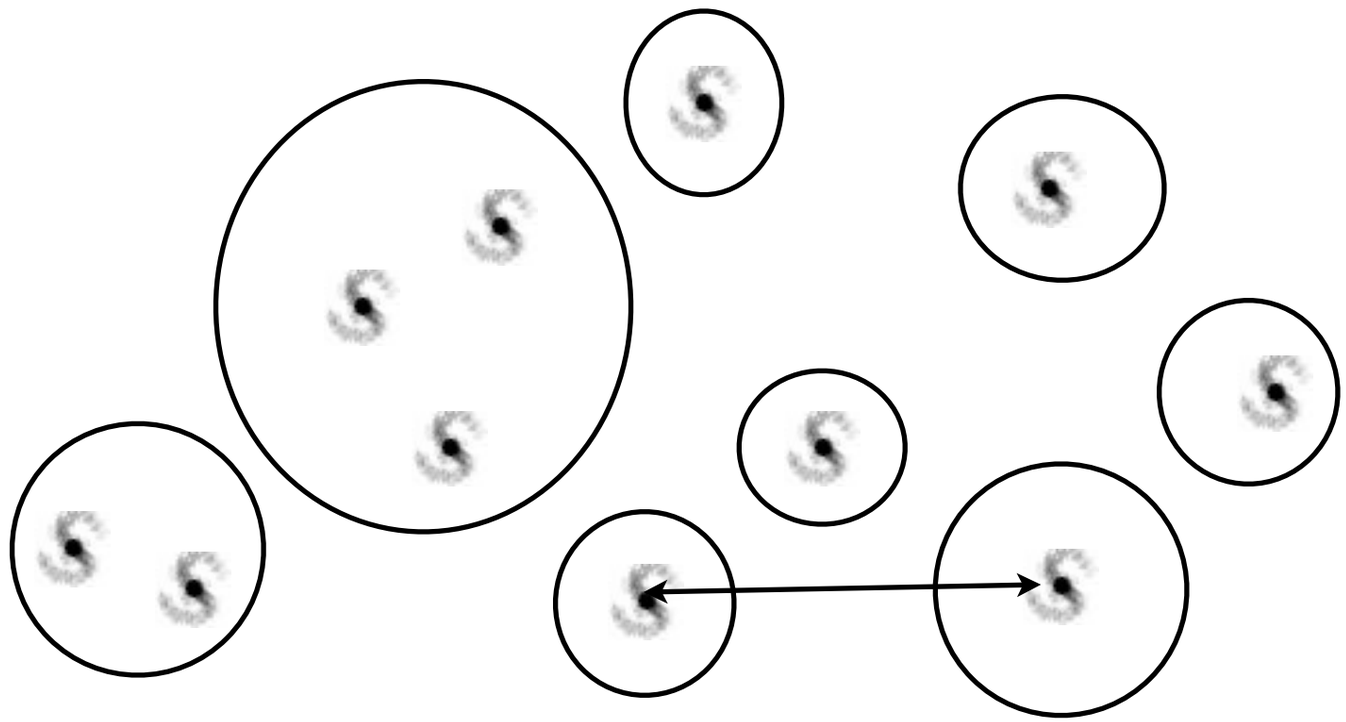
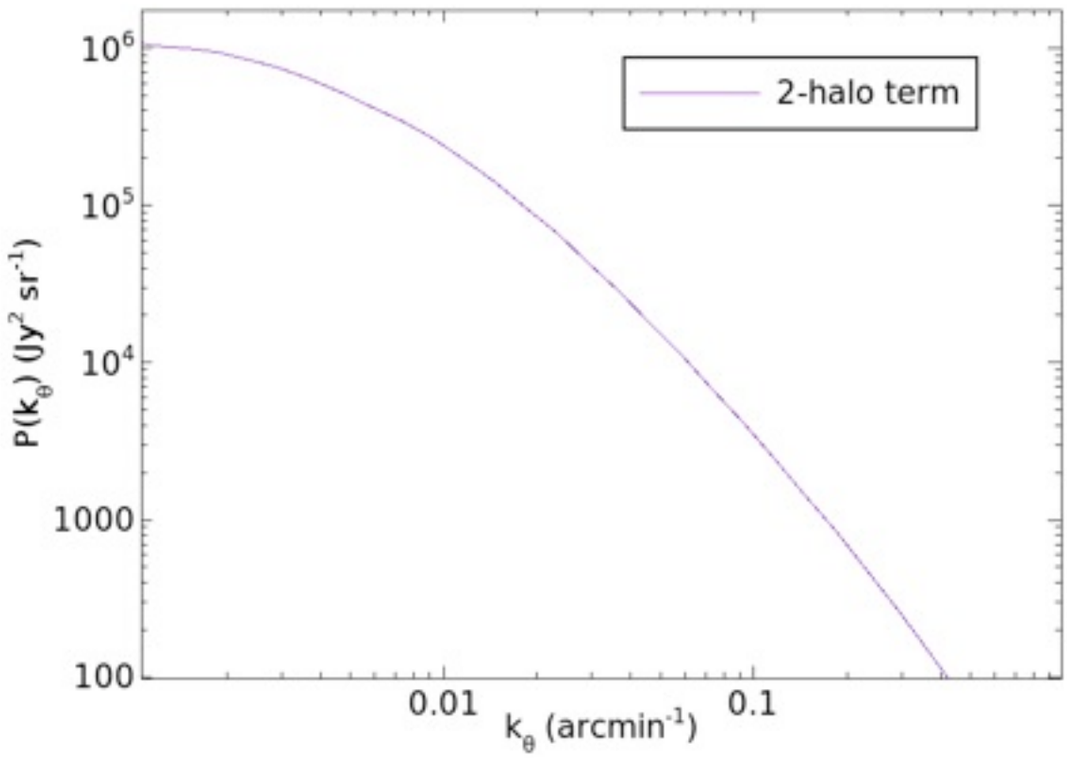
  - 2-halo: Linear Regime (large scales)





