GALACTIC SCIENCE WITH LITEBIRD

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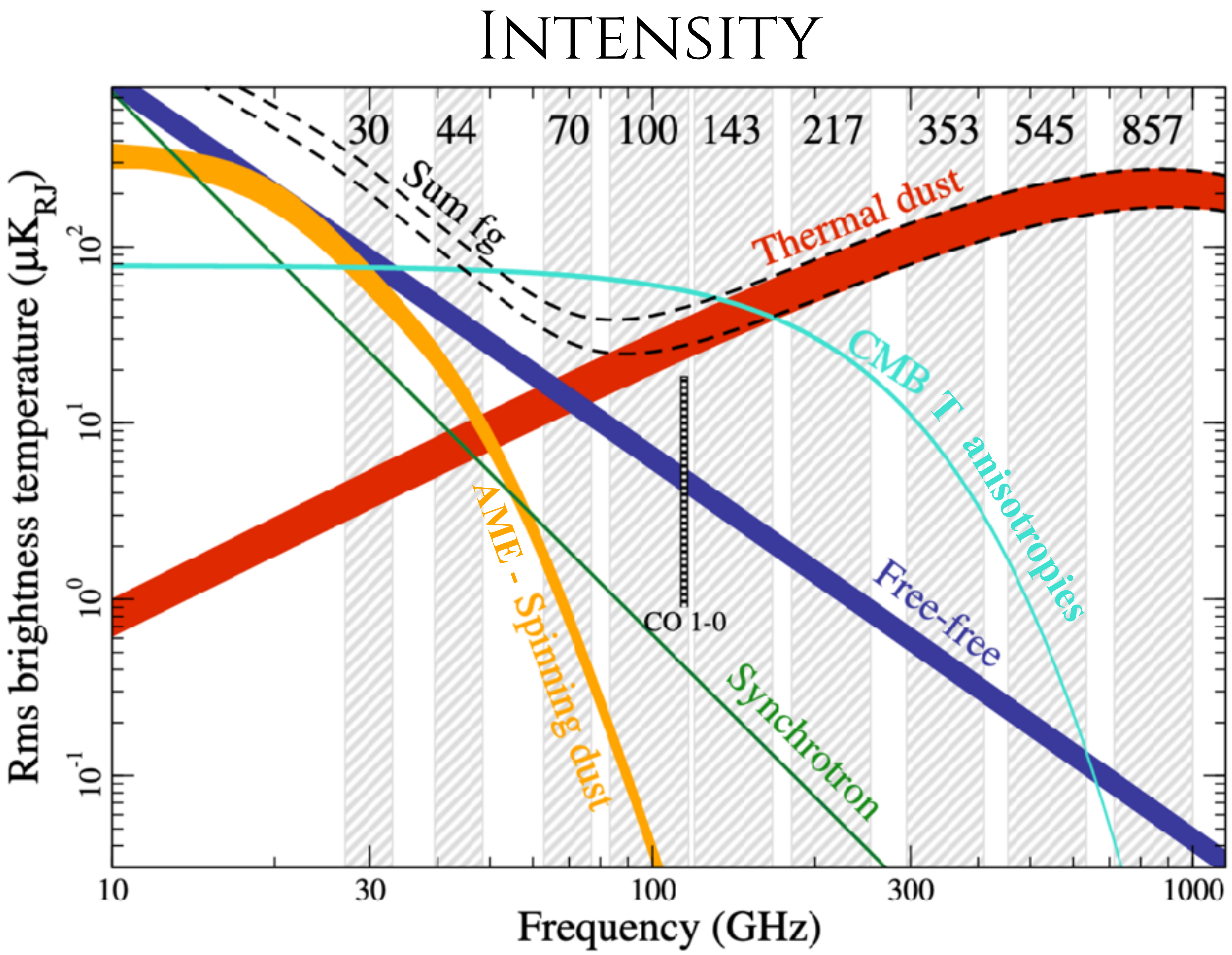
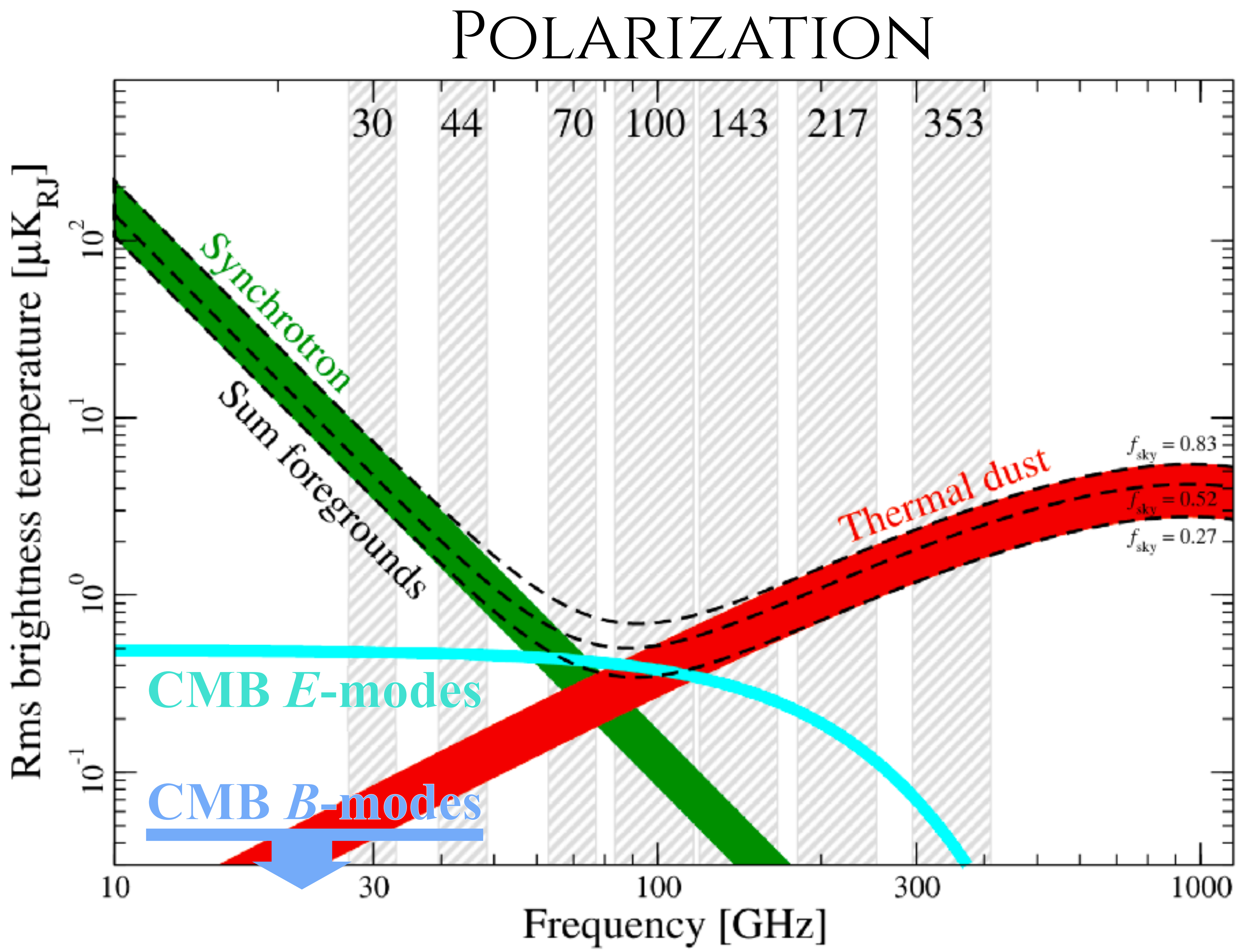
CMB foregrounds





