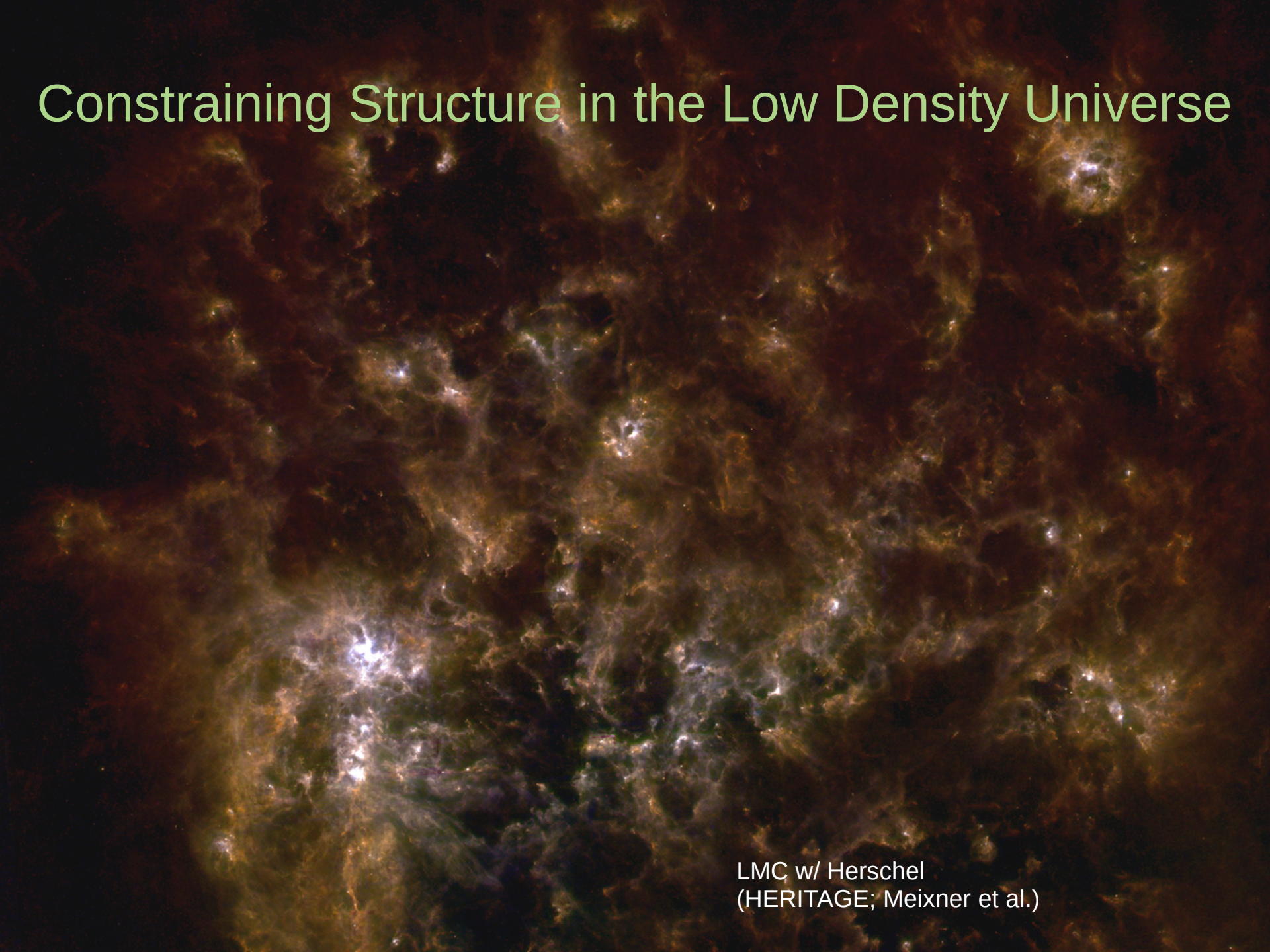
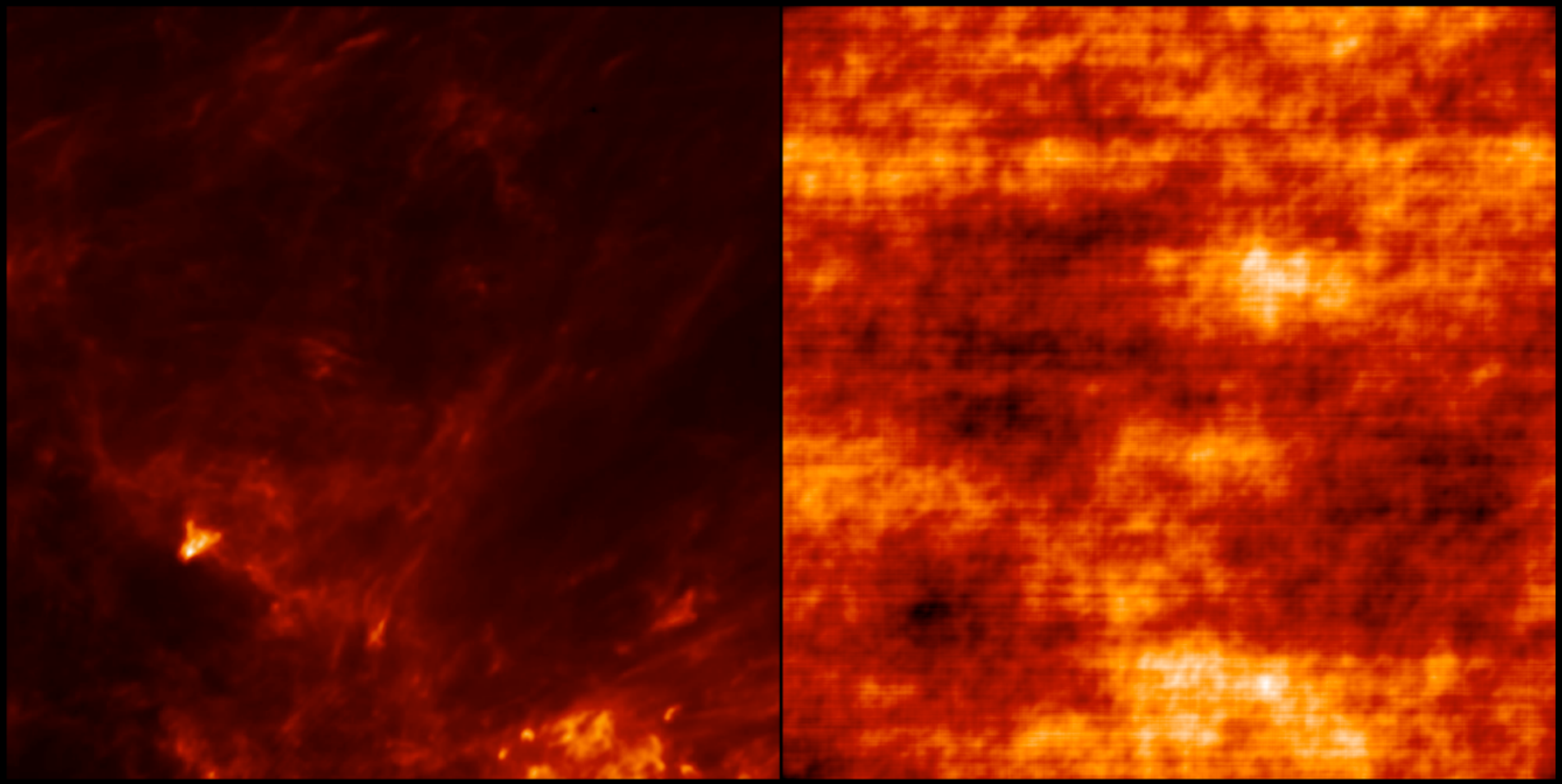
Constraining Structure in the Low Density Universe