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- Clustering Signal made up of two regimes
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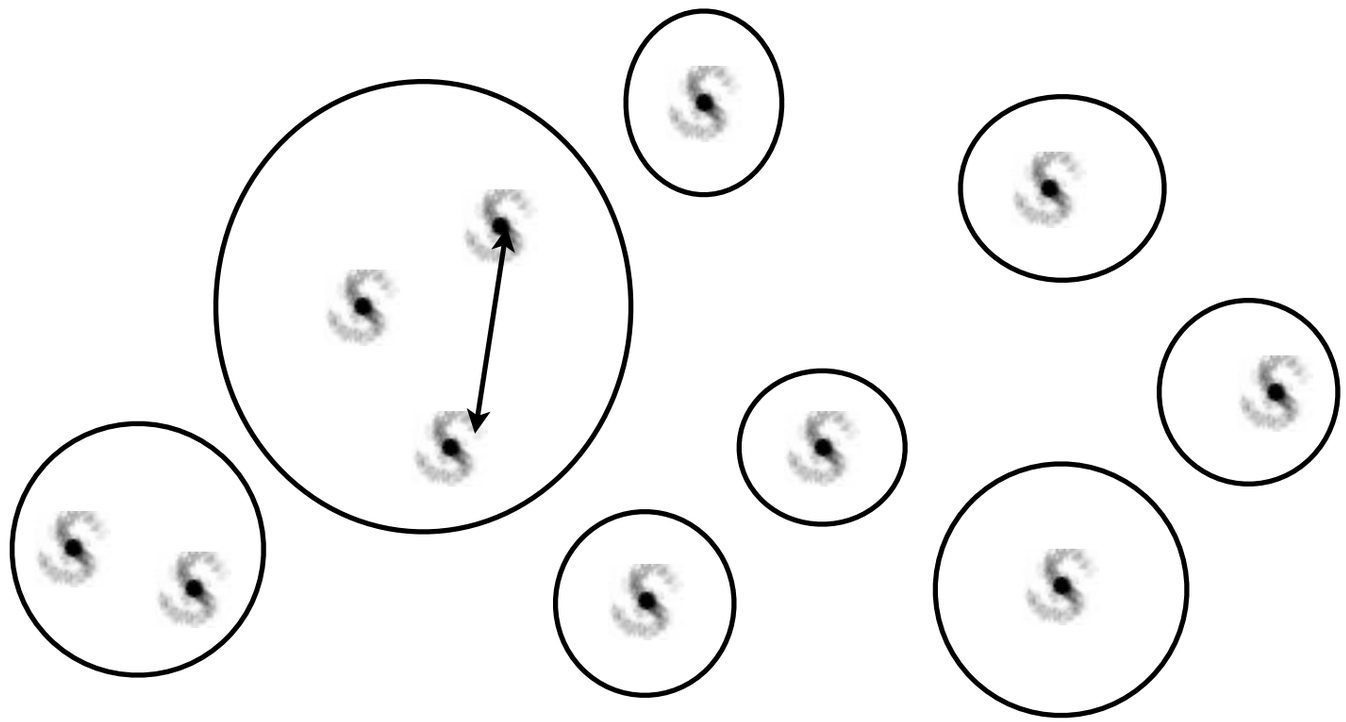

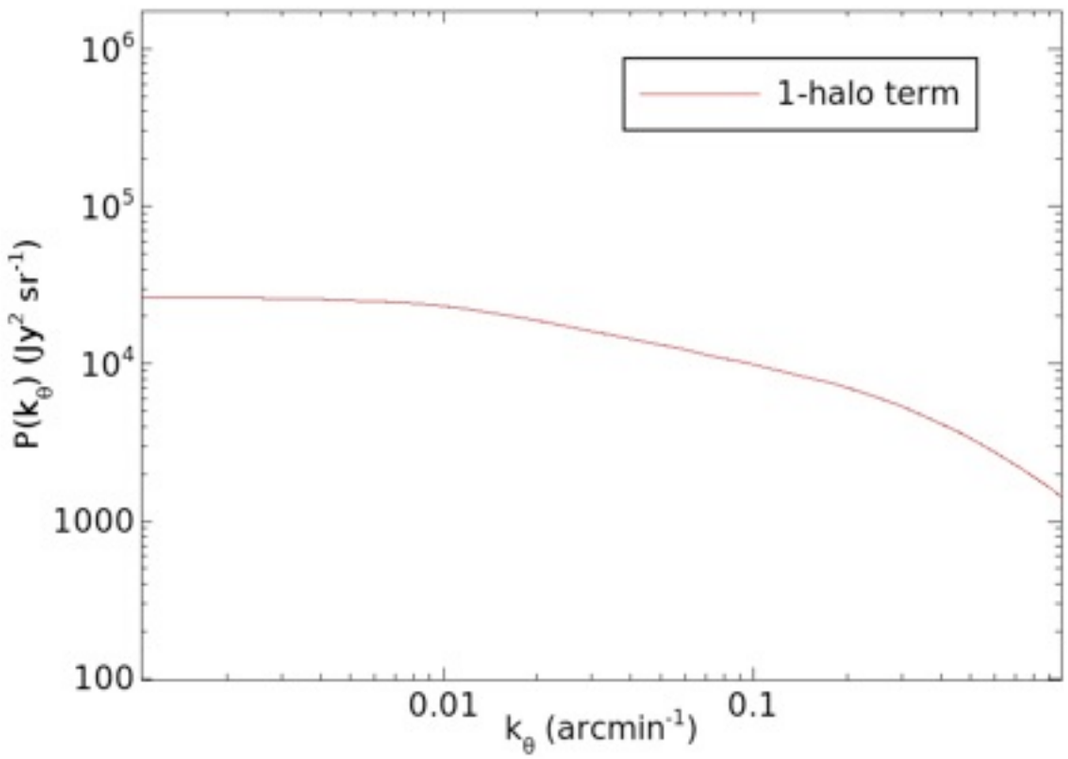

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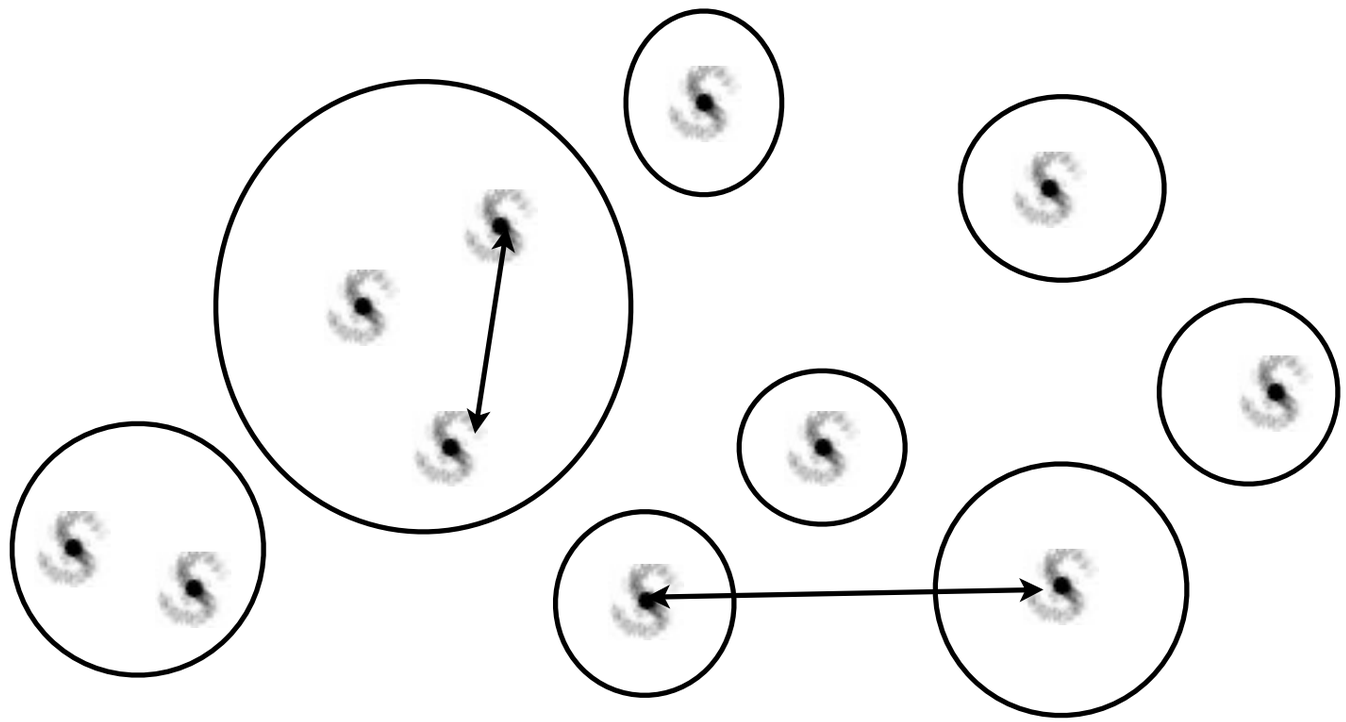