[Adapted from Planck 2015 X and Planck 2018 IV]

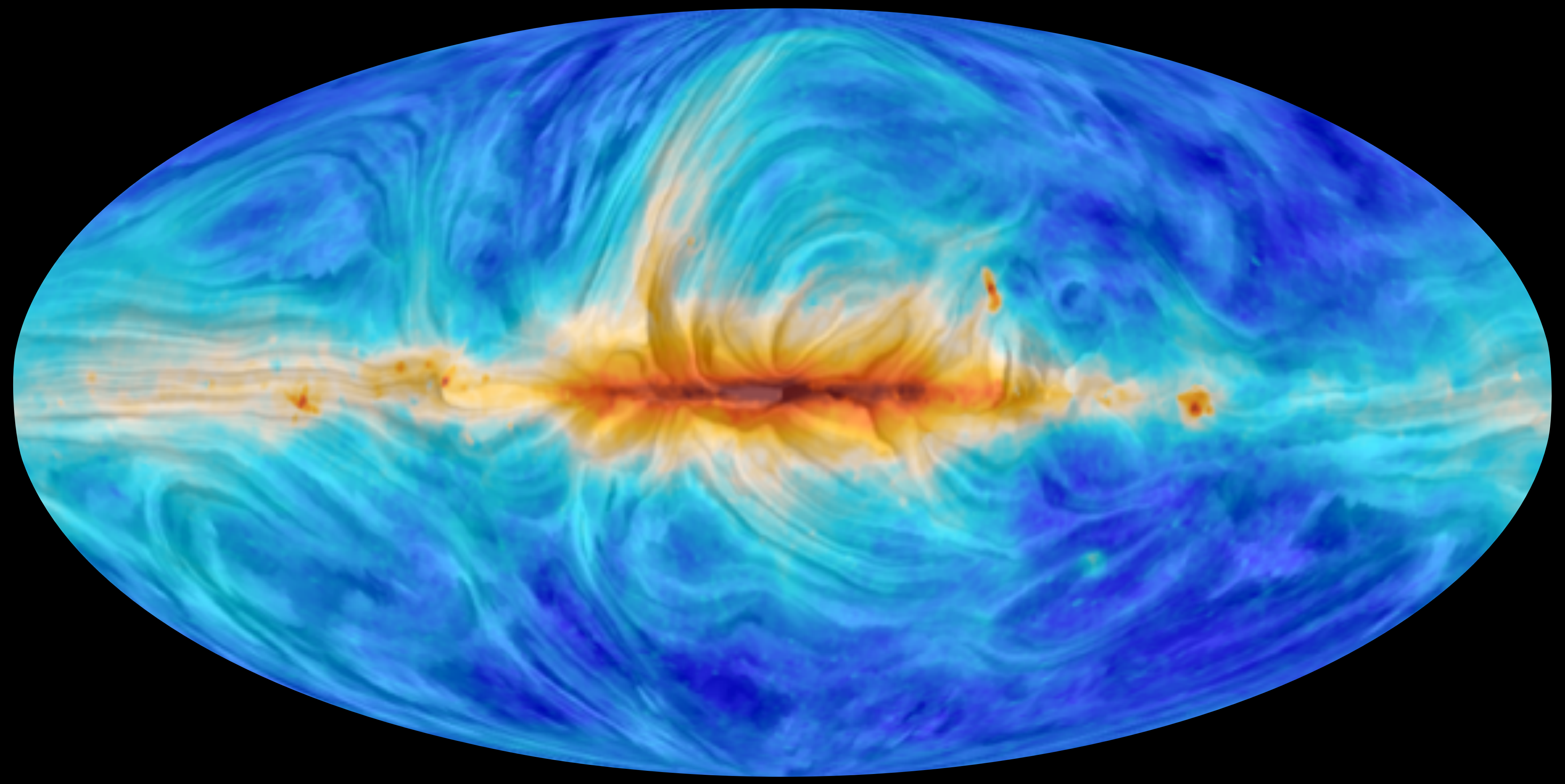
CMB foregrounds

[Adapted from Planck 2015 X and Planck 2018 IV]