LMC w/ Herschel
(HERITAGE; Meixner et al.)

The power spectrum isn't everything

Same Power Spectrum



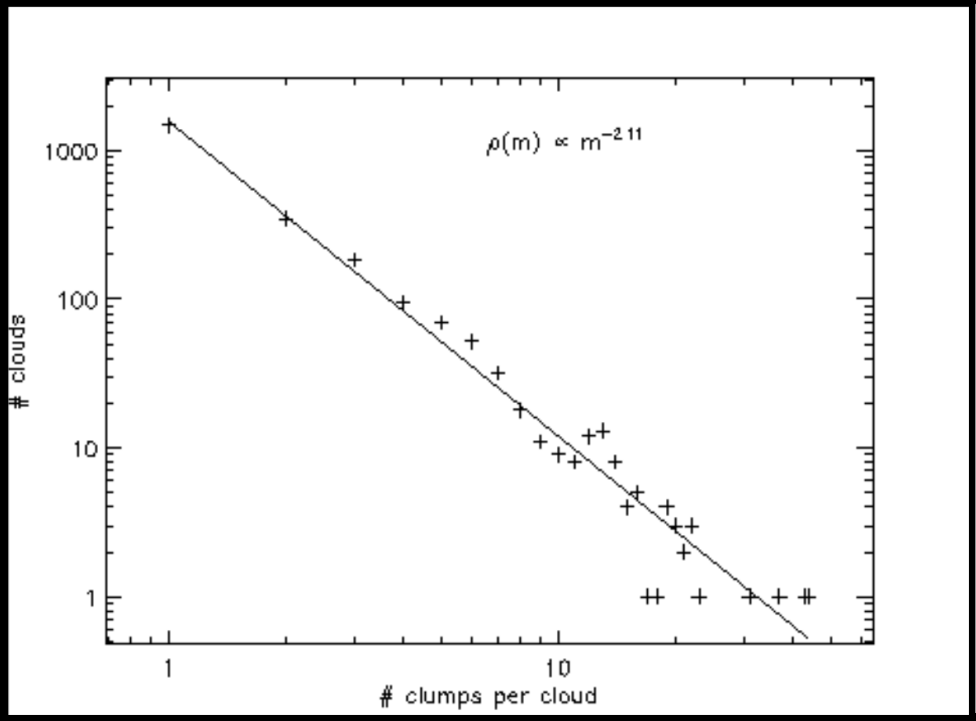
Original **Phase Scrambled**

Peek (priv. comm., 2018)

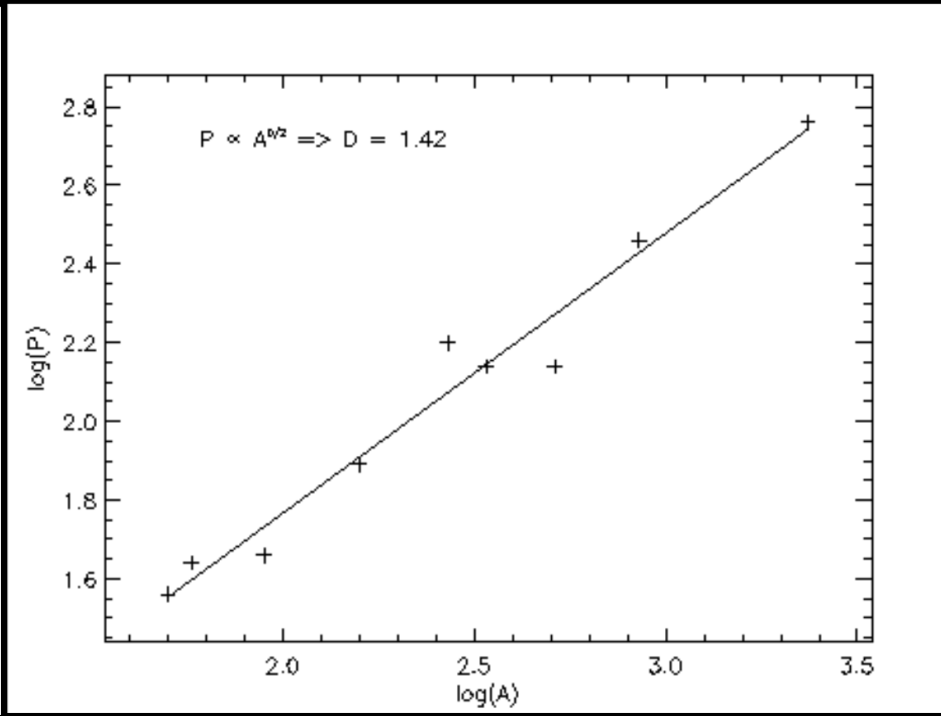
Generation of Realistic ISM Structures Needed for Modeling