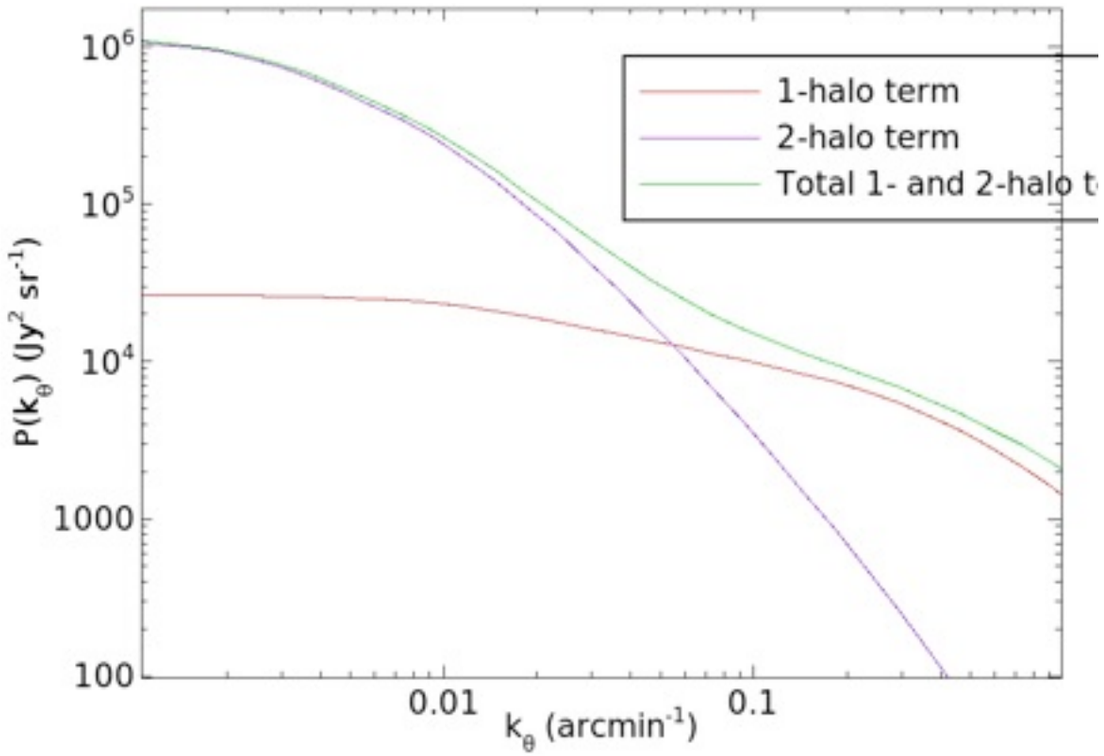

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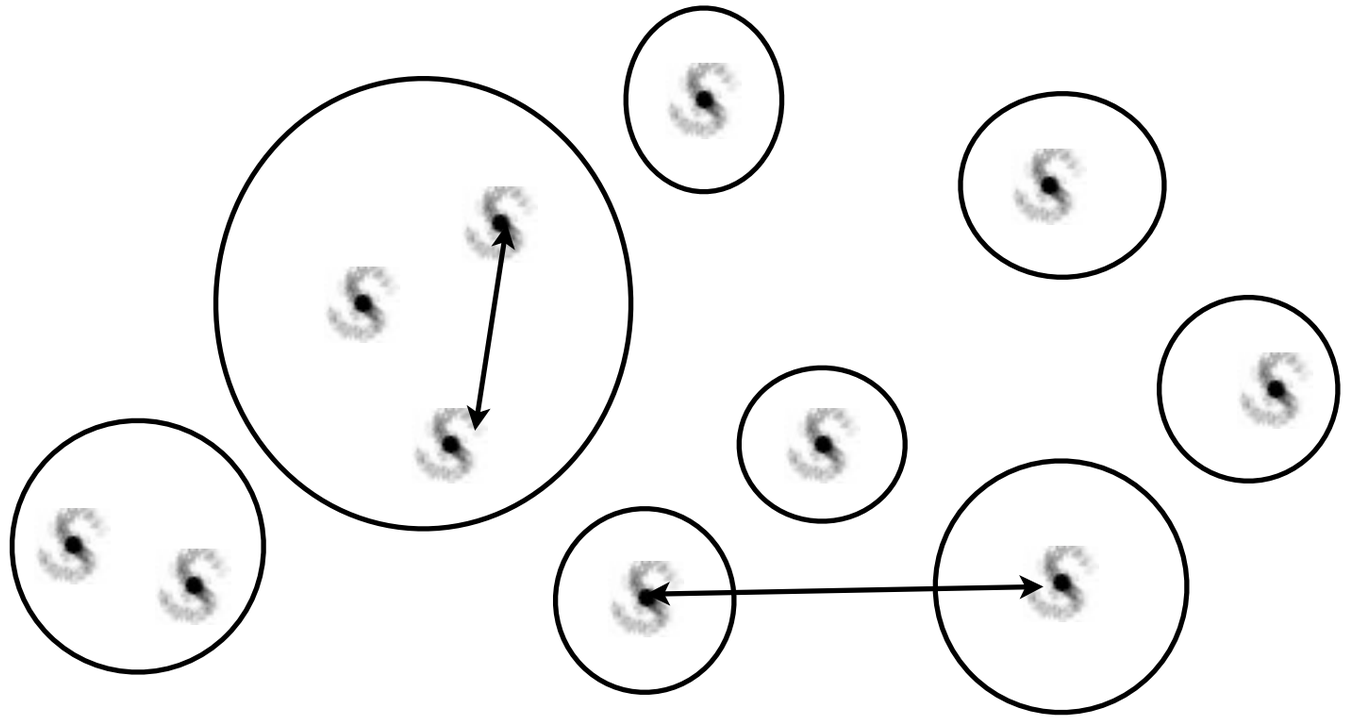