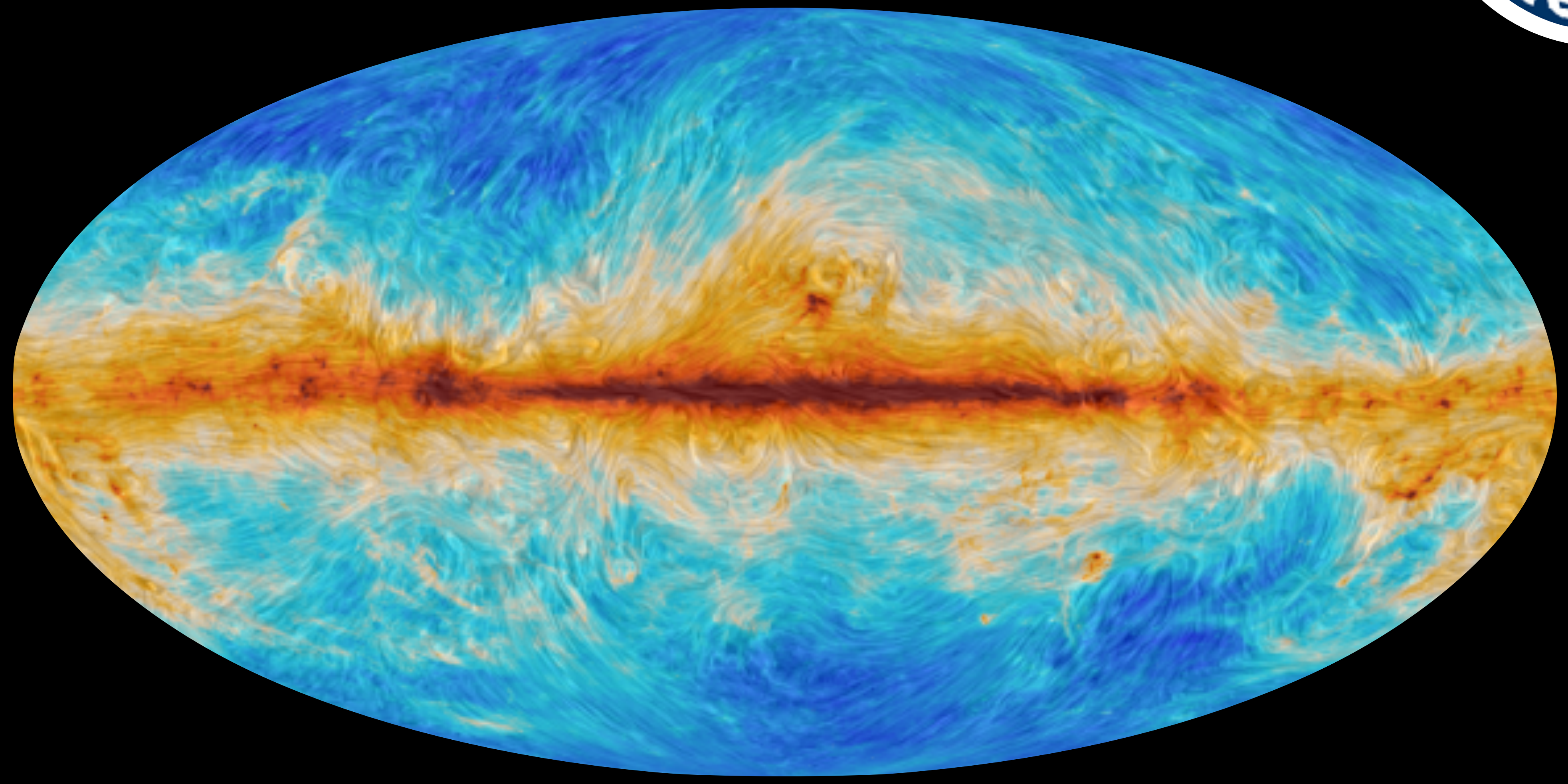
POLARIZED
- Galactic dust emission
- Galactic synchrotron emission
- Radio and IR point sources?

UNPOLARIZED? (to which level?)
- Anomalous Microwave Emission (AME)
- CO and other molecular lines
- Free-free emission
- Cosmic Infrared background (CIB)
- …

