Summary

Raphael Flauger

B-modes From Space, Berkeley, CA, December 4, 2017

Background

- In fall 2016 NASA solicited proposals for mission concept studies for probe missions (<1B USD)
- 27 proposals were submitted, 8 were selected for further study

Inflation Probe Mission Concept Study

Galaxy Evolution Probe

STROBE-X

Cosmic Evolution through UV Spectroscopy

Transient Astrophysics Probe Concept Study

A High Spatial Resolution X-ray Probe Satellite

Cosmic Dawn Intensity Mapper

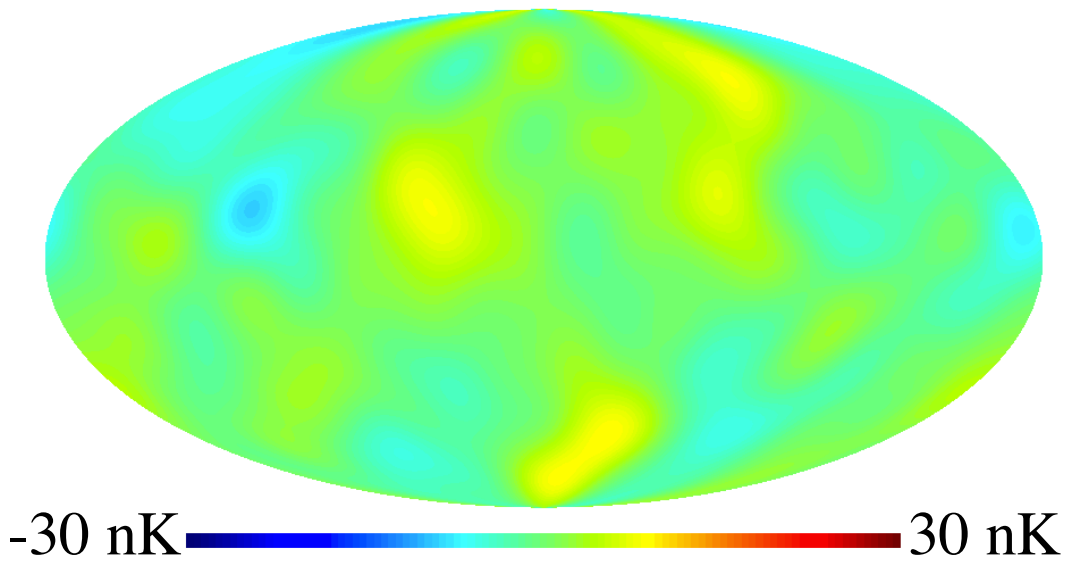
Probe of Extreme Multimessenger Astrophysics

Background

- The studies will conclude with a report in December 2018
- These reports will provide input for the 2020 Astrophysics Decadal Survey
- The main goal is to establish whether probe missions (<1B USD) should be included in NASA's portfolio
- The best outcome would be eight compelling reports with probe mission concepts convincingly <1B USD

Motivation

- A compelling CMB proposal must demonstrate the need for a space mission and go significantly beyond what can be achieved from the ground
- This requires control over the largest angular scales not accessible from the ground (so far)