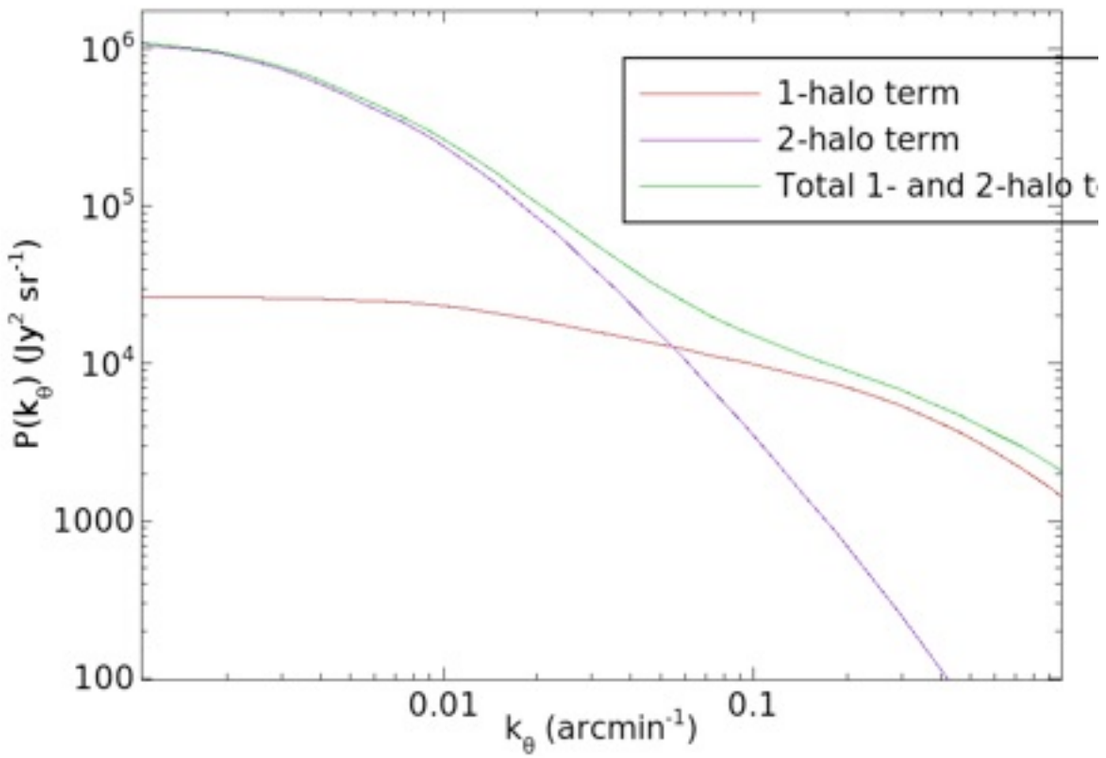

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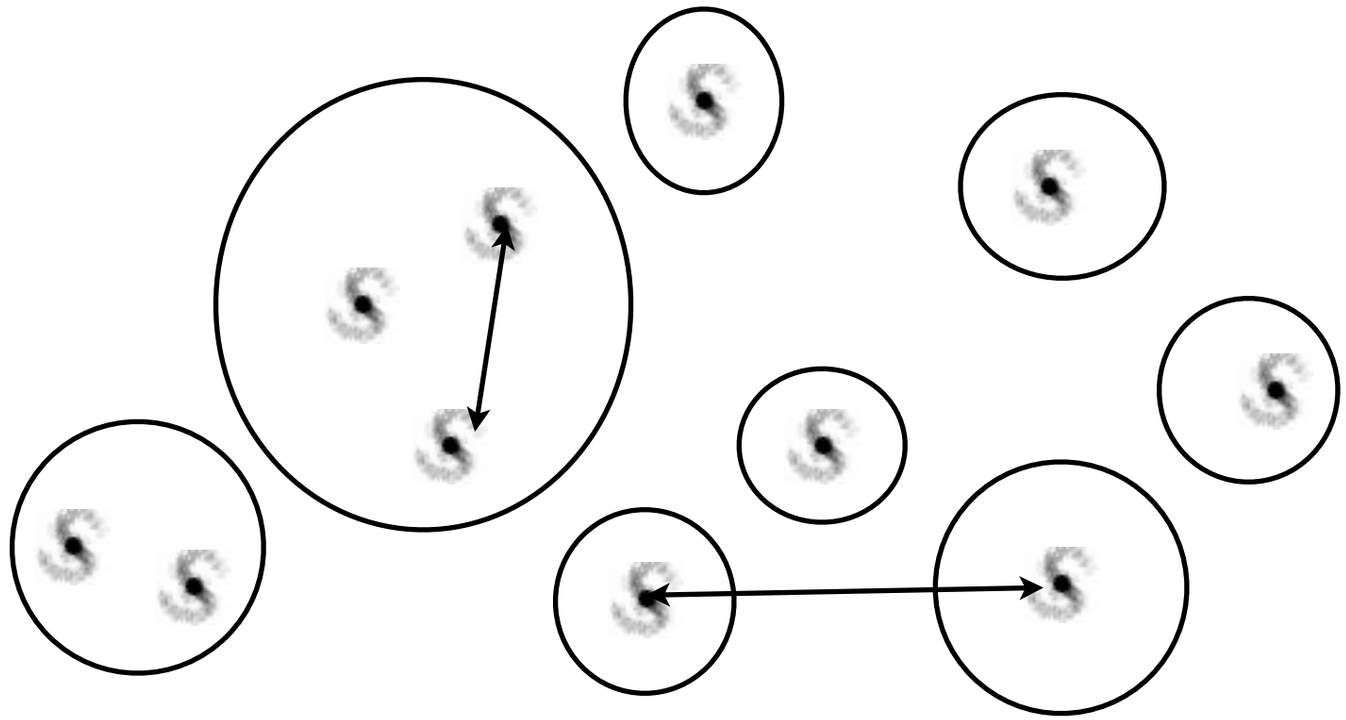