LiteBIRD main polarized foregrounds

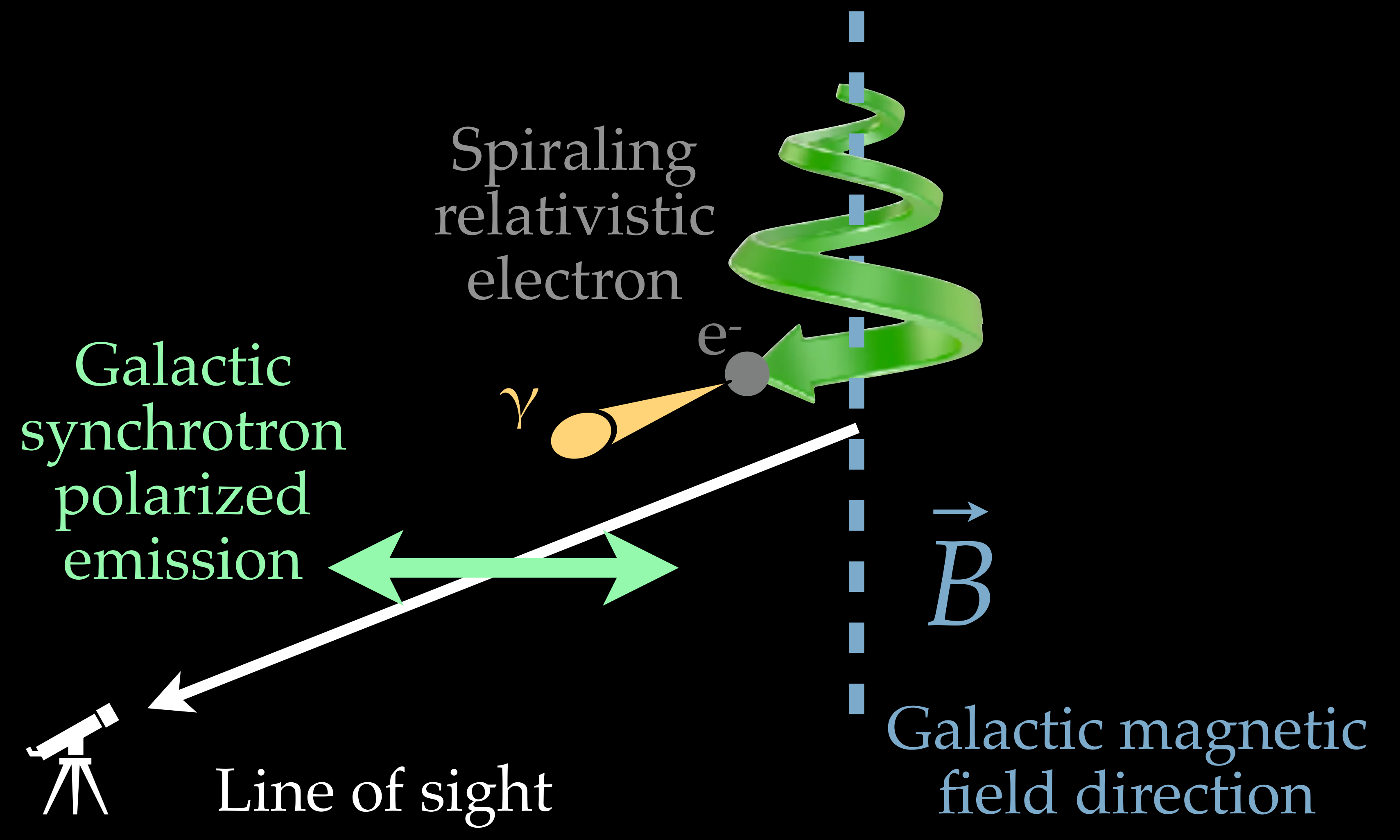


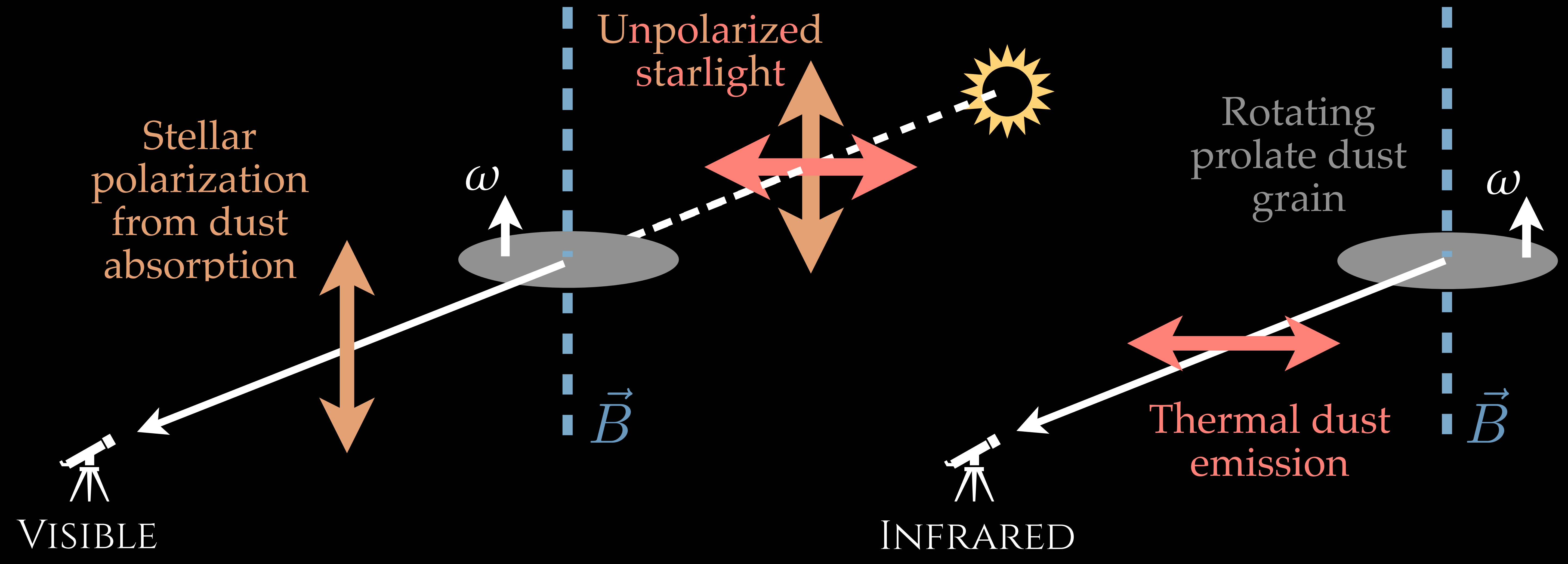
Galactic synchrotron from Planck



Galactic thermal dust from Planck

[Planck 2015 X]

