



Simons Observatory Large Aperture Telescope



Merry Duparc

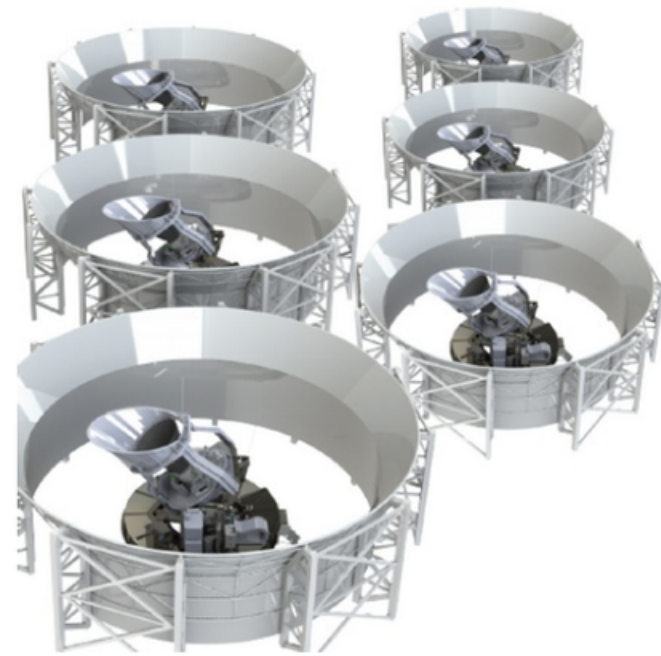
8 June 2026 - PHENIICS FEST

Simons Observatory

- CMB/mm observatory located in Atacama desert, Chile
- Two components :



Small Aperture Telescopes (SATs)



Large angular scales

Large Aperture Telescope (LAT)



Small angular scales

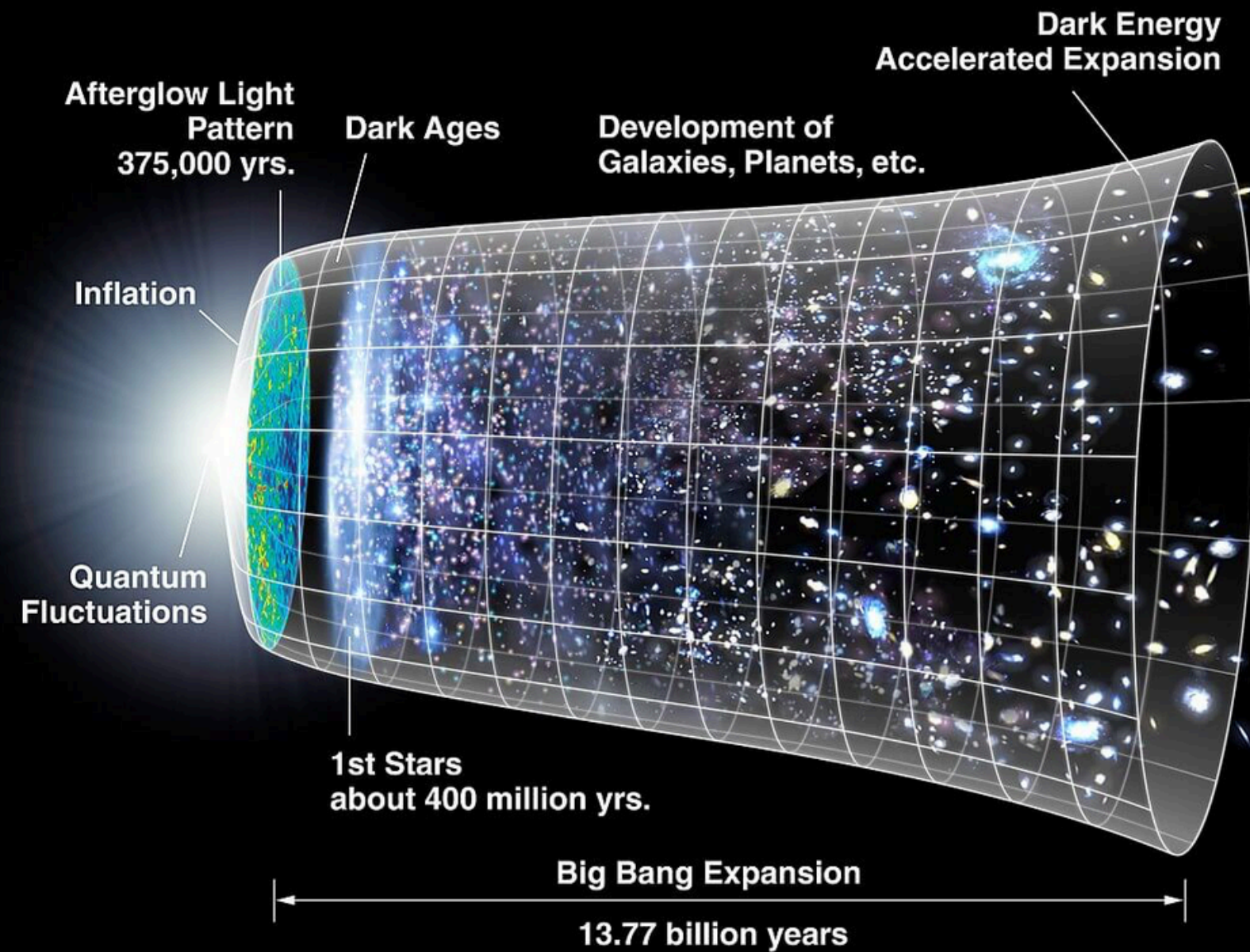
Site : Cerro Toco

- 5200m altitude
- Very low humidity
- Large part of the sky accessible

→ Perfect for micro wave domain observations !



What is the CMB ?



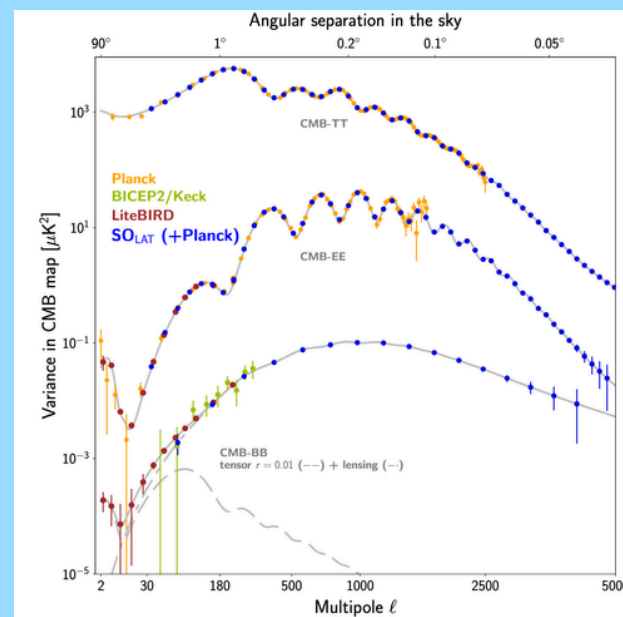
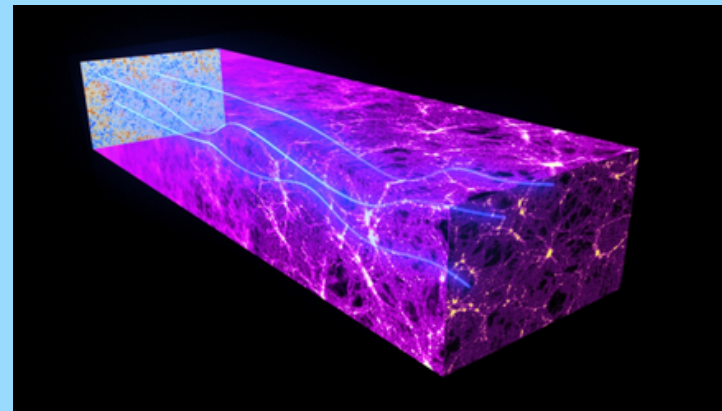
Oldest light of the Universe !
~380000 years after the Big Bang

Contains plenty of information about
the **beginning** and **evolution** of the
Universe

LAT Science cases

Cosmology

Dark matter
Dark energy
Growth of structure
Cosmic birefringence
Reionization

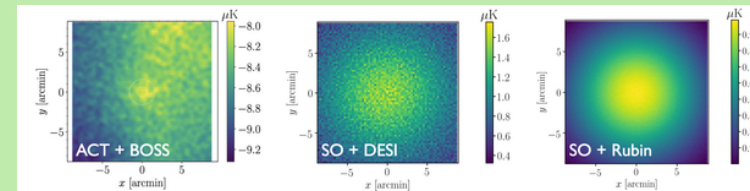


Primordial perturbations

Inflation parameters (ns)
Tensor to scalar ratio
Primordial non-gaussianities

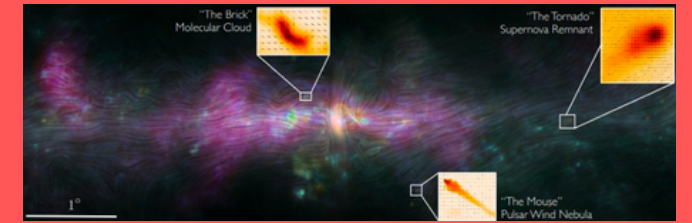
Time-domain astrophysics
Gamma ray bursts,
interacting supernovae,
...

Cluster physics
Galaxy feedback
Cluster evolution



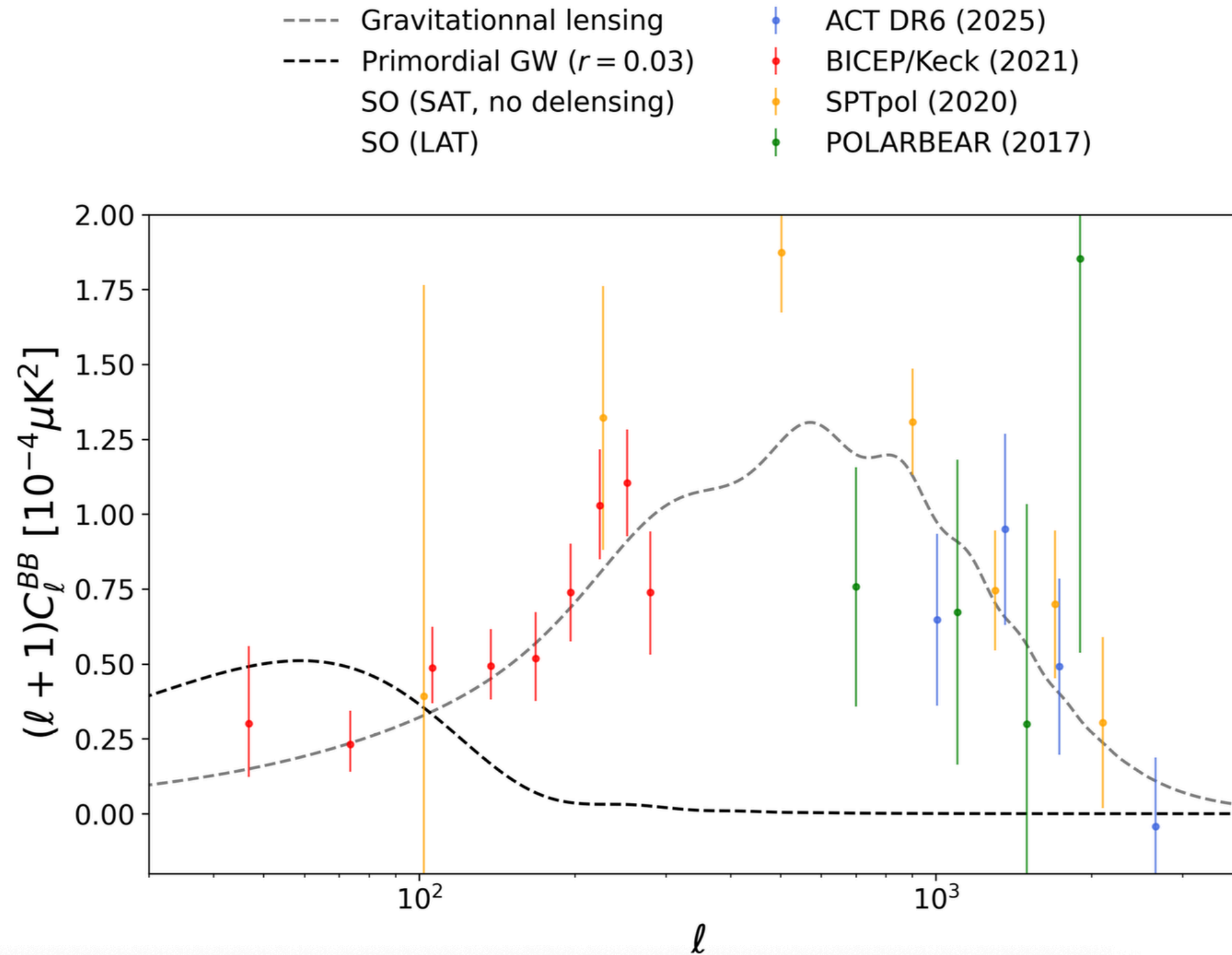
Particle physics
Number of relativistic species
Neutrinos masses

Galactic science
Interstellar dust
molecular clouds
AGNs

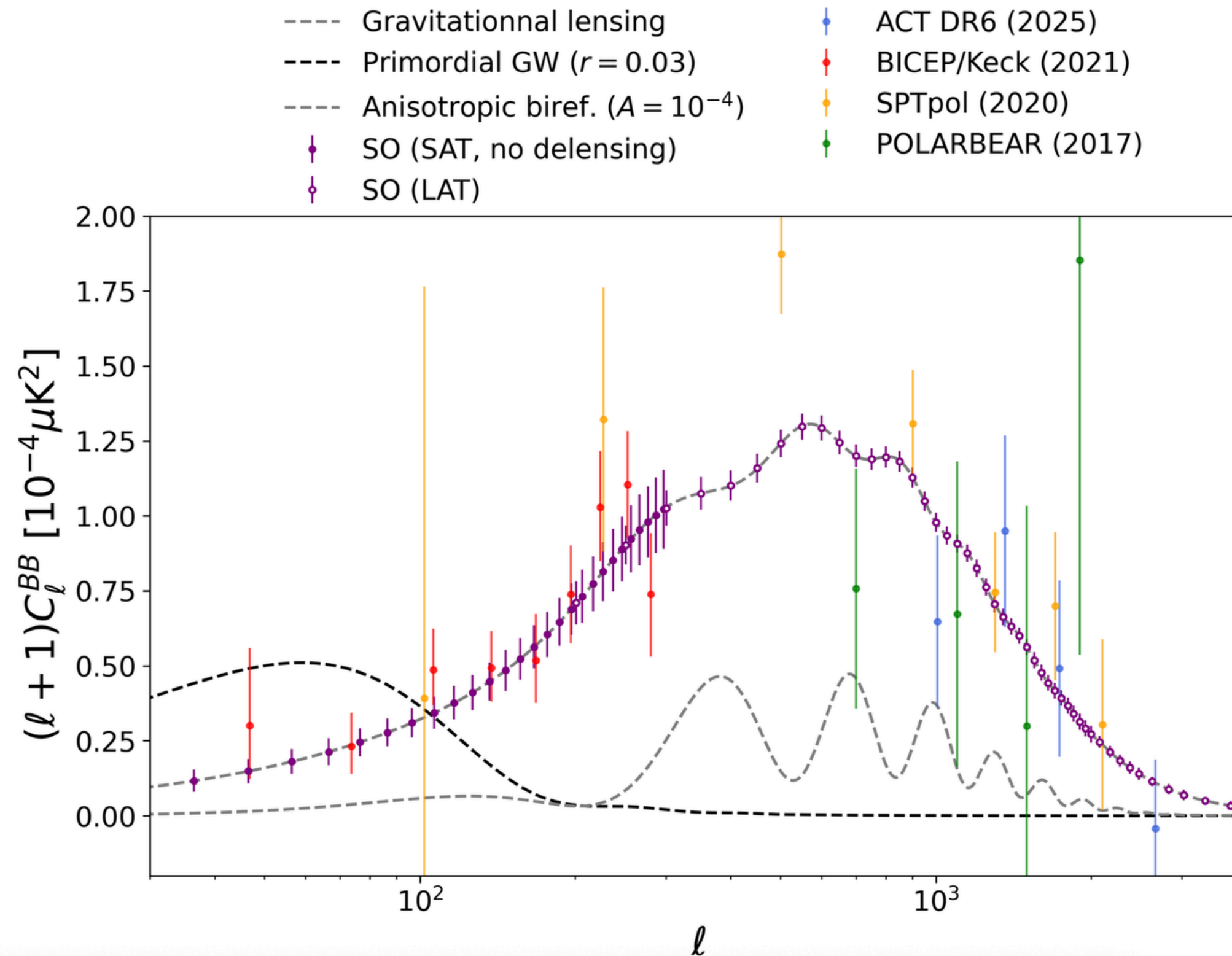


Stellar system science
Star formation
Planet 9
Asteroid regoliths

SO : Comparison to actual experiments



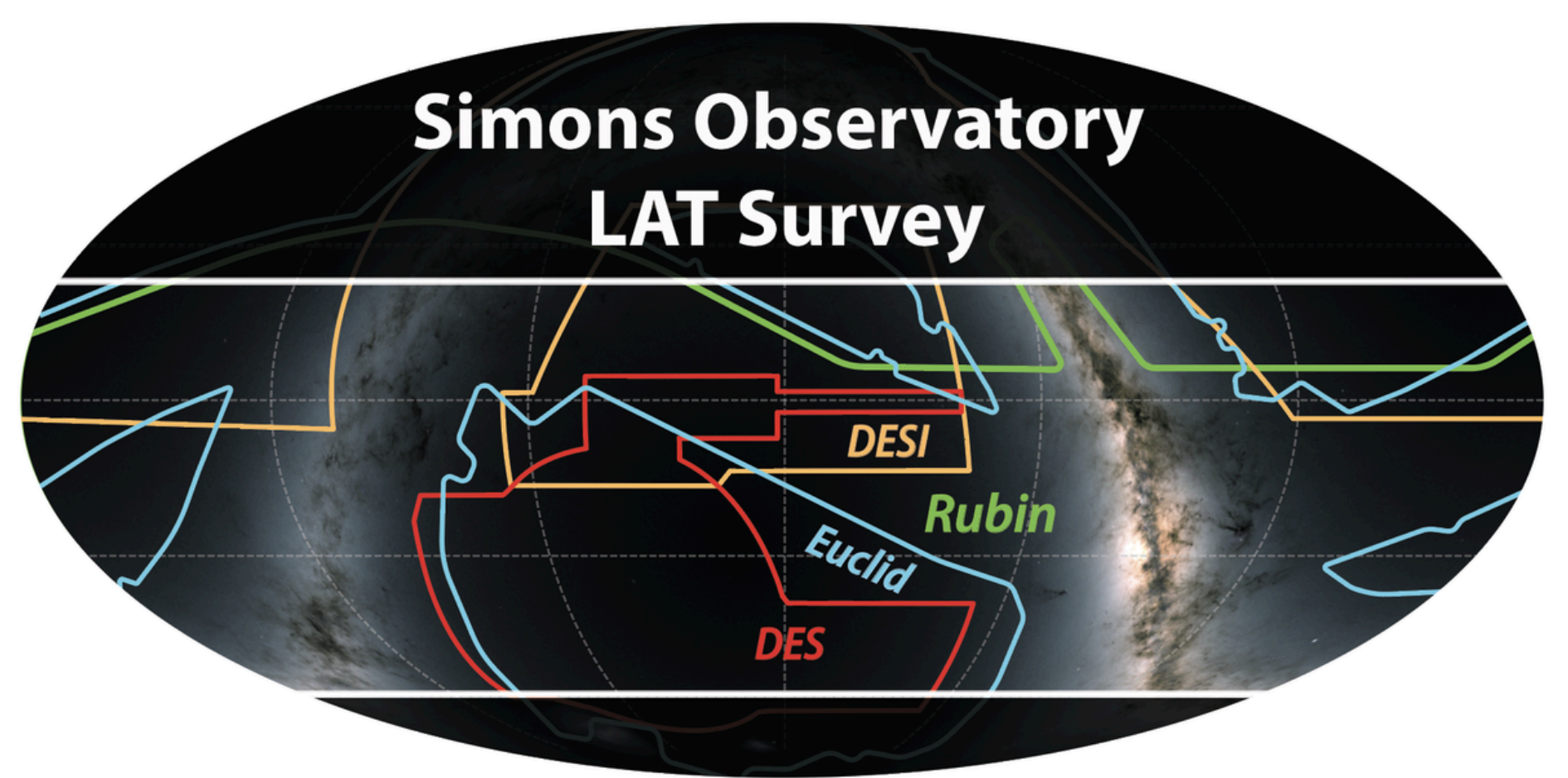
SO : Comparison to actual experiments



SO LAT



Credit : José Argañaraz

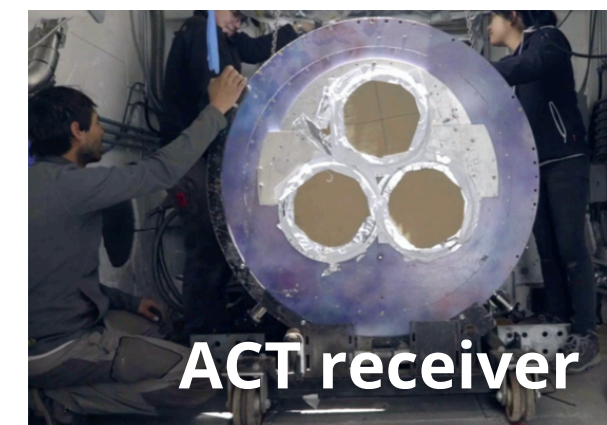
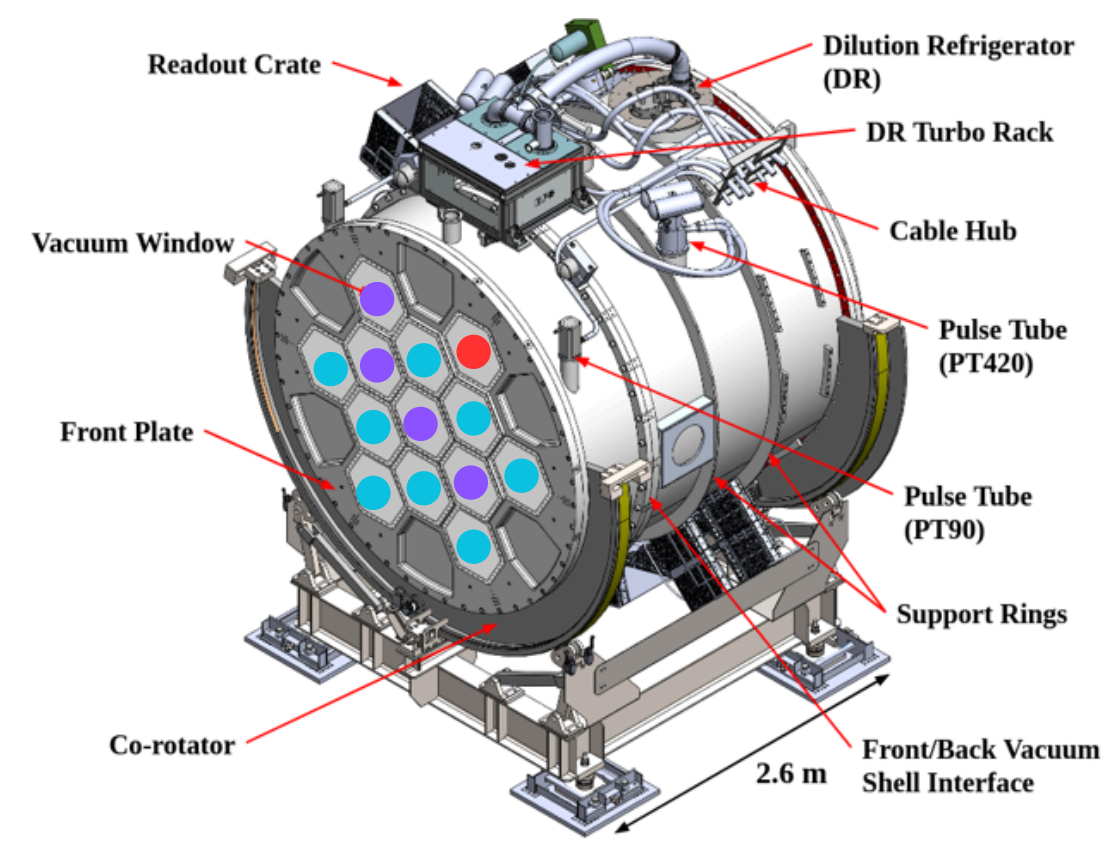


- 6 meter mirror
 - good angular resolution (\sim arcmin)
- 60 000 cryogenic detectors at 100mK
 - most detectors for a CMB telescope !

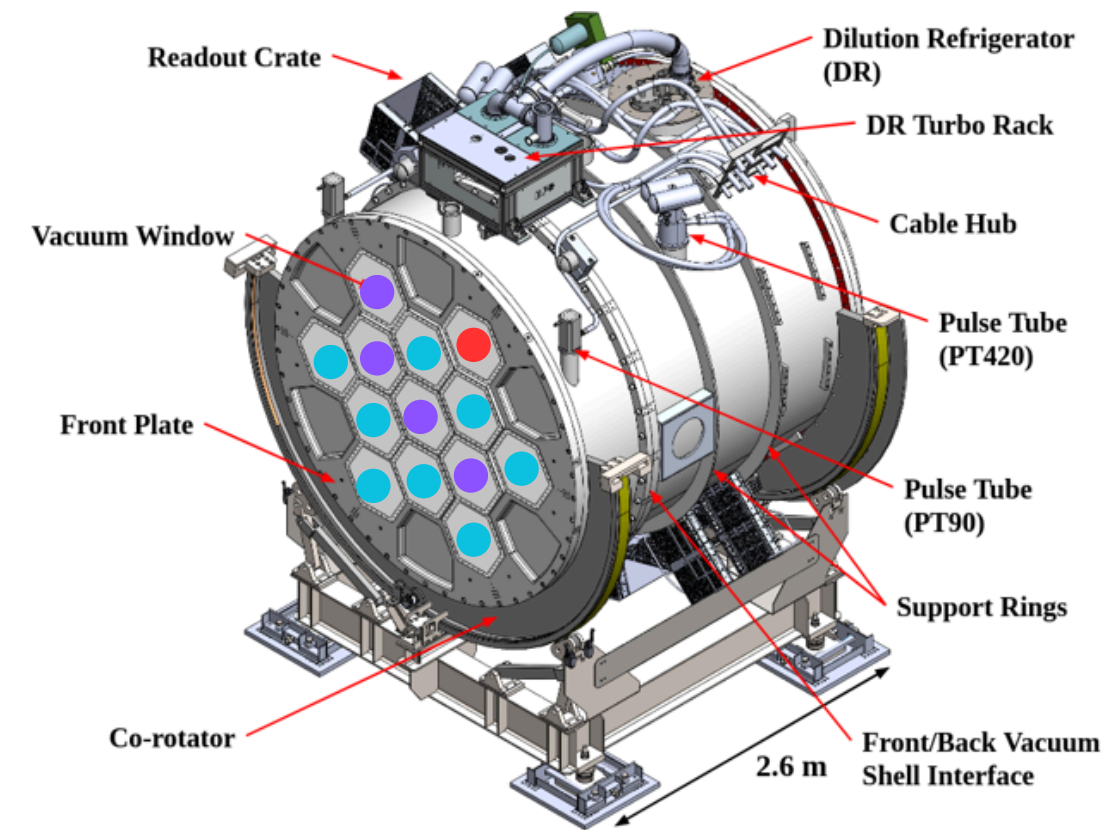
SO LAT



Credit : José Argañaraz



SO LAT



1 Low Freq

27 & 40 GHz

8 Mid Freq

90 & 150 GHz

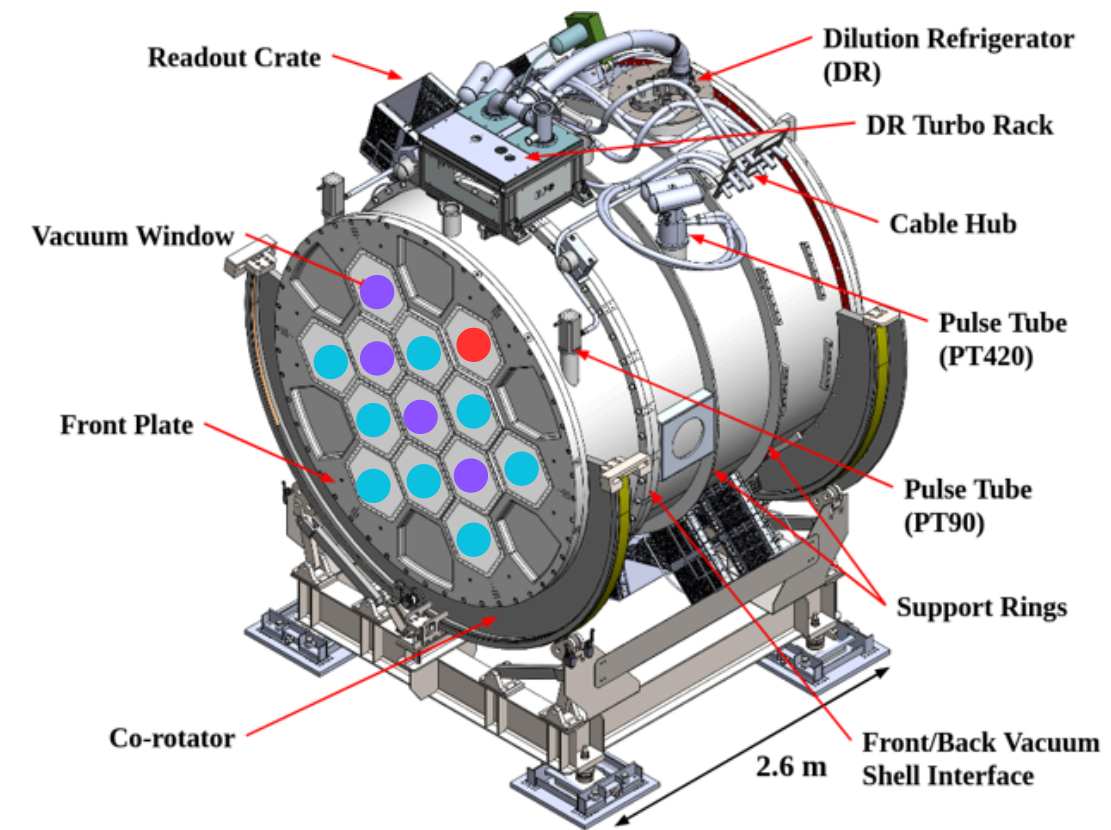
4 High Freq

220 & 280 GHz

>10 times more detectors than previous
CMB experimetns

improved frequency coverage

SO LAT



1 Low Freq

27 & 40 GHz

8 Mid Freq

90 & 150 GHz

4 High Freq

220 & 280 GHz

- First light in **march 2025**,
- Currently in commissioning

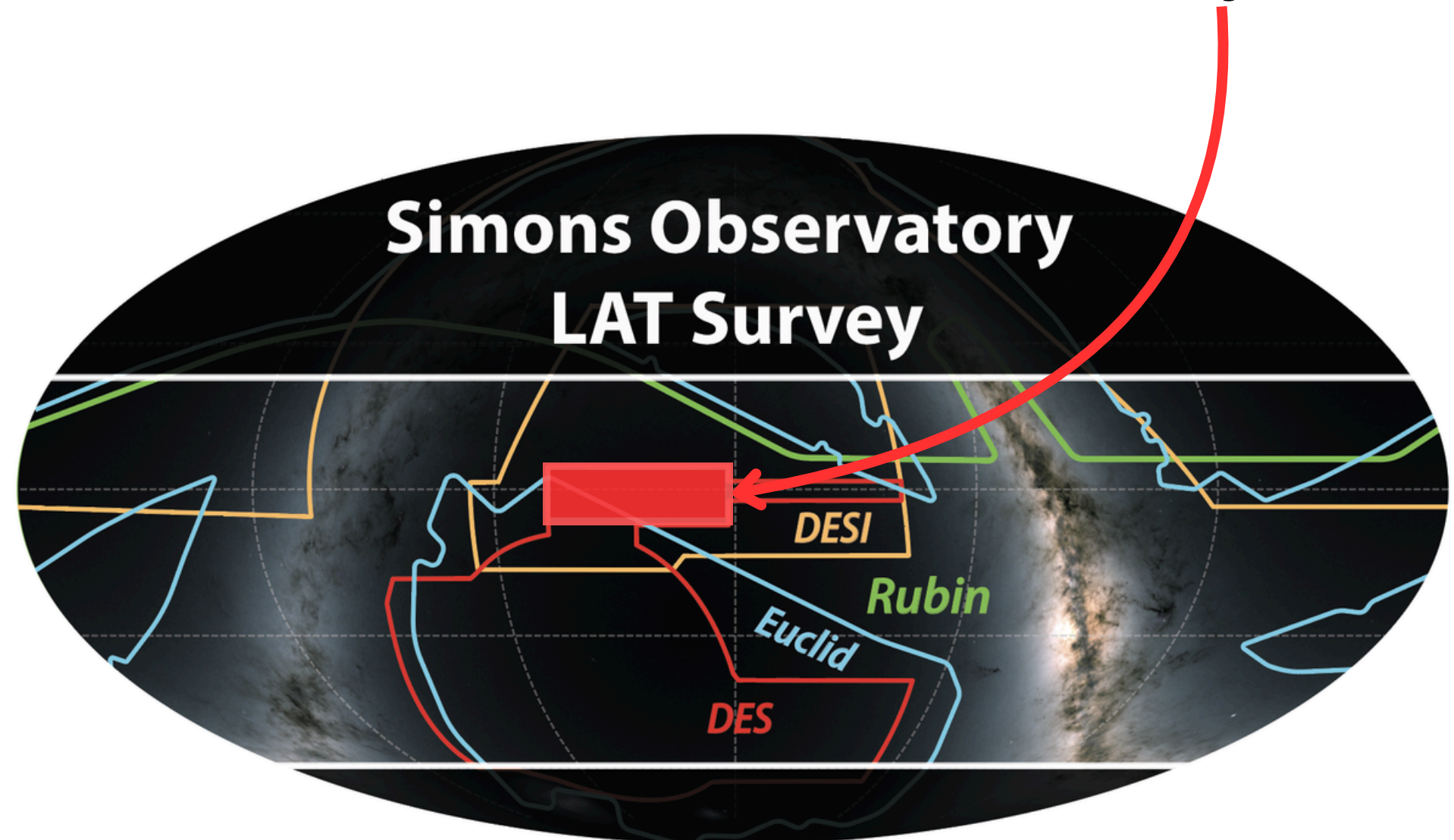
SO LAT



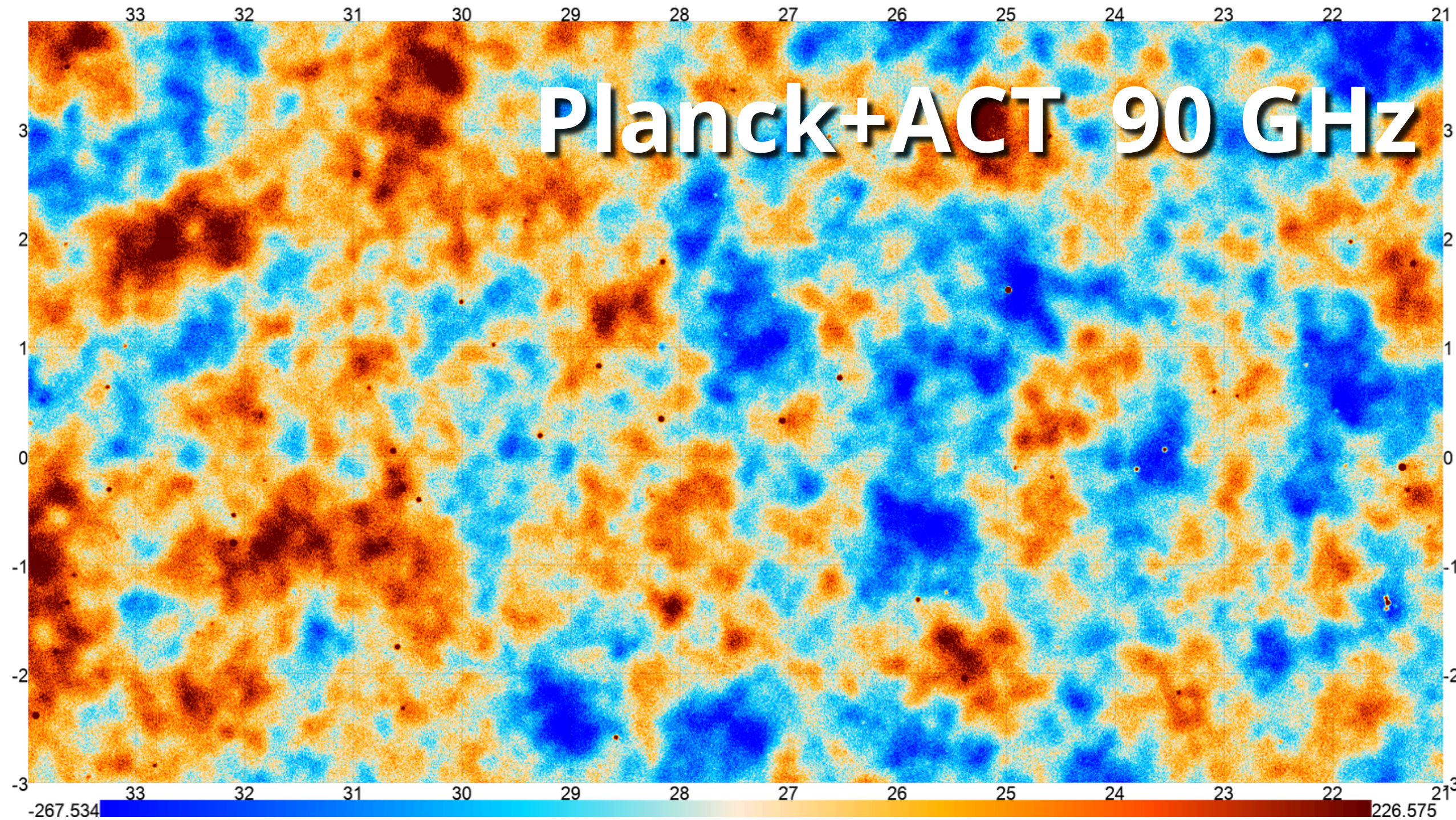
Credit : José Argañaraz

Initial Science Observations

Results shown here: ~1% of the sky

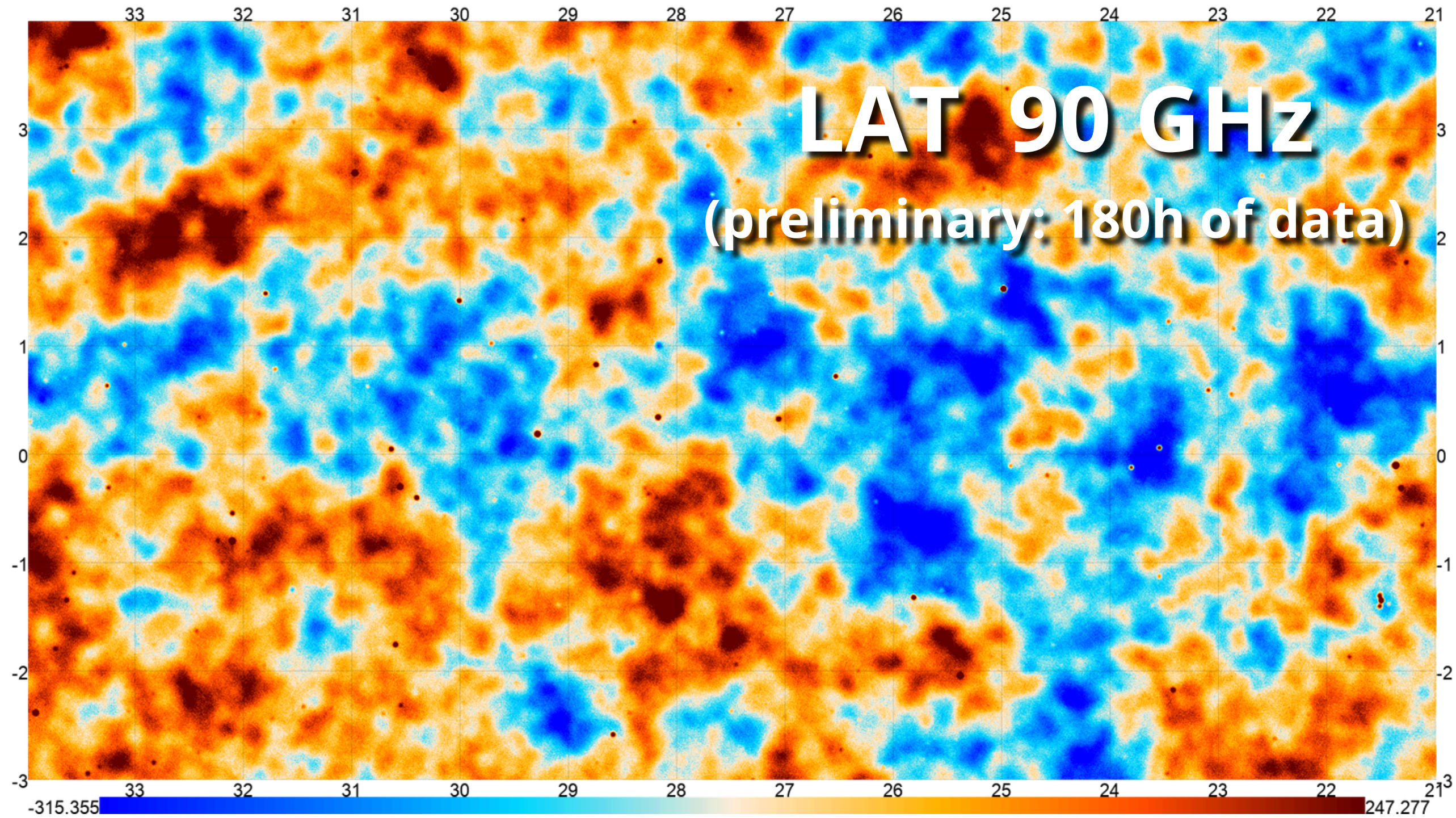


Maps

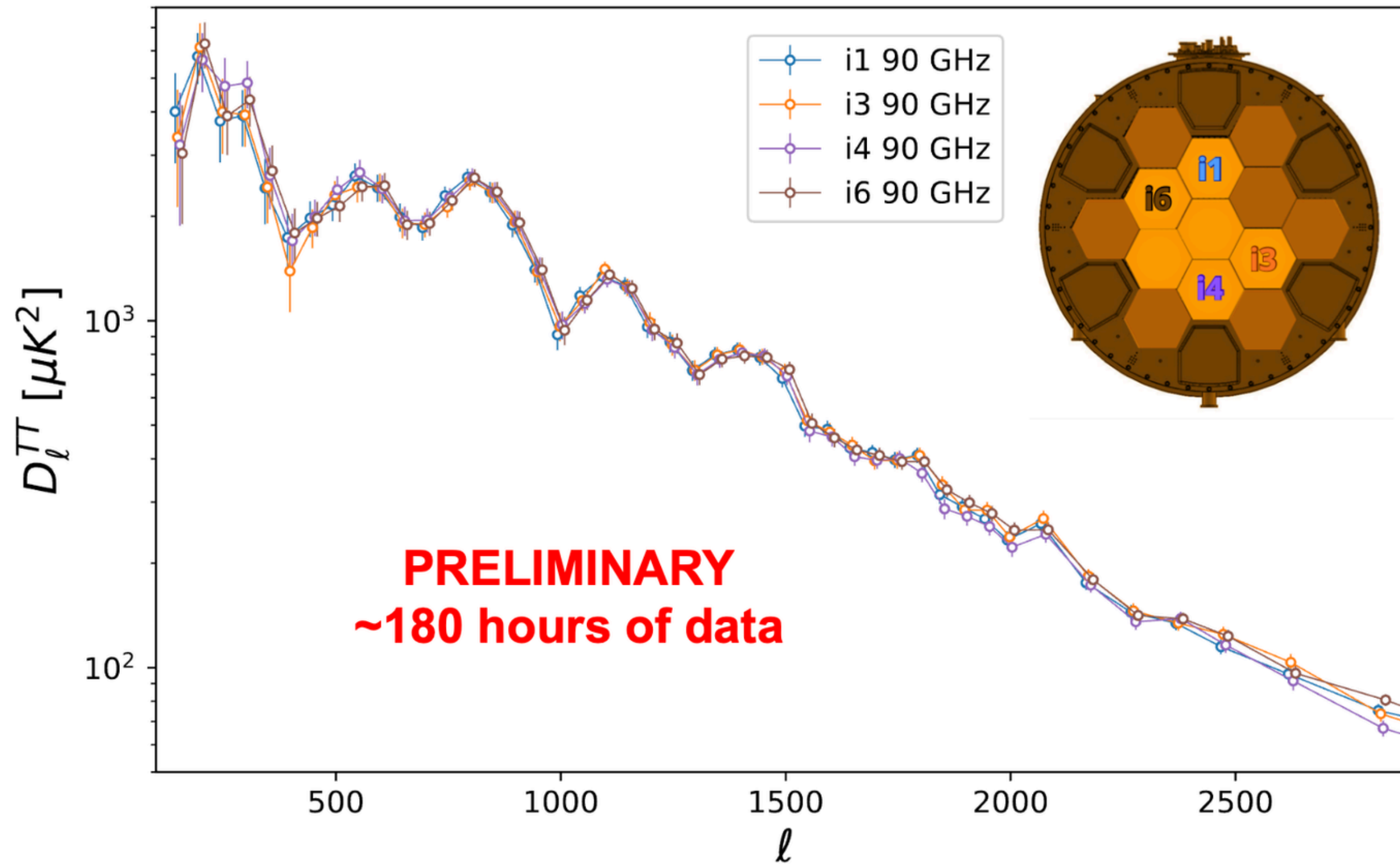


State of the art
CMB map

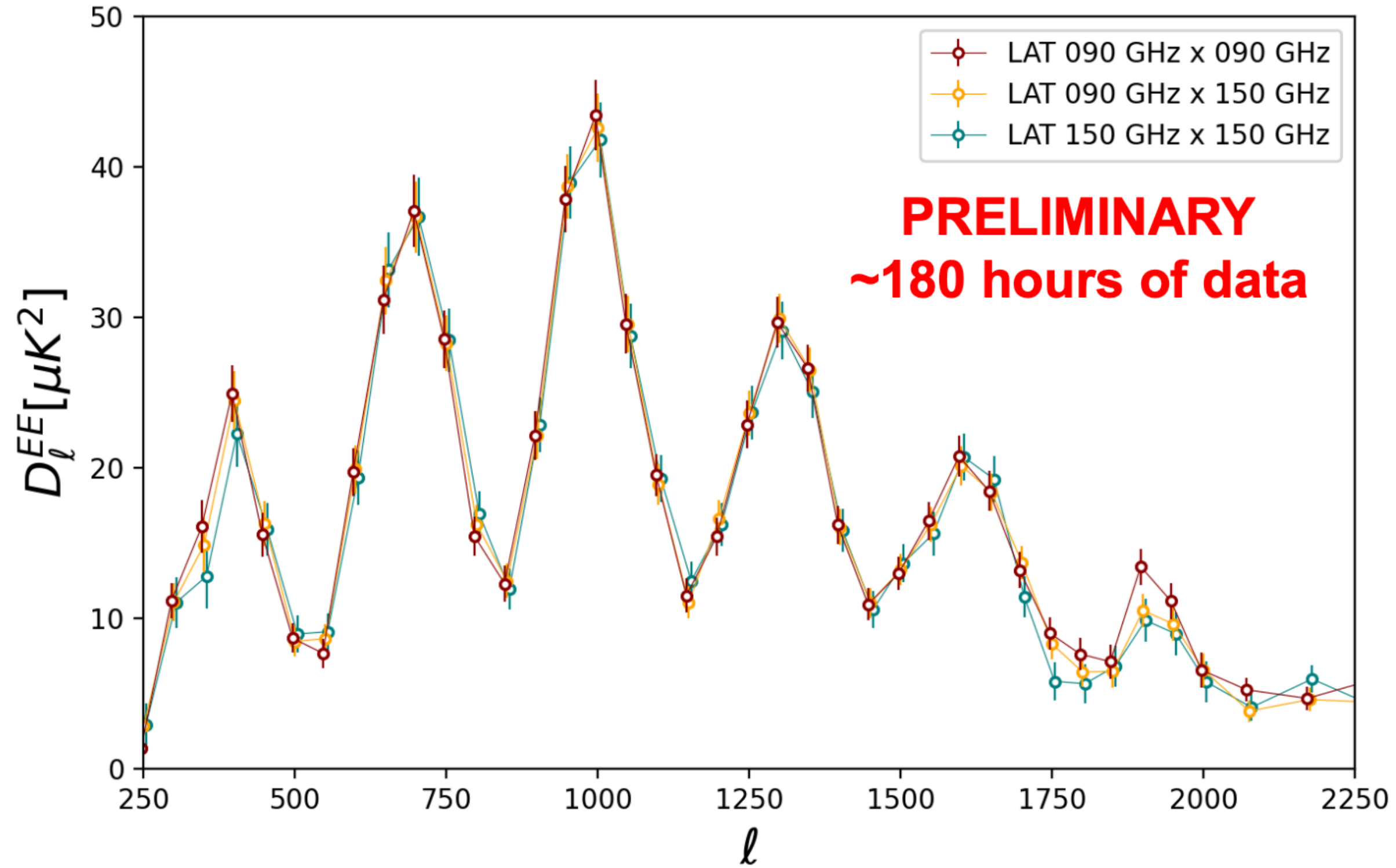
Maps



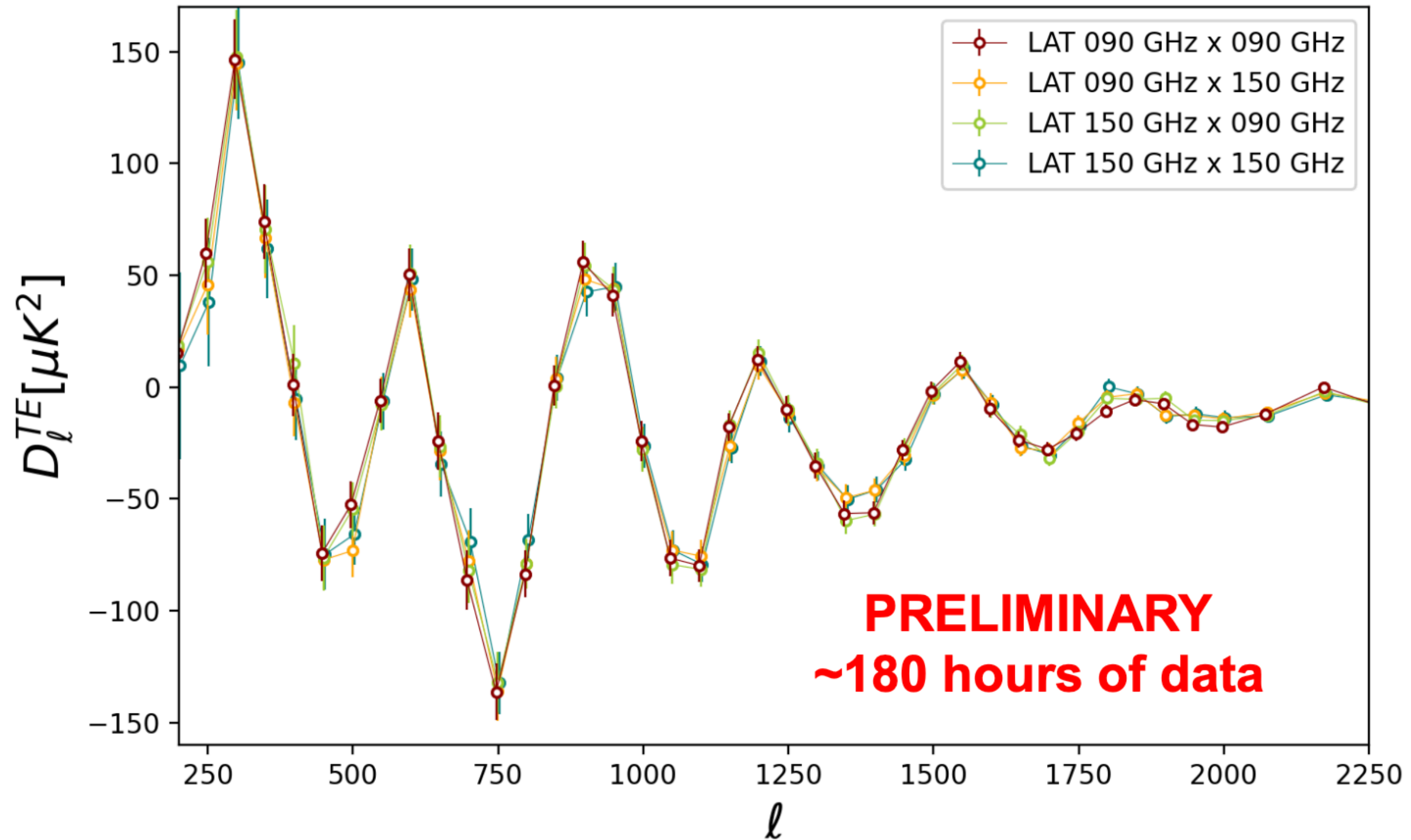
Power spectra



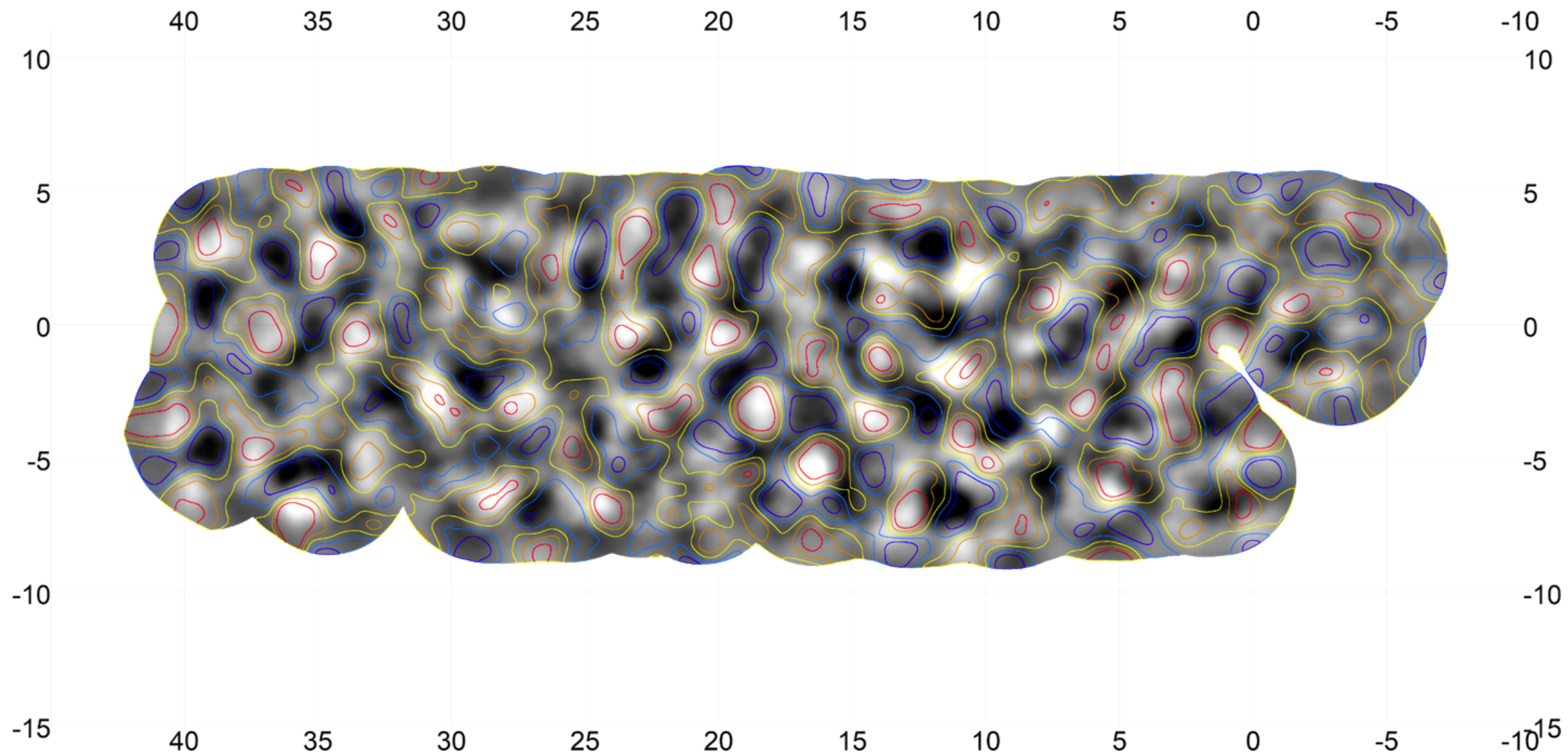
Power spectra



Power spectra



Lensing



Black and white:
mass map estimated with
LAT data

Blue/red contours:
CIB estimated from Planck

Thank you !



Backup slides

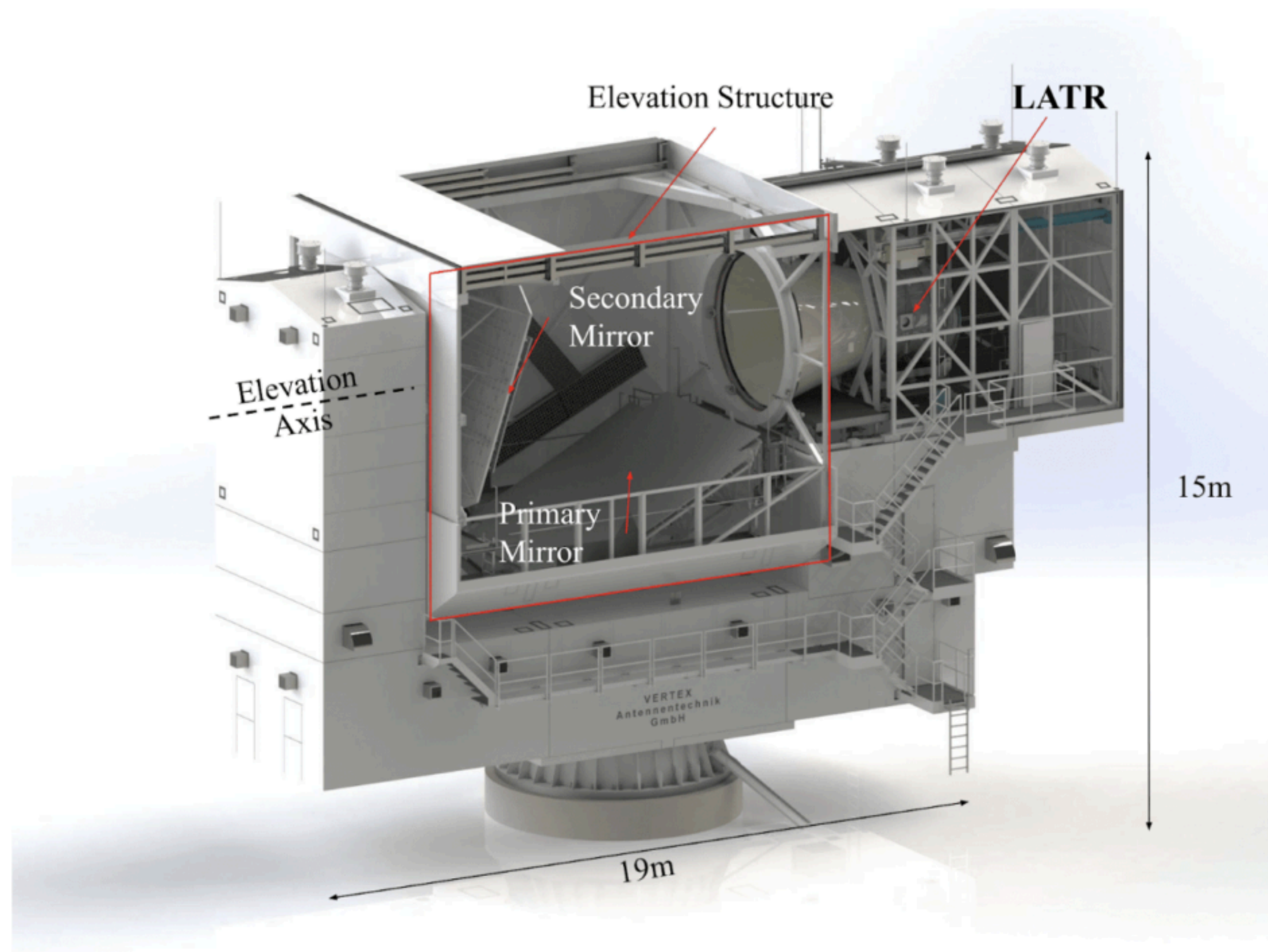


FIGURE 1: The Large Aperture Telescope and Receiver

Atmosphere emission