Simple structure recipe: Use a filling factor and a density ratio
→ reproduces some measures of ISM structure

Cloud Mass Spectrum



Cloud Fractal Dimension



Witt & Gordon (1996)

Constraining Structure in the Low Density Universe Overview

- Structure is found in the diffuse Universe over all scales, from clouds and sheets in the ISM, to accreting streams in CGM, and filaments in the IGM.
- The nature of this structure has implications for star formation, stellar feedback, the baryon cycle, escaping ionizing photons, and the reionization of the Universe.
- New ways to observe, quantify, and simulate this structure are emerging.
- Focus on all aspects of structure in the low-density Universe: what we know, how we know it, and what its implications are.
- Balance new observational results with latest theoretical insights.
- Relevant to long-running ISM/CGM/IGM work with Hubble, Spitzer, Herschel, ALMA, ...
- JWST will make great progress on gas, dust, their interactions, and evolution over cosmic time.

Constraining Structure in the Low Density Universe

Meeting Outline

- Day 1 am: **Overview** (intro to structure in the LDU),
- Day 1 pm: **Observational tracers of structure**: H I, metals, dust, molecules, magnetic fields
- Day 2 am: **Spatial/Kinematic/Phase Structure** in the LDU (theory & observations)
- Day 2 pm: half-day unconferencing/collaboration time
- Day 3 am**: Quantifying structure** (metals, dust, molecules, kinematics)
- Day 3 pm: half day unconferencing/collaboration time
- Day 4 am: **Origin of structure**

Topics: Filaments, sheets, turbulence, kinematic & spatial structure, small-scale structure, impact of star formation, metal mixing, spiral structure, absorption vs emission, fractals
Not: star formation itself

Overall questions for speakers and unconference sessions to address:
Q) what is the importance of structure?
Q) how do we measure structure?
Q) what is the origin of structure?

Constraining Structure in the Low Density Universe

Unconference/collaboration Goals

Generate ideas for quantifying structure in observations and models

Directly test those ideas during the meeting

- have example observation and model datasets available
- Observations
  - 2D measures (Spitzer/Herschel; dust mass maps)
  - 3D measures (HI cubes; Milky Way dust maps)
- Models
  - Hydro simulations

One potential outcome from the meeting

- New quantitative structure measures
- White paper?

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Candidates for Invited Speakers

Overview: Mary Putman, Naomi McClure Griffiths or Jay Lockman, Snezana Stanimirovic, Andrew Wetzel, Filippo Fraternali
Metal mixing: Robin Shelton, Joop Schaye or Romeel Dave
Turbulence: Blakesley Burkhart, Stella Ofner, Mark Heyer
Molecules: Clare Dobbs
Magnetic fields: Alex Hill, Gina Panopoulou
Filaments: Susan Clark
Dust structure: Eddie Schafly, Gail Zasowski (kinematics)
Turbulence/instabilities: Marc-Antoine Mivelle Deschenes
Global ISM structure: Alyssa Goodman

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Potential SOC Membership

Alessandra Aloisi, Andy Fox, Steve Goldman, Karl Gordon, Lea Hagen, Bethan James, Claire Murray, Josh Peek, Marc Rafelski, Julia Roman-Duval, Ravi Sankrit, Jason Tumlinson, & others that are interested

Co-Chairs: Karl Gordon, Ravi Sankrit

Constraining Structure in the Low Density Universe

Other Relevant Meetings

Various recent and future meetings on ISM/IGM/SF topics
- → none focusing on structure
- → at most, structure a minor component

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