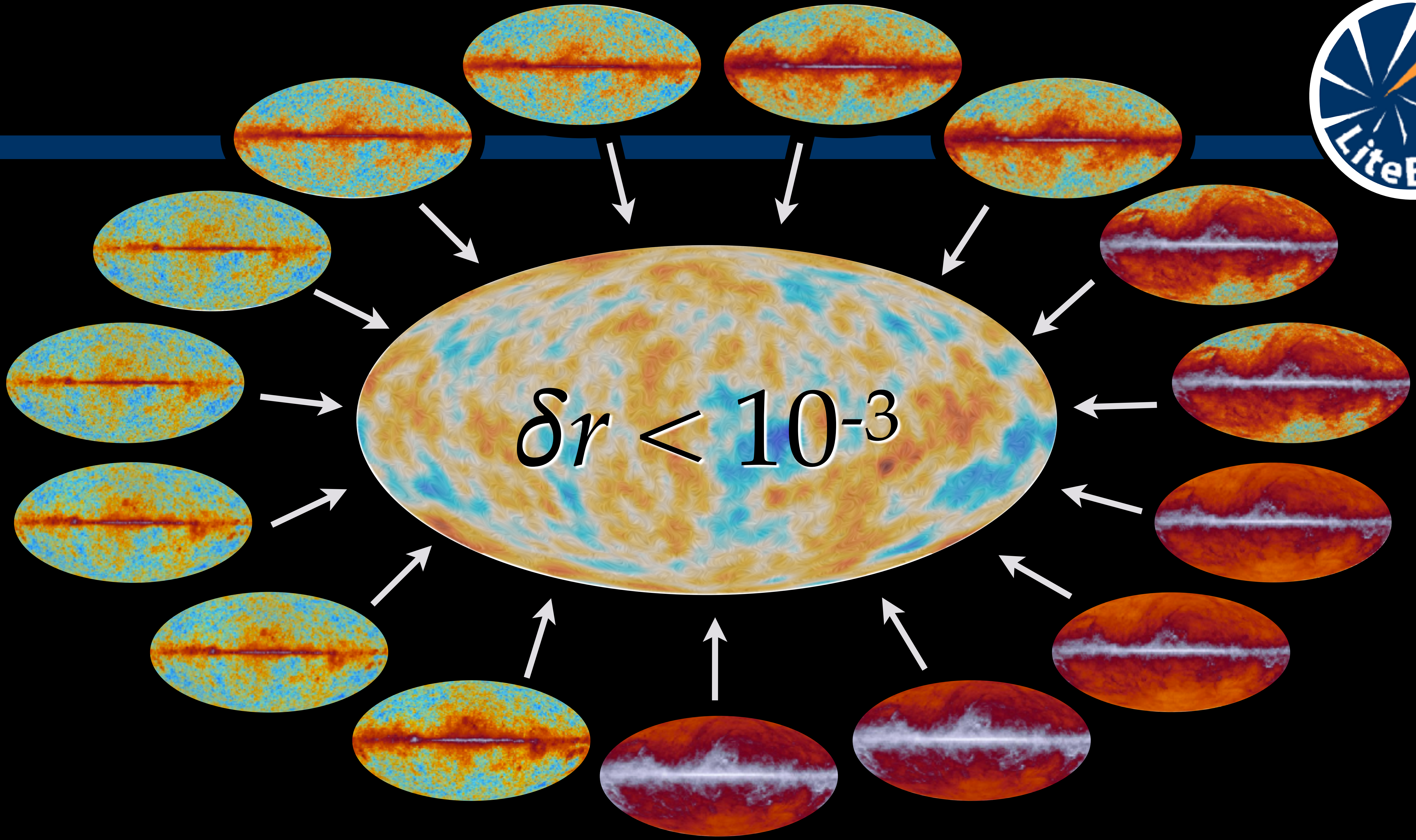




LiteBIRD legacy

15 bands spanning frequencies from 34 to 448 GHz, with resolutions from 70 to 18 arcmin

Full sky maps with very-high polarization accuracy



[Planck 2015 I]

Cosmology

- Inflation
- Neutrino mass
- Reionization
- Cosmic birefringence

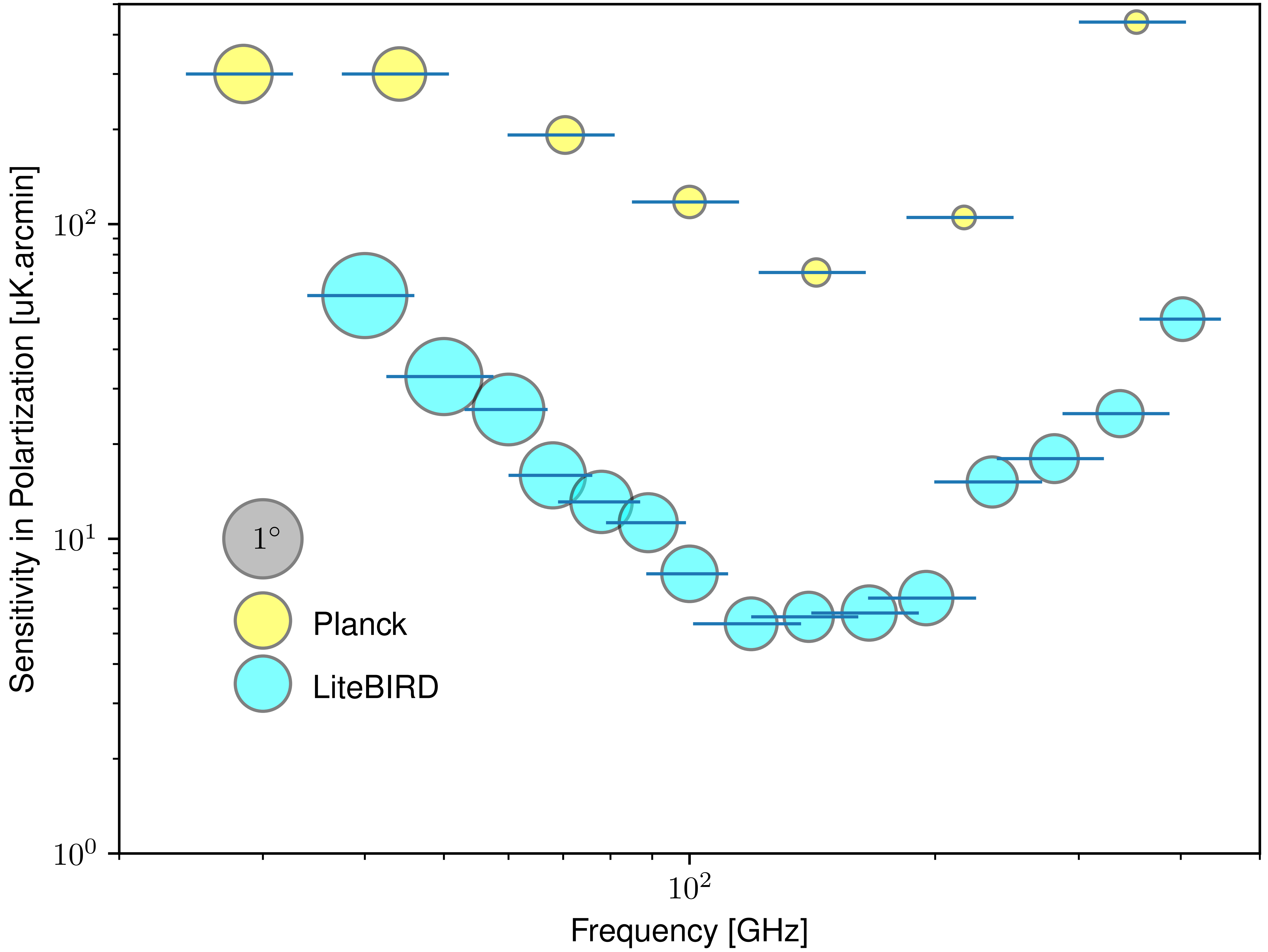
Extra-galactic science

- Cosmic infrared background (CIB)
- Cross-correlation with Euclid
- SZ distortions