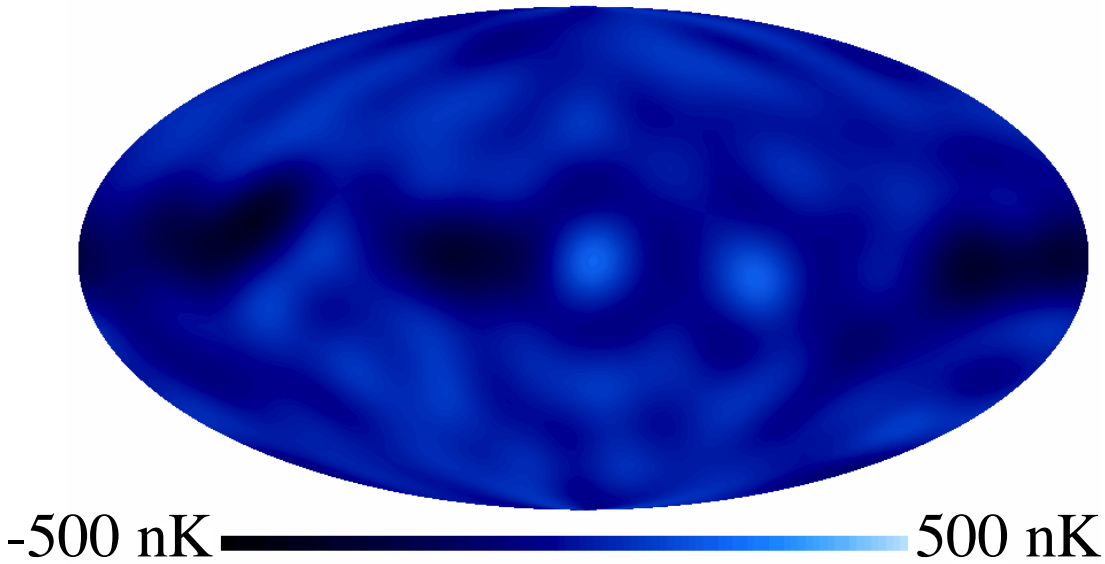


r=0.001

l=2...12

Motivation

- Must control *foregrounds* and *systematics* at the few nK level

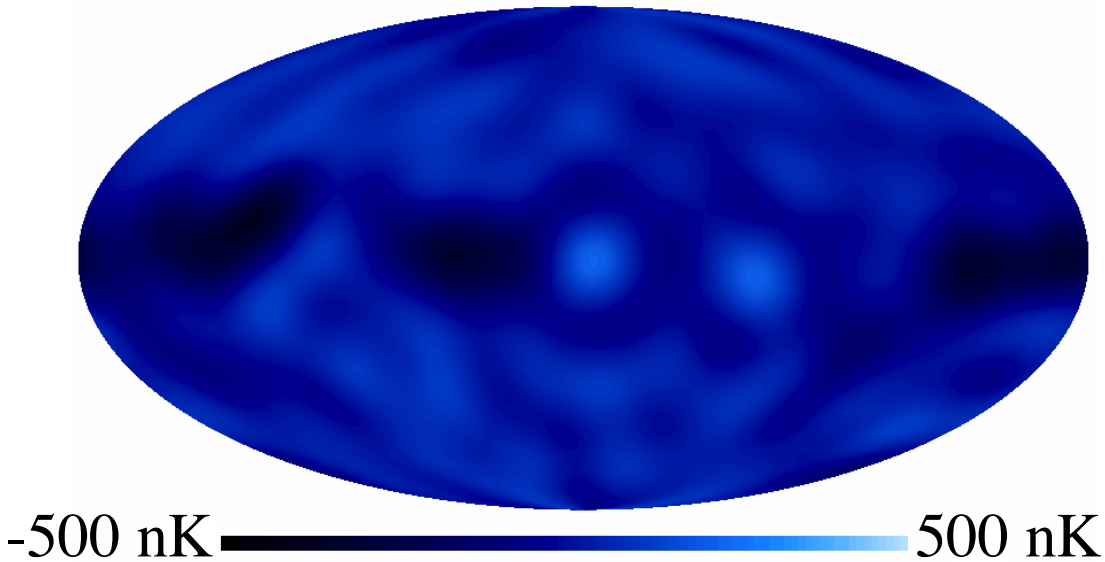


353 GHz noise scaled to CMB frequencies

l=2…12

Motivation

- Must control *foregrounds* and *systematics* at the few nK level