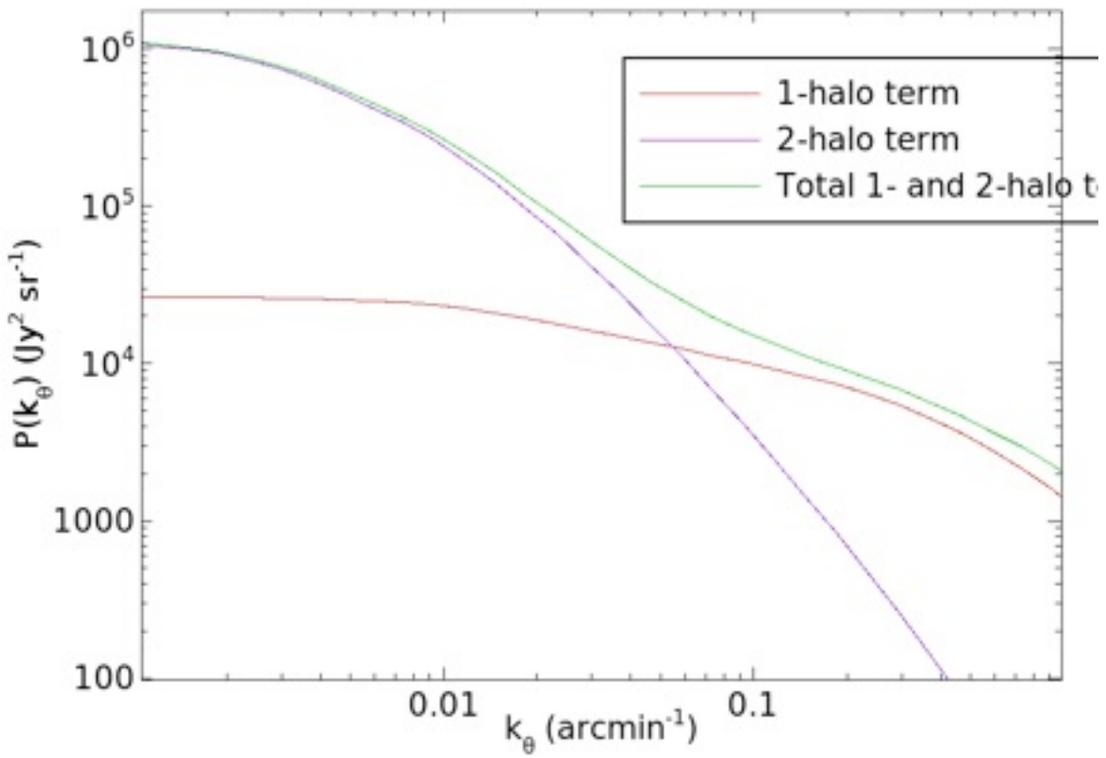

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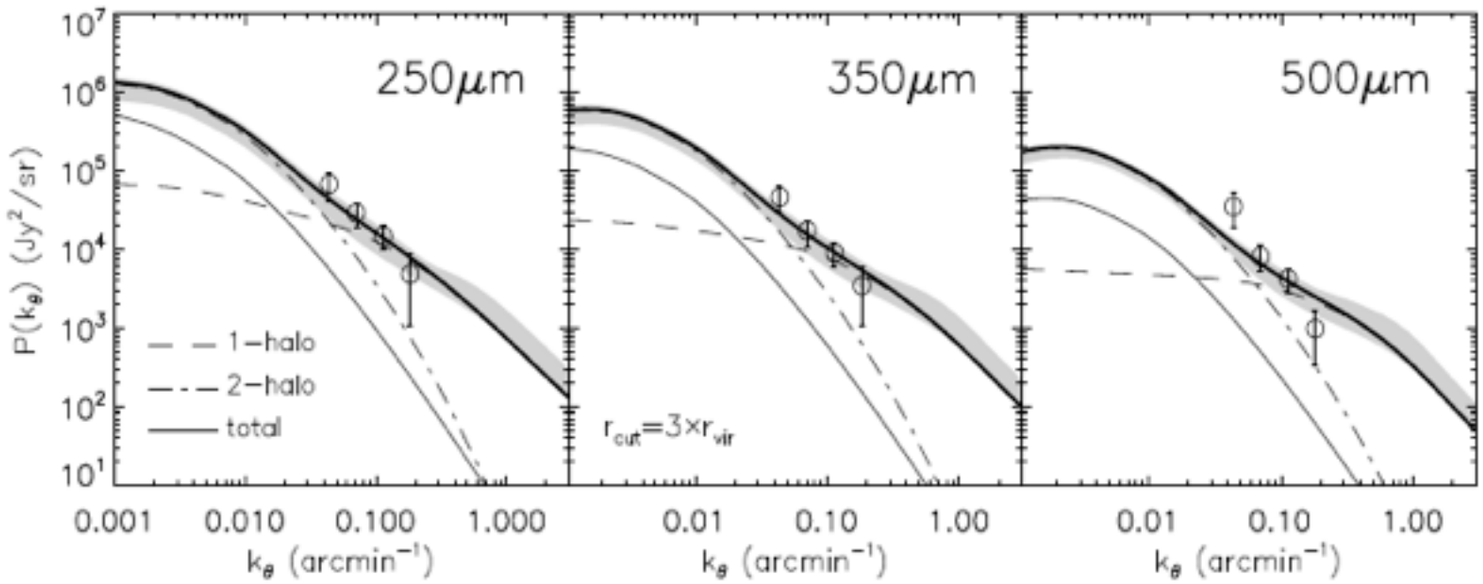

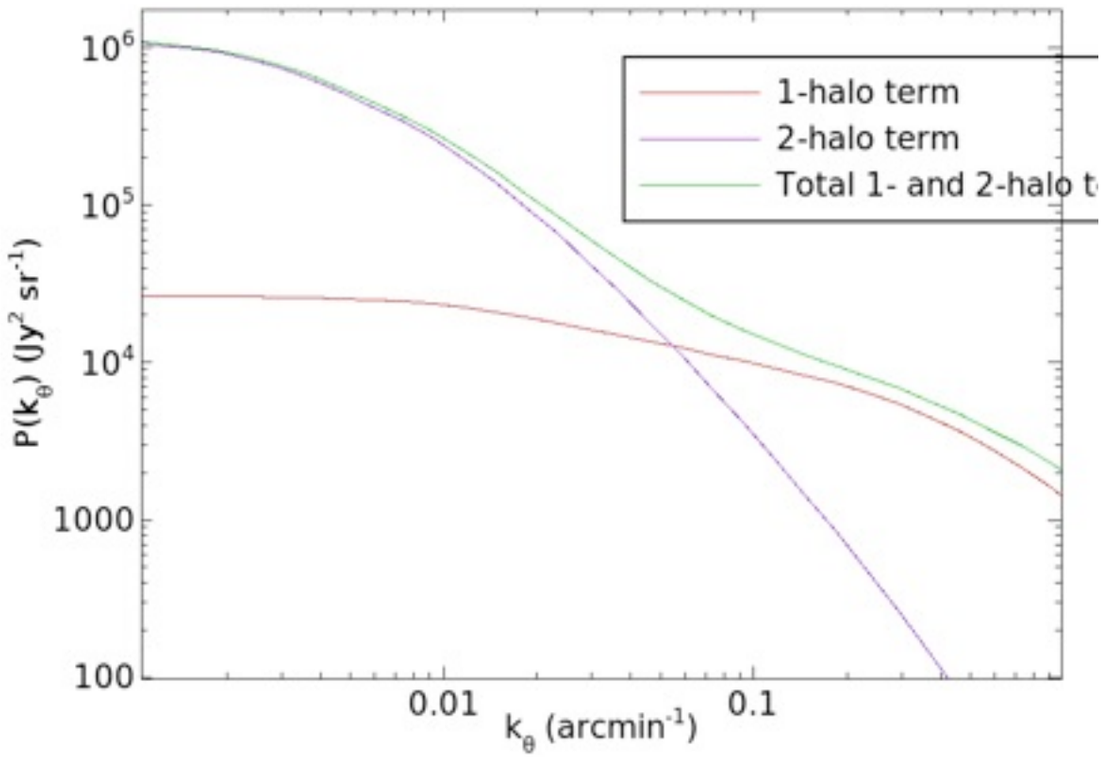

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- Model Halos are Spherical, whereas simulations show they are fact tri-axial