Galactic science

- Synchrotron, free-free, spinning dust
- Galactic magnetic field
- Galactic dust, star formation

LiteBIRD – Planck comparison

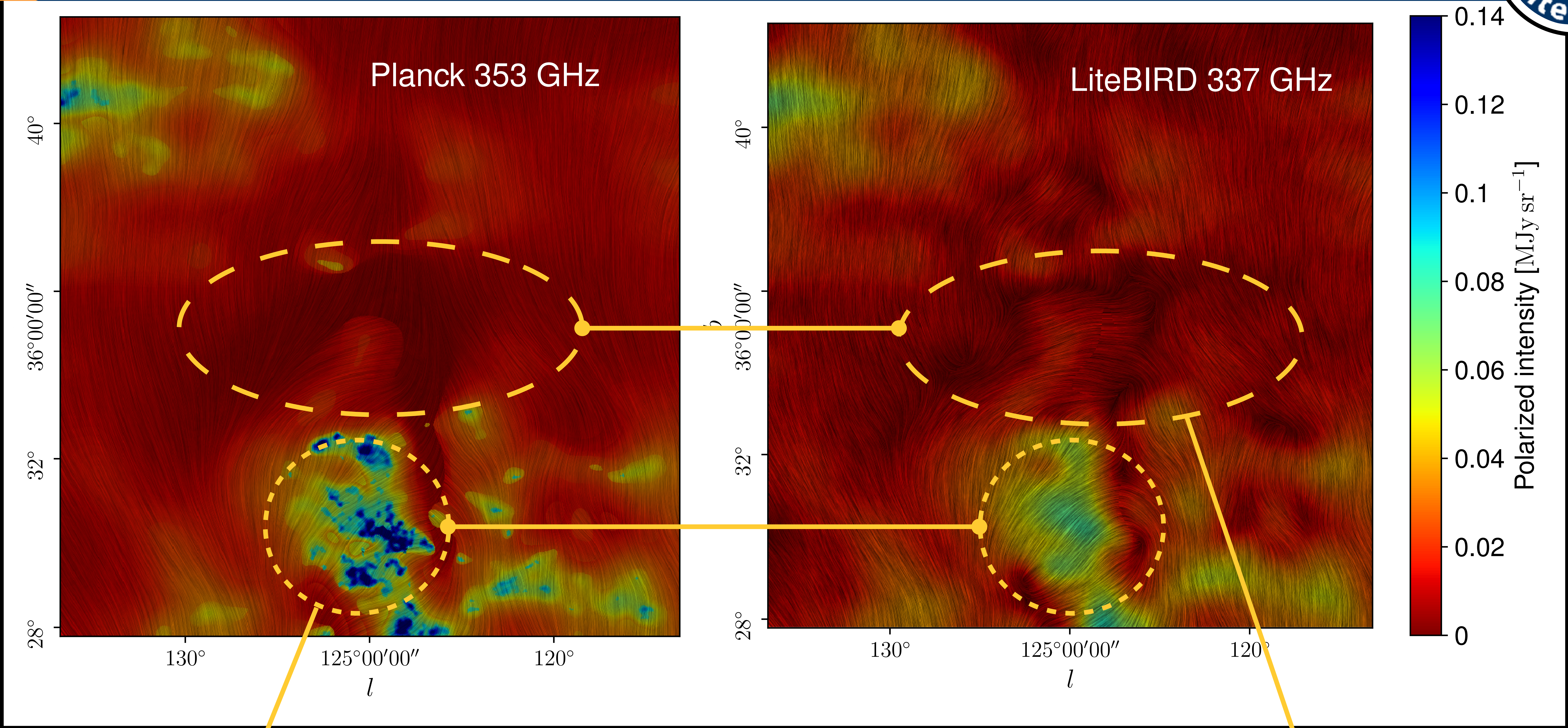


Gain in frequency coverage (**15 bands vs. 7**)