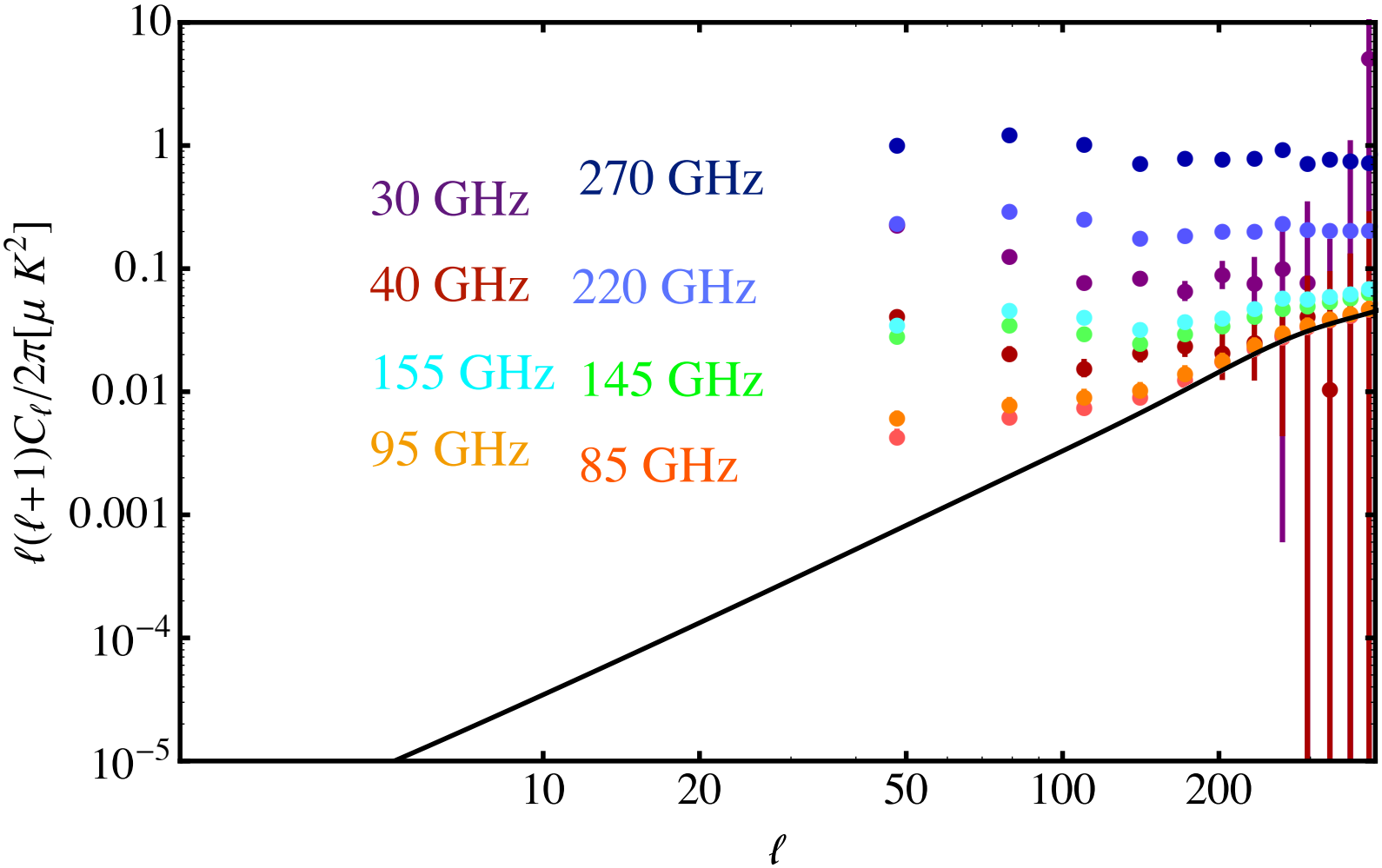
353 GHz noise scaled to CMB frequencies

l=2…12

Far beyond current capabilities

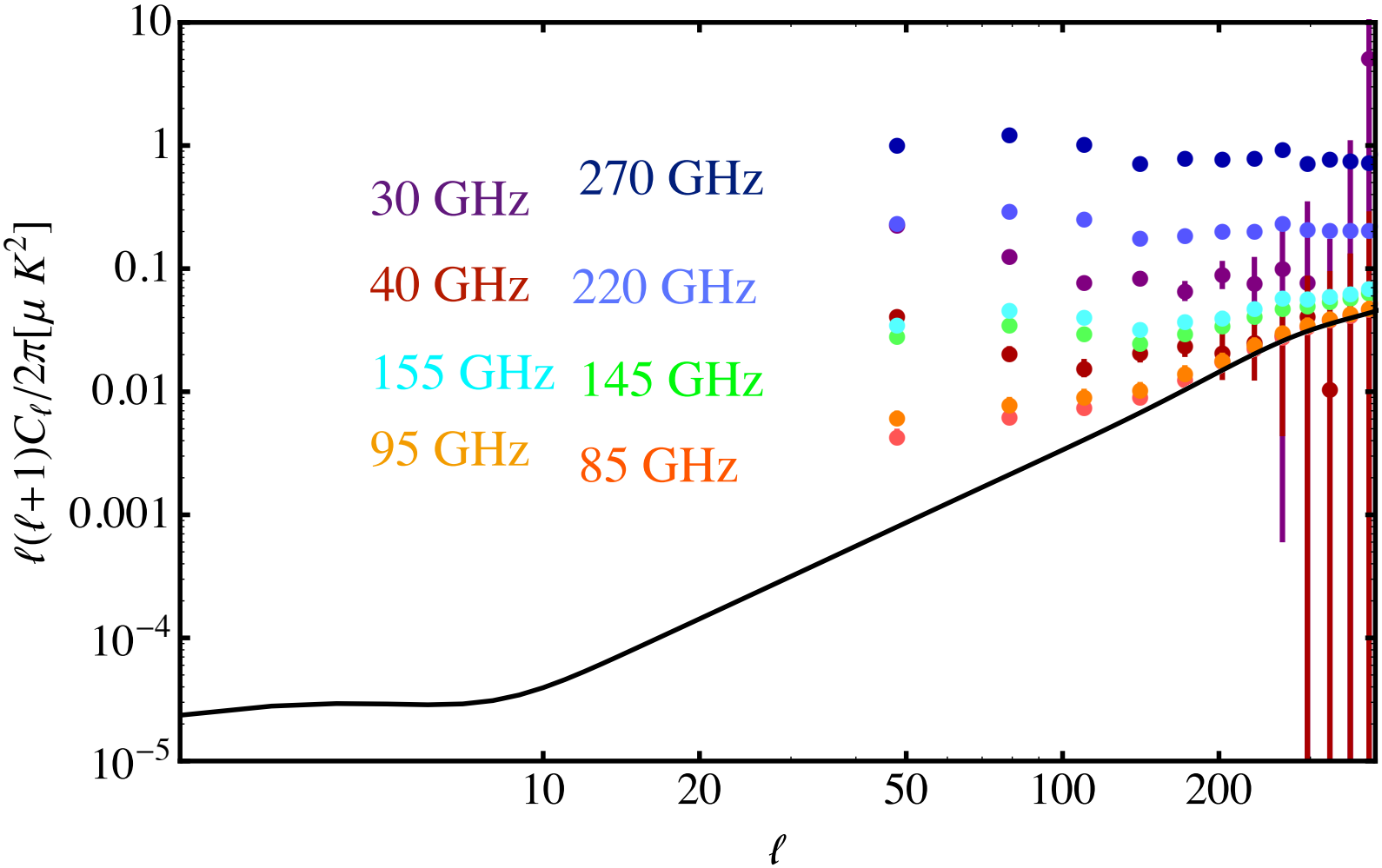
Motivation

The challenge is to use maps with auto-spectra shown below to tell the difference between (r=0)...