Change How Galaxies Trace Halos

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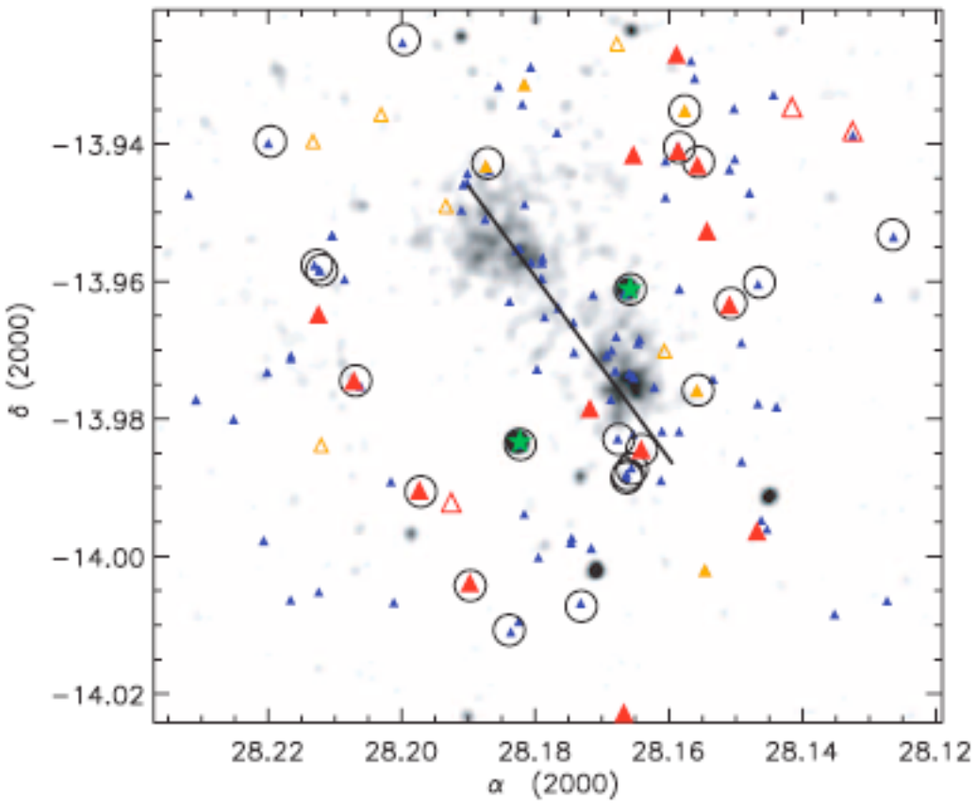

Marcillac et al. 2007

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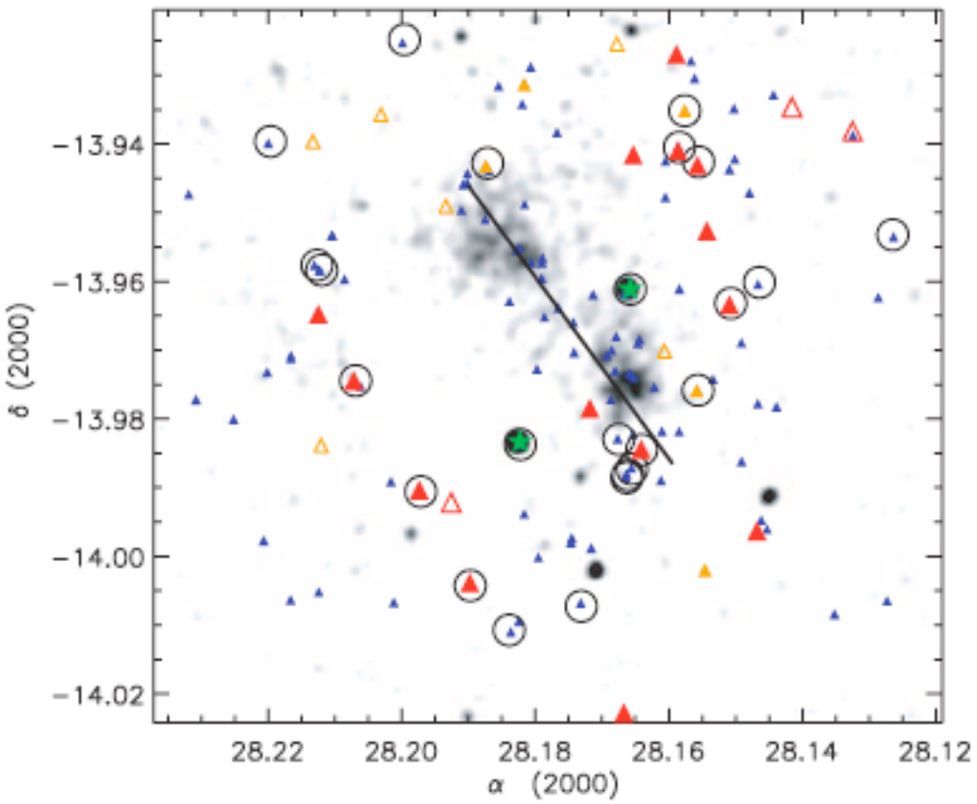

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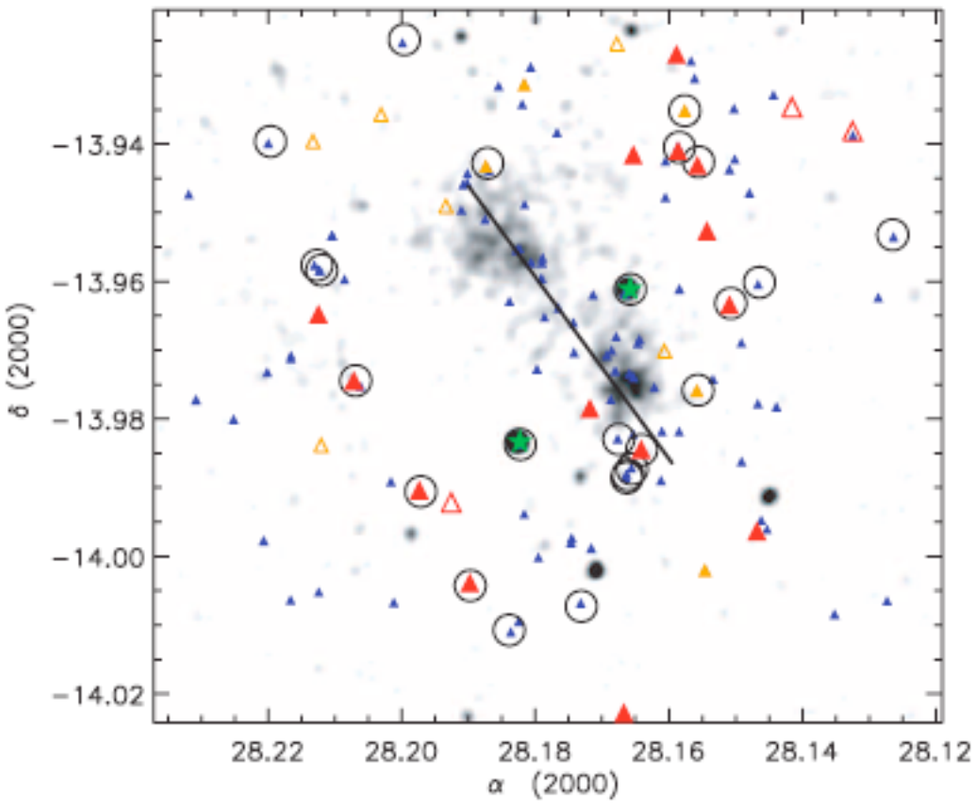