Gain in sensitivity (**x10**) over the whole frequency range

Gain in S/N (**x30**) from the highest frequency band

LiteBIRD – Interplay with magnetic field

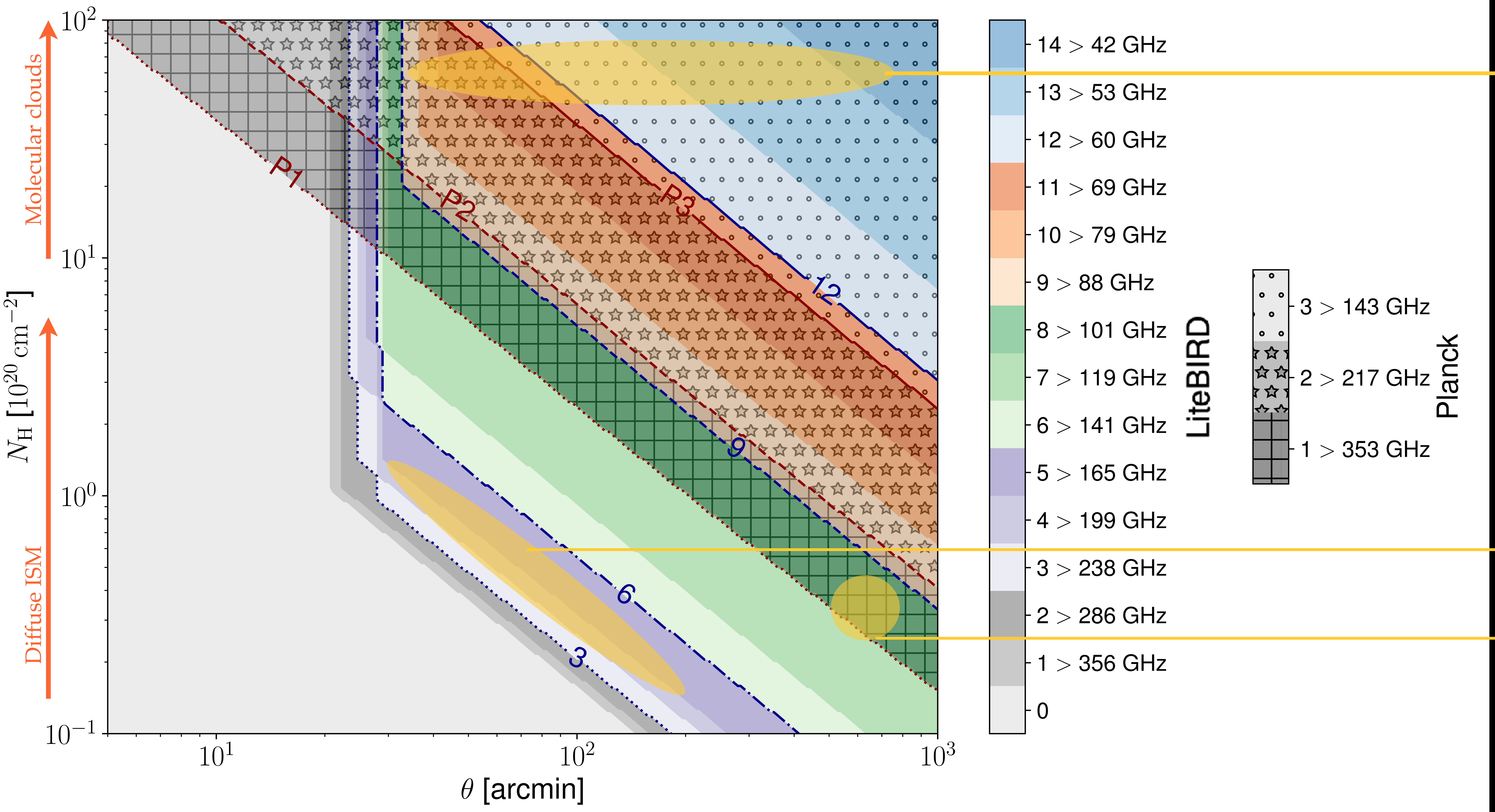


[LiteBIRD Collaboration, PTEP 2022, in prep.]

No gain in bright high-resolution regions

Exploration of mid-scale diffuse regions

LiteBIRD – Spectral gain over Planck



[LiteBIRD Collaboration, PTEP 2022, in prep.]

Broad multi-frequency in bright regions at degree scale

Exploration of the diffuse medium

Broad multi-frequency in diffuse regions at large scales

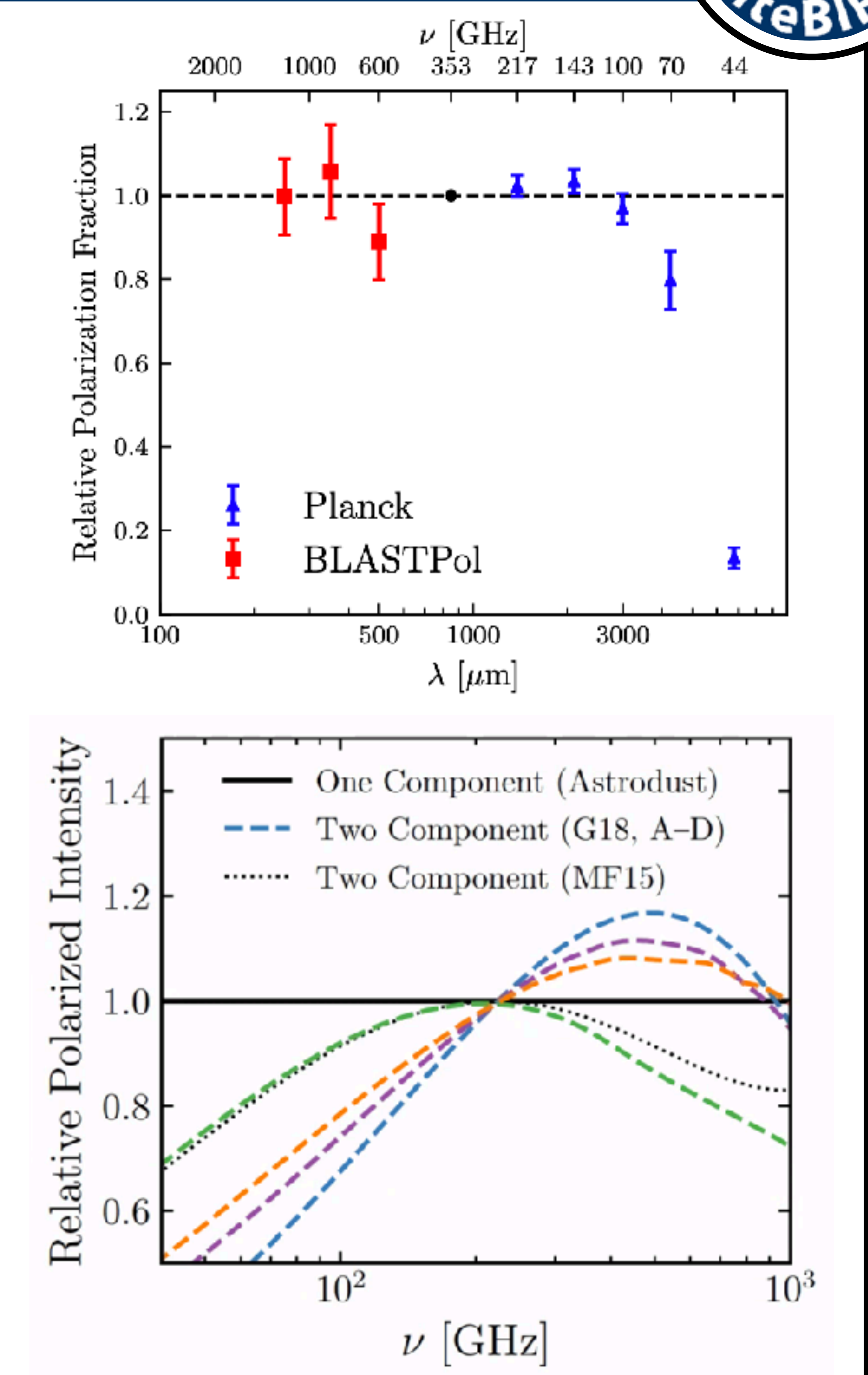
LiteBIRD – Science thanks to spectral gain