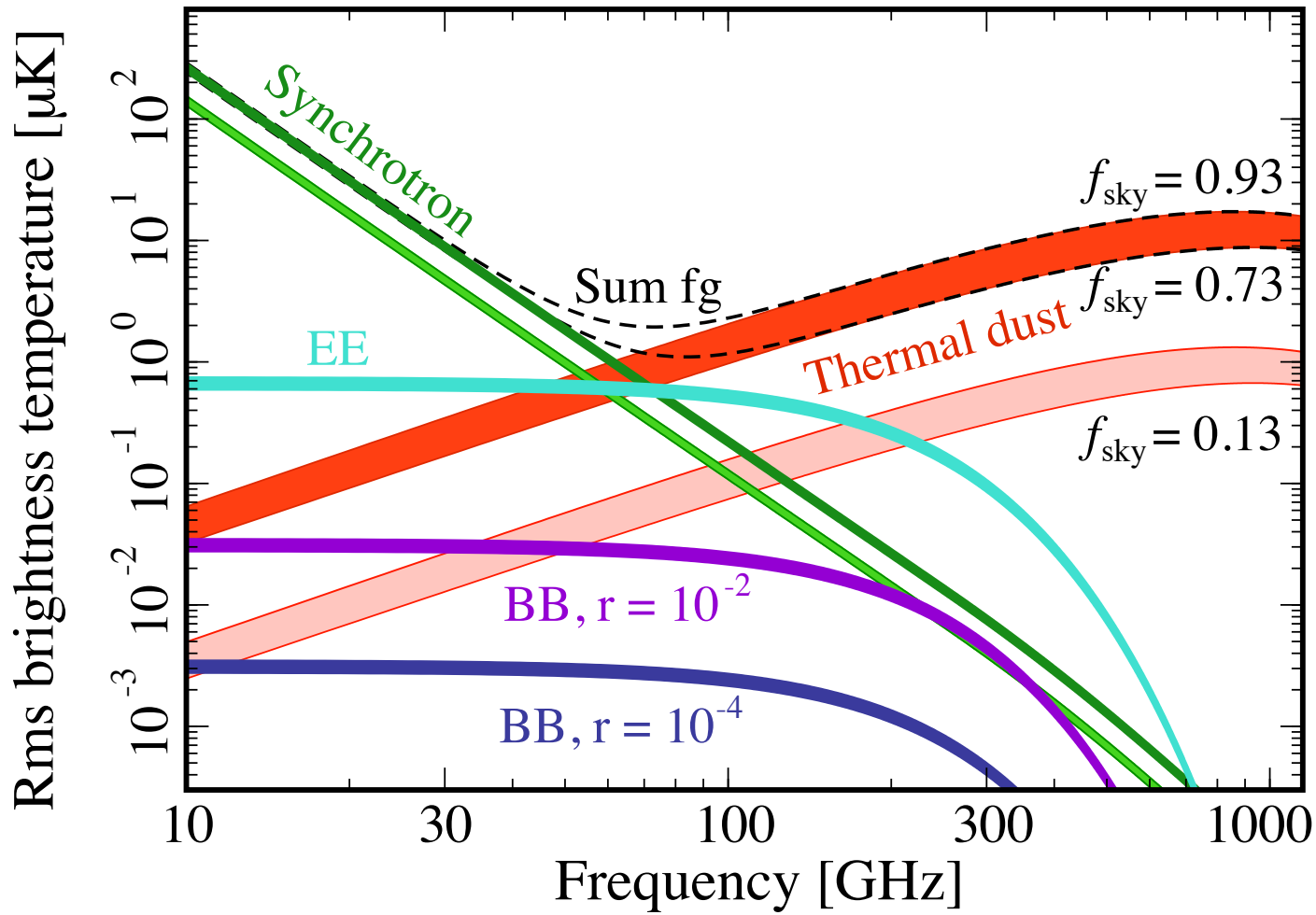


Motivation

and r=0.001...



Motivation



Foregrounds dominate by orders of magnitude at all frequencies even in the cleanest patches

Motivation

The goal of the workshop was to identify a path forward for the treatment of foregrounds for the probe mission study and other CMB experiments

- Identify the state of the art
- Identify steps beyond the current state of the art feasible on the time scale appropriate for the report
- Identify steps forward for the longer term

Slides available at cmbworkshop2017.ucsd.edu

Workshop Summary

Wednesday

Observational Status I - High Frequencies

Jean-Loup Puget
Francois Boulanger
Tuhin Ghosh
Chris Sheehy

Observational Status II - Low Frequencies

Carlo Baccigalupi
Nicoletta Krachmalnicoff
Michael Jones
Flavien Vansyngel

Workshop Summary

Wednesday

Galactic Modeling I

Clem Pryke

Susan Clark

Brandon Hensley

Jens Chluba

Alex Lazarian

Galactic Modeling II

Chang-Goo Kim

Ka Ho Yuen

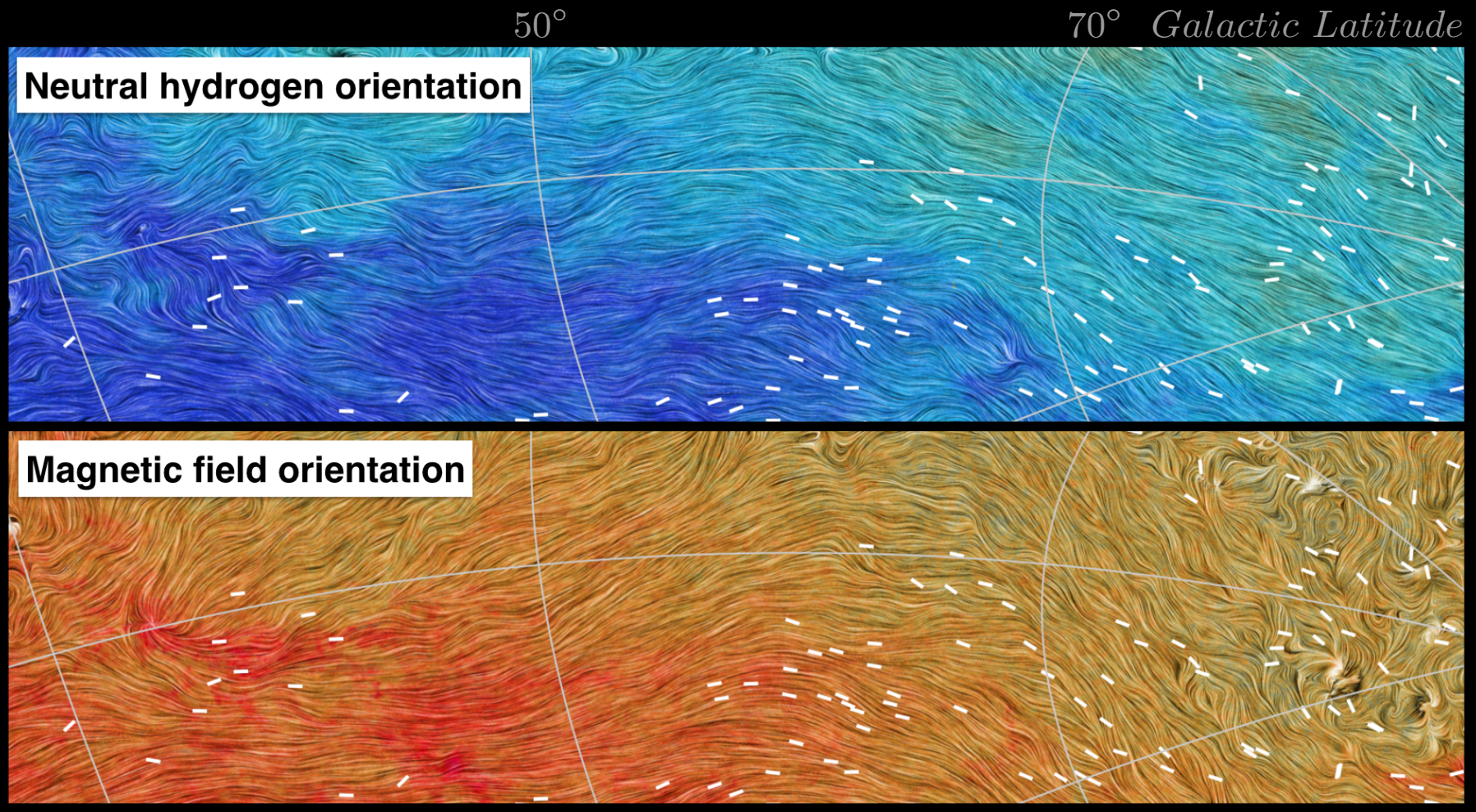
Alexei Kritsuk

David Collins

HI data and dust emission

Susan Clark

High-latitude GALFA-HI structures are aligned with the Planck magnetic field orientation.

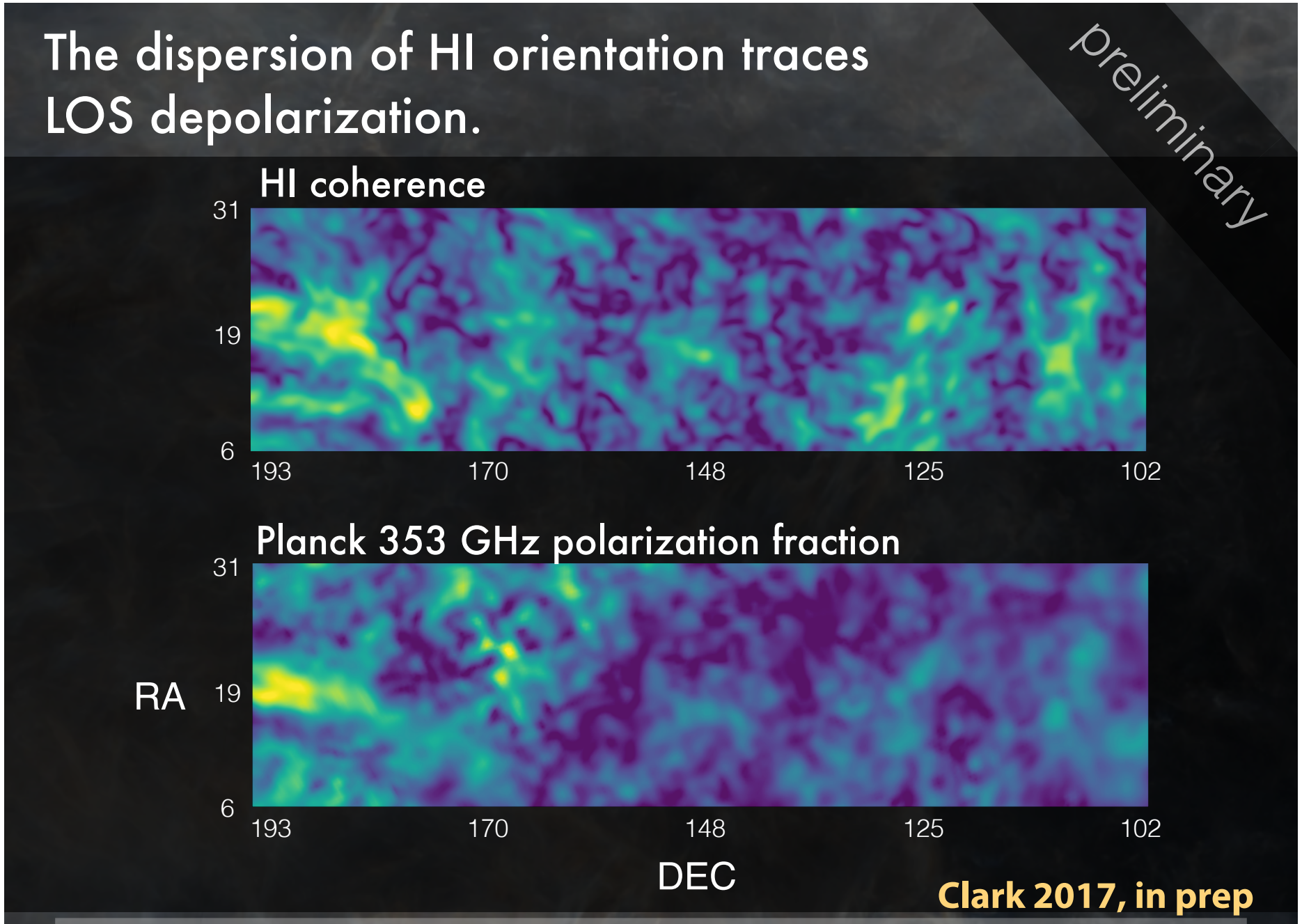


Starlight polarization: Heiles 2000

Clark, Hill+ 2015, PRL

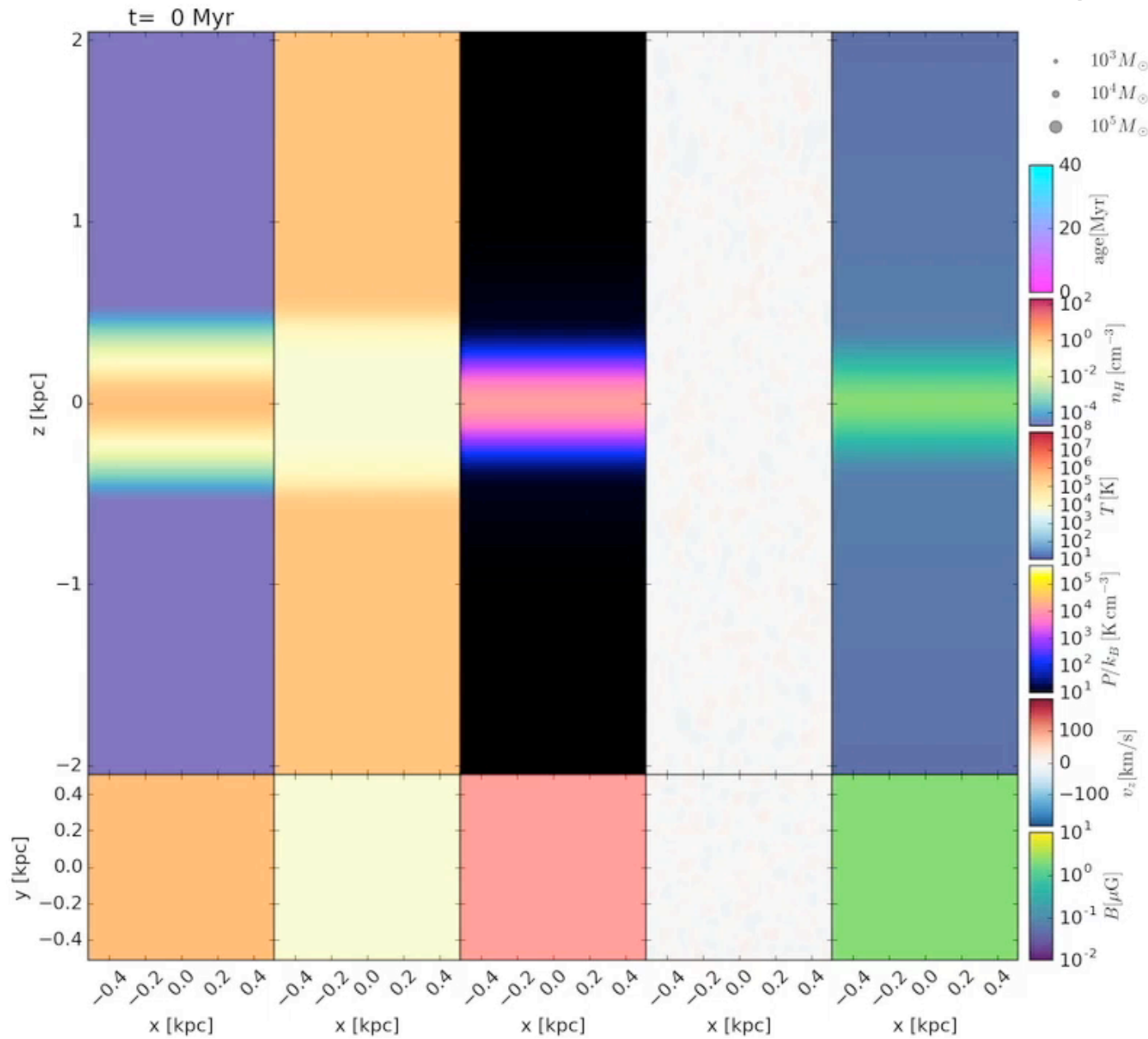
HI data and dust emission

Susan Clark



MHD simulations for ISM turbulence

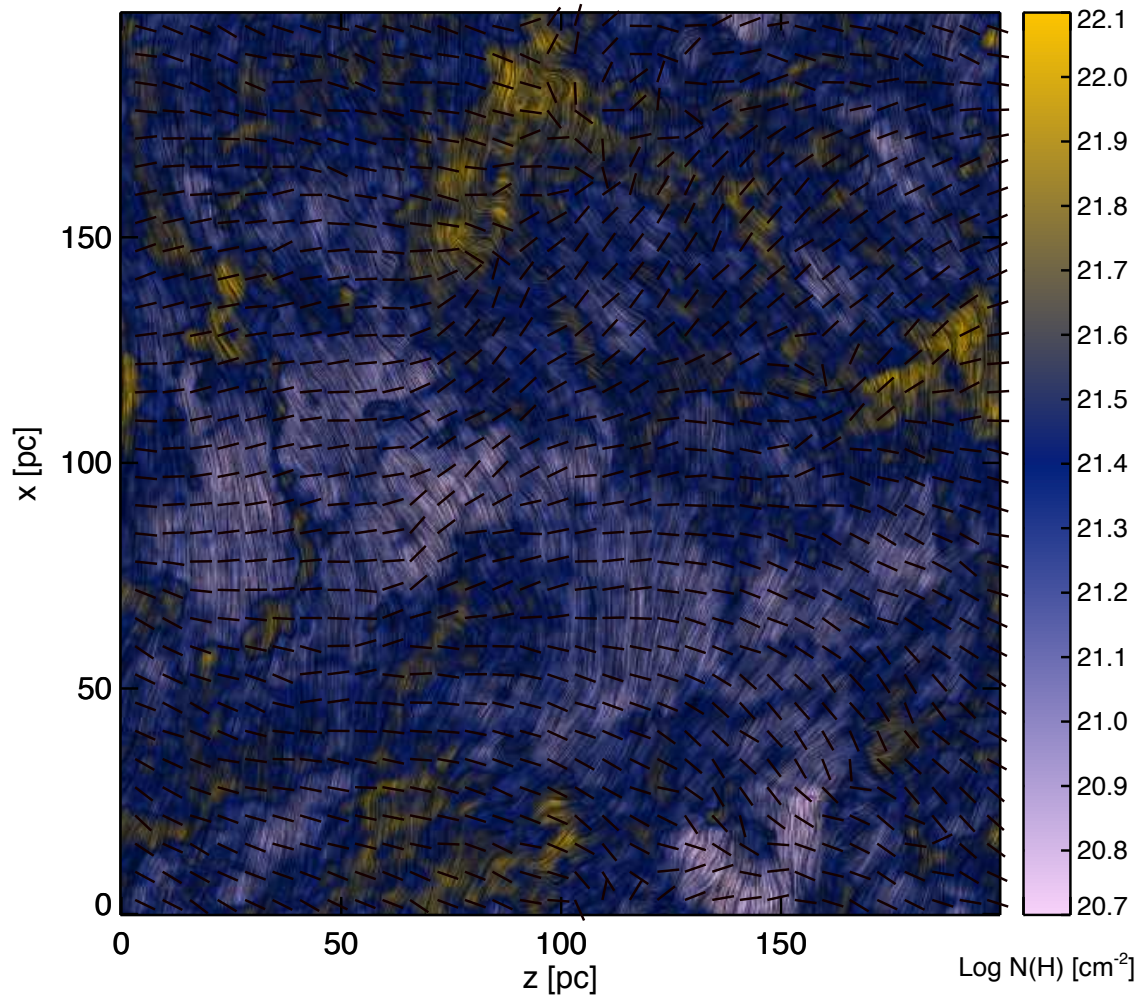
Chang-Goo Kim



MHD simulations for ISM turbulence

Synthetic dust-polarization map for case A

Alexei Kritsuk

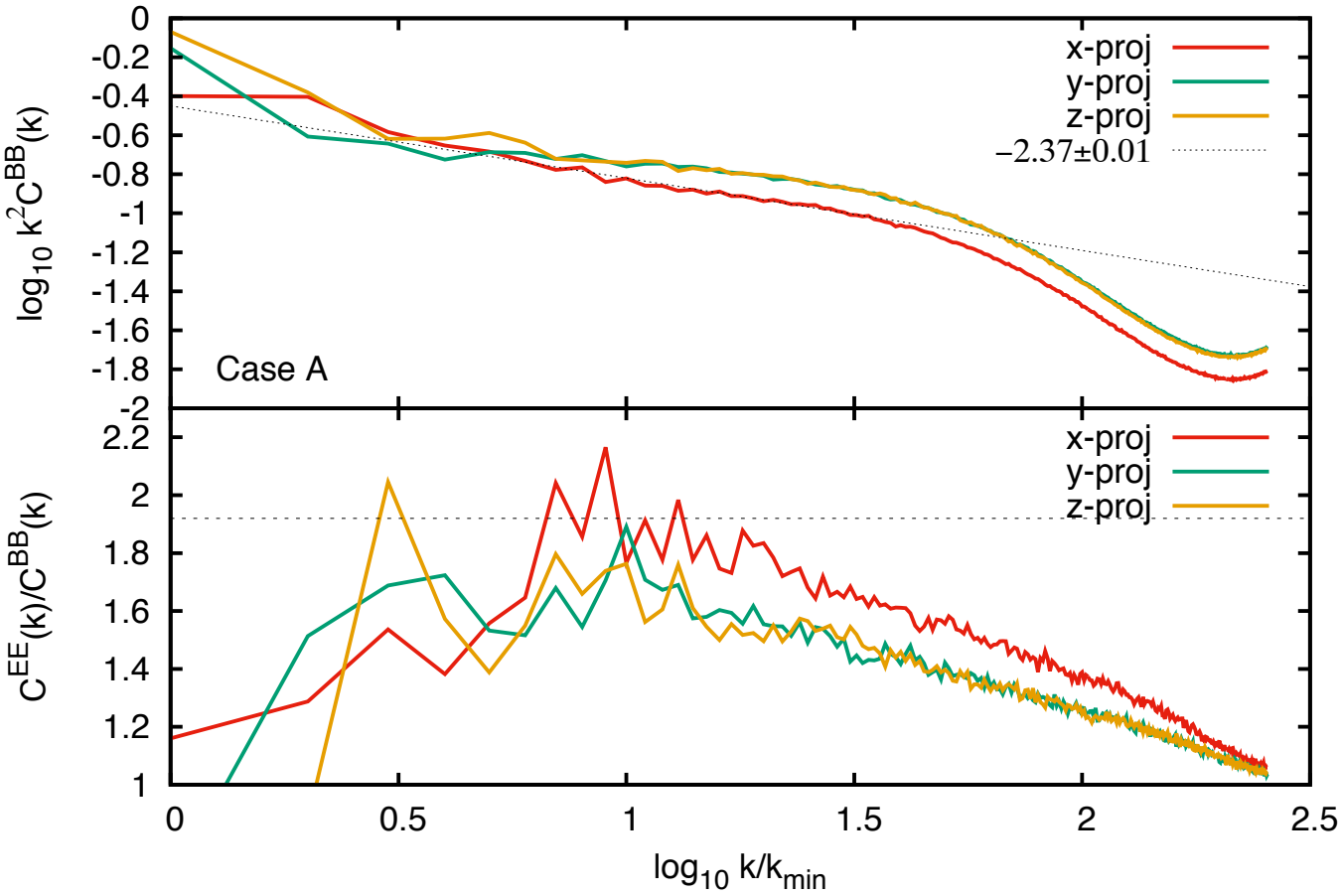


- Projection orthogonal to the mean field $\boldsymbol{b}_0$
- Texture – POS magnetic field; Color – column density; Pseudo-vectors – polarization

MHD simulations for ISM turbulence

B-mode spectra and E-to-B ratios for case A

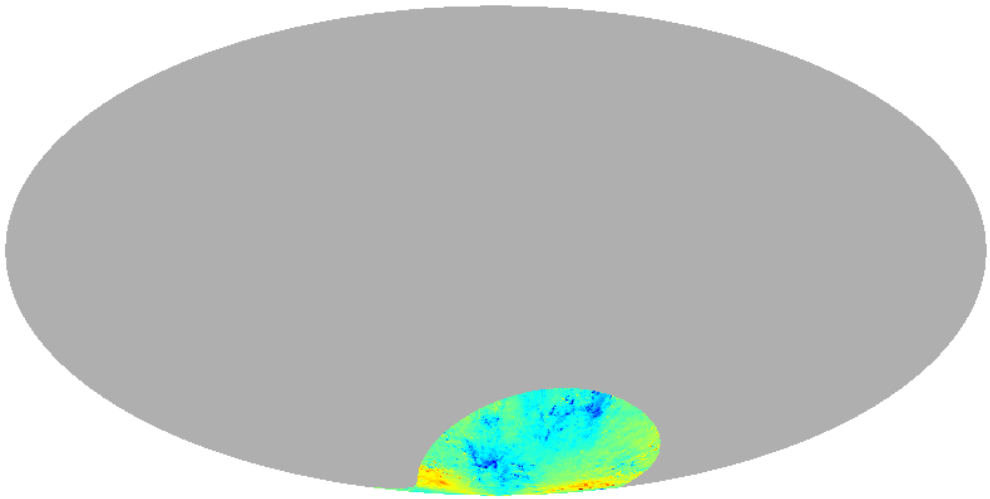
Alexei Kritsuk



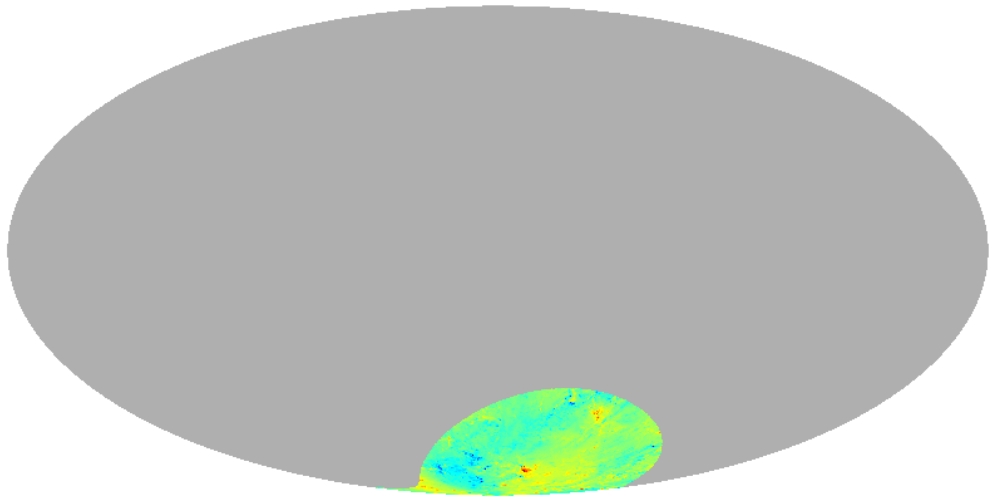
- Statistical sample includes 210 projections based on 70 flow snapshots at 512^3

MHD simulations for ISM turbulence

These simulations together with a simple model for dust and synchrotron emission form the basis of model 6 in the CMB-S4 CDT report



Stokes Q



Stokes U

155 GHz

Workshop Summary

Thursday

Extragalactic Modeling

Marcelo Alvarez

Colin Hill

Gianfranco DeZotti

Delivering the total sky

Jacques Delabrouille

Ben Thorne

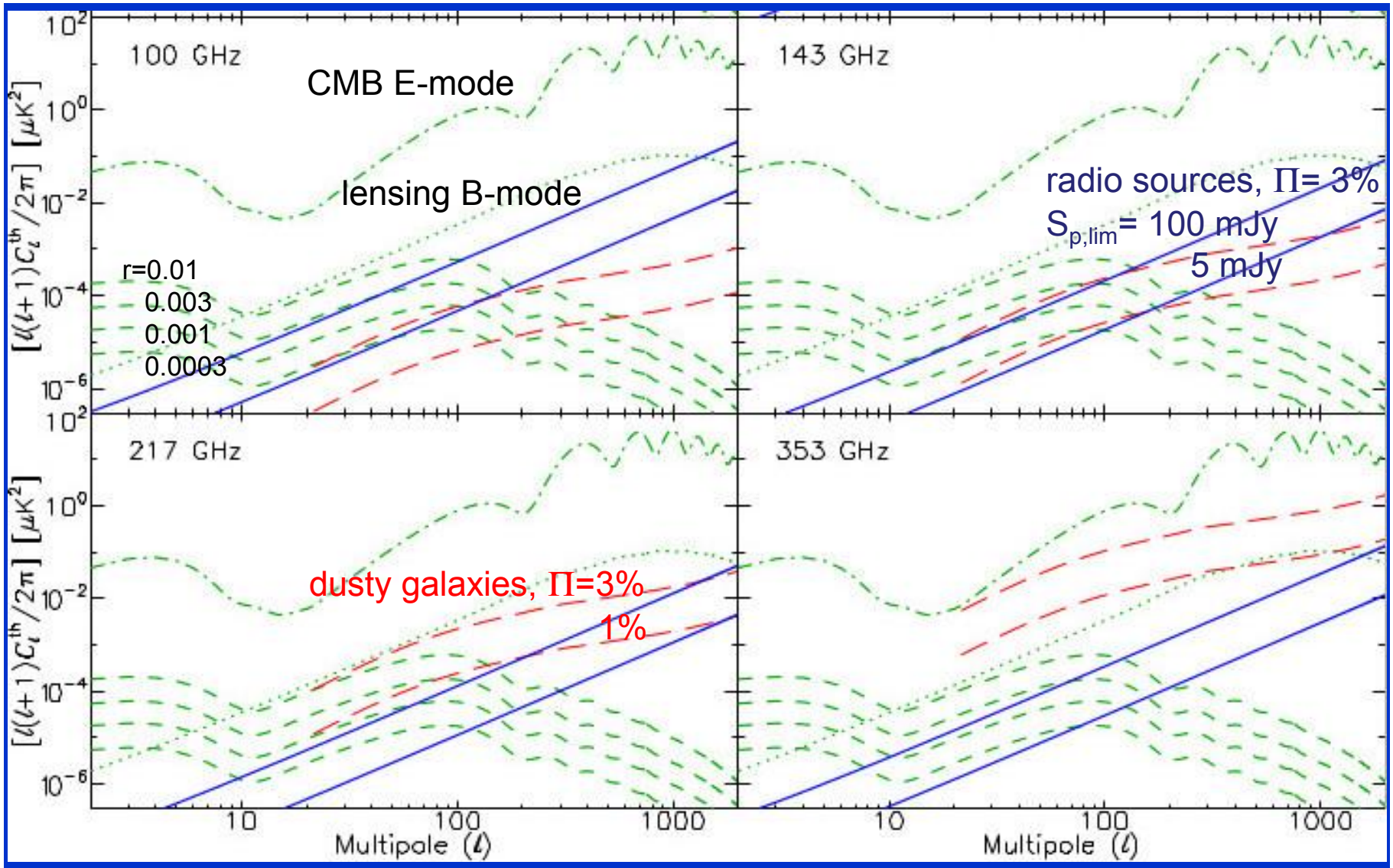
Adrian Liu

Carlos Hervias

Julian Borrill

Extragalactic sources

Gianfranco DeZotti



Trombetti et al., in preparation

Workshop Summary

Thursday

Analysis

Mathieu Remazeilles
Josquin Errard
Alex van Engelen

Working groups

Galactic foregrounds
Extragalactic foregrounds
Delivering the total sky
Analysis

Workshop Summary

Friday

Reports from working groups

Galactic foregrounds
Extragalactic foregrounds
Delivering the total sky
Analysis

Planning the next steps

Workshop Summary

We can use help in all working groups and anyone interested in the study is welcome to contribute.

If you would like to contribute, or just keep up to date, you can sign up for the mailing list

https://support.physics.umn.edu/wws/info/cmbprobe

Thank you