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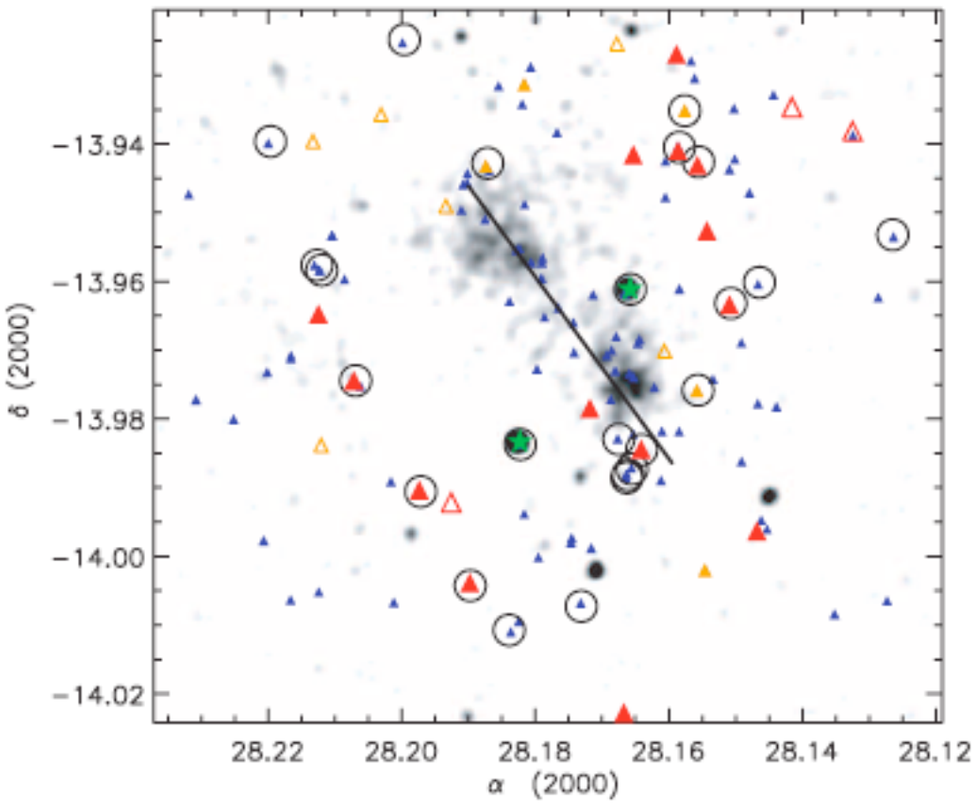

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  - It may be that the *environment* influences **where** Star Formation takes place!

Implications

Clustering in Context

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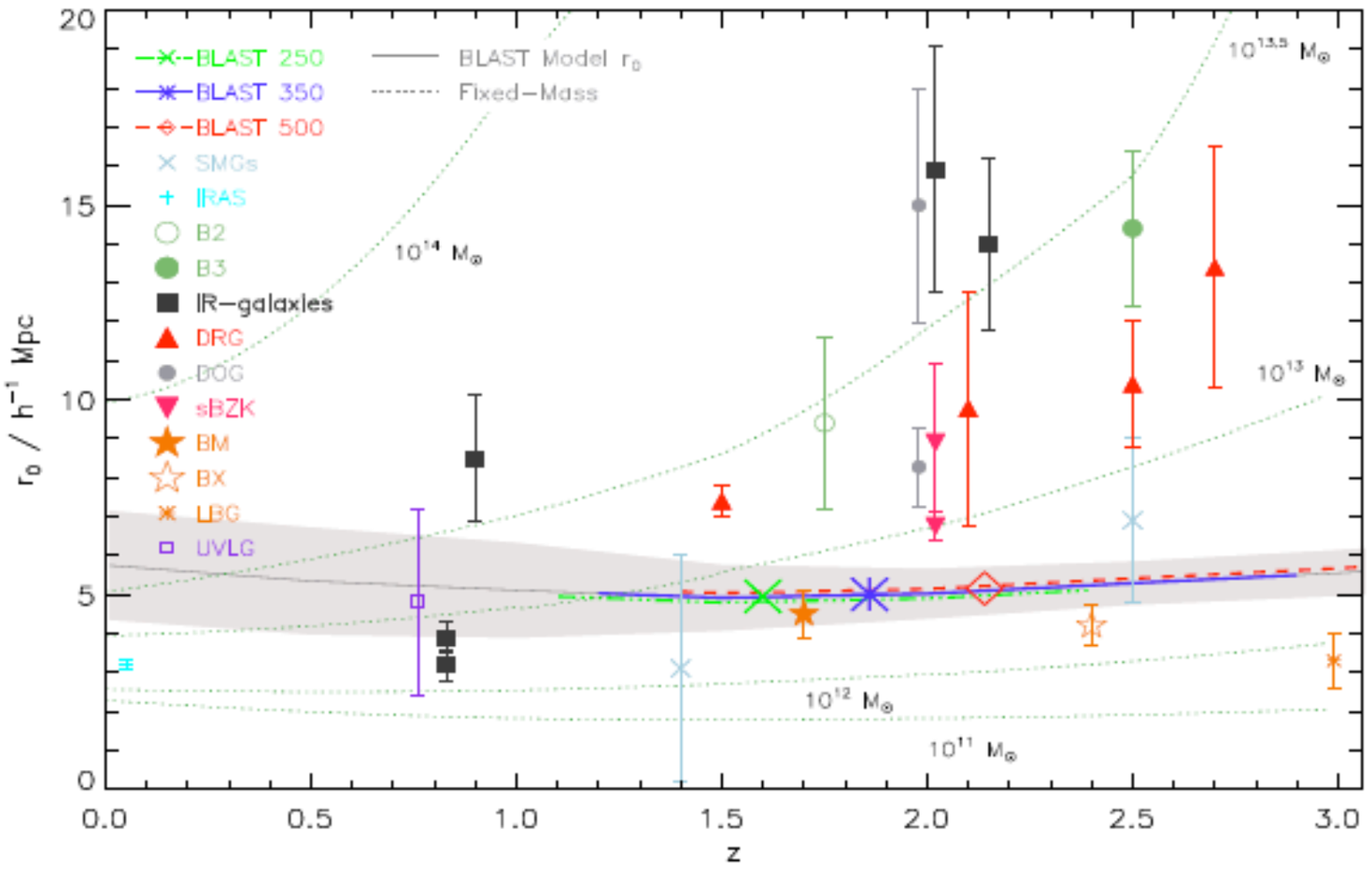
- Clustering Properties



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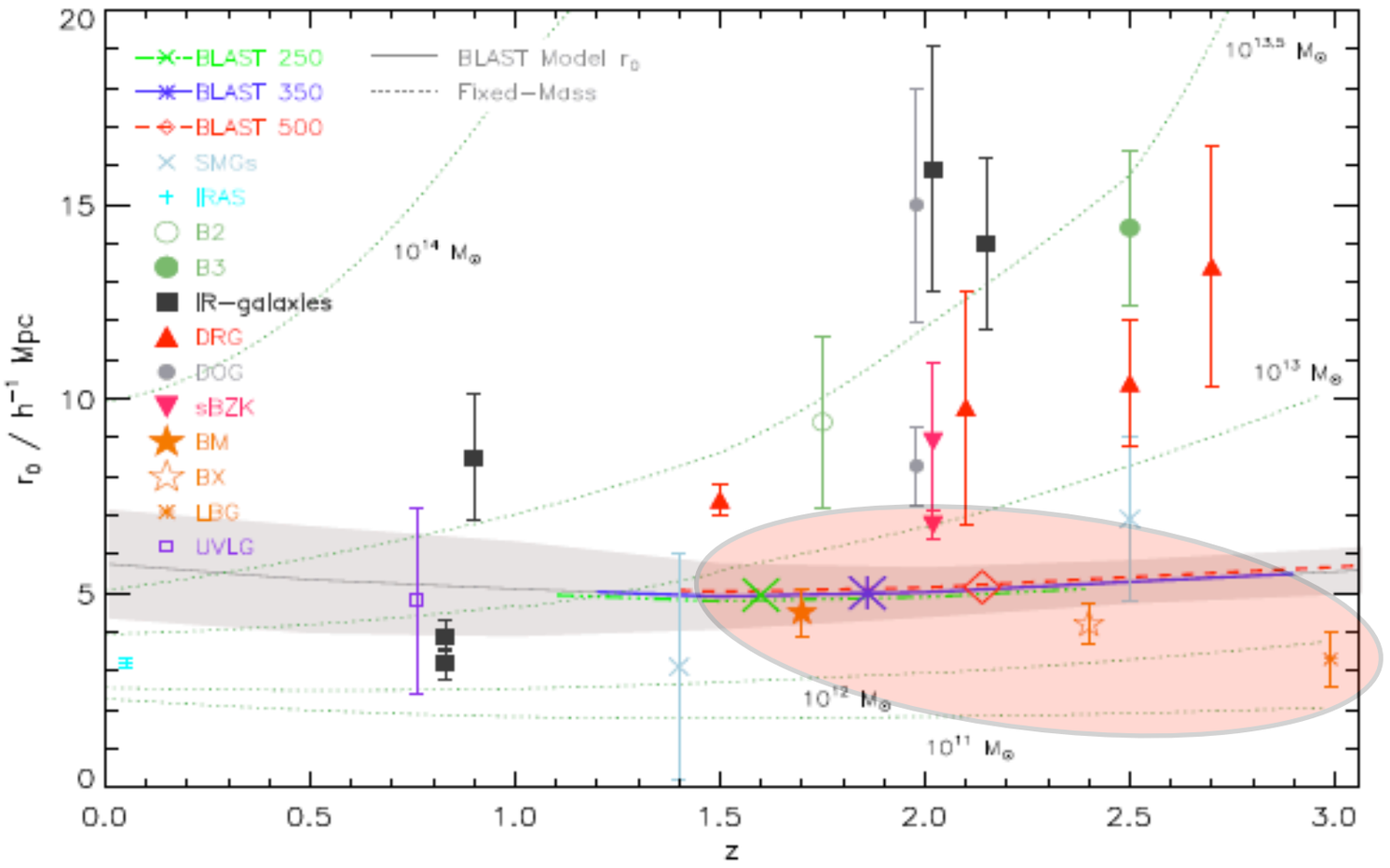

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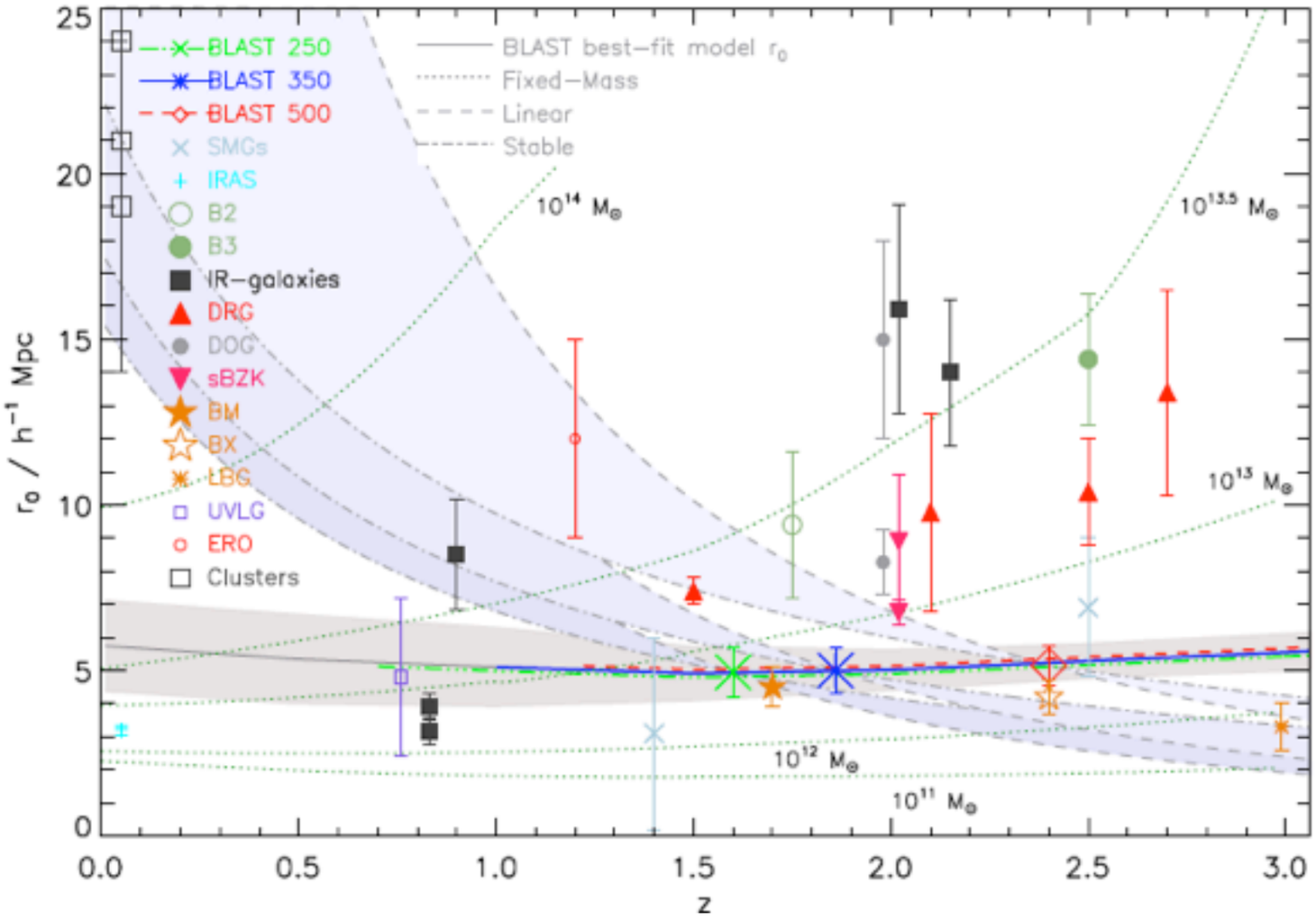
- Clustering Properties
  - BLAST, BX/BM and LBGs all seem to have similar clustering properties
- Clustering Evolution
  - $\xi(r,z) = (r/r_0)^{-\gamma}(1+z)^{\gamma-(3+\varepsilon)}$
    - Stable Clustering $\varepsilon = 0$,
    - Linear Clustering $\varepsilon = 1$



Maps, Papers and more at: http://blastexperiment.info

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(2) BLAST clustering on small scales may indicate dusty star-forming galaxies do not trace halos in a simple way

- Possibly due to environmental effects in large halos

Science & Technology Facilities Council

NASA

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