- **Dust grain properties**
    - Ferromagnetic inclusions ?
    - Single versus multi-component models ?
    - Comparison with Laboratory measurements

- **Spectral index of synchrotron emission**

- **Anomalous Microwave Emission (AME)**
    - Detection of polarised emission of AME
    - ➡ New constraints on the nature of its carriers
    - Combination with C-BASS, Quijote, S-PASS datasets

- **Spatial variations & line of sights effects**
    - Spatial variations of grain composition ?
    - Strong coupling with modelling of 3D structure of the magnetic field



LiteBIRD – Interplay with magnetic field

Dust Emission:

- LiteBIRD sensitivity improved by a factor 10 at 400 GHz, compared to Planck.
- Interplay between turbulent gaz motions and magnetic field
  ➡ High sensitivity data to be compared with MHD simulations.
- Parity violation (TB Correlation): random fluctuations or generic turbulence feature ?
  ➡ Impact on Cosmic birefringence forecasts.

Synchrotron Emission:

- LiteBIRD sensitivity improved by a factor 5 at 40 GHz, compared to Planck.
- Extension of the range of scales over which the correlation between dust and synchrotron polarization is characterized.

3D modeling:

- Dust / Synchrotron correlation towards the modelling of the 3D structure of the Galactic magnetic field, in particular within the Solar neighbourhood.
- Probe 3D Galactic magnetic field in combination with PASIPHAE and Gaia data

LiteBIRD – Galactic science Project Study

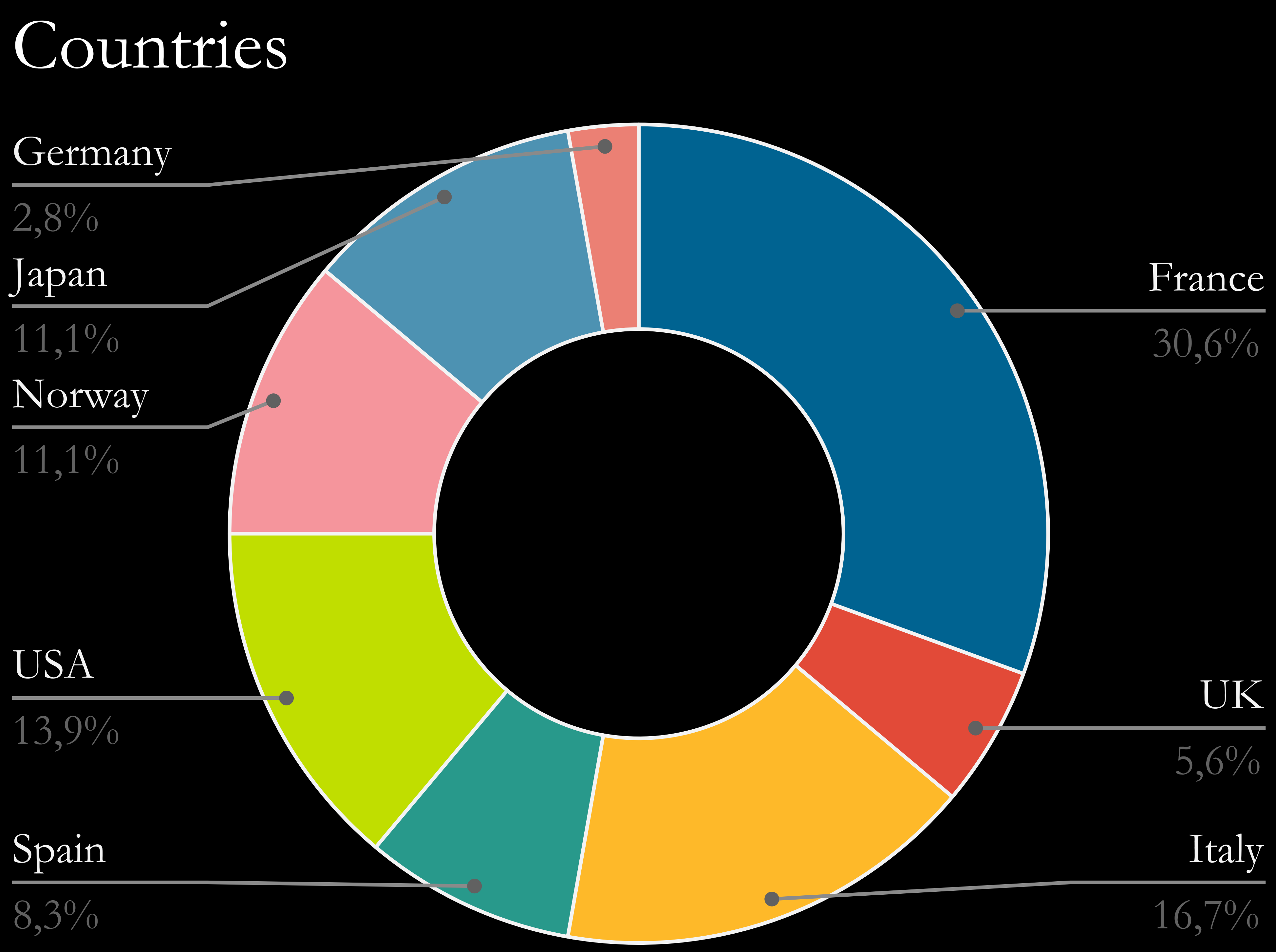
Coordination: Jonathan Aumont & Eirik Gjerløw
40+ members from 8 countries

Goals:

- Gather people in LiteBIRD with an expertise/interest in Galactic science
- Create a group to assess the feasibility of Galactic science studies with LiteBIRD data
- Contribute quantitative forecasts on Galactic science
- Produce models and methods that could benefit the CMB *B*-mode forecasts

Achievements:

- 7+ LiteBIRD project papers in discussion
- Teams formed



Take home message

- LiteBIRD maps will provide a wealth of information on Galactic science by improving upon Planck in polarization
  - ➡ More bands
  - ➡ Improved sensitivity
  - ➡ Improved resolution in diffuse regions

- We are organizing the work to forecast the capabilities and prepare the analysis within the Galactic science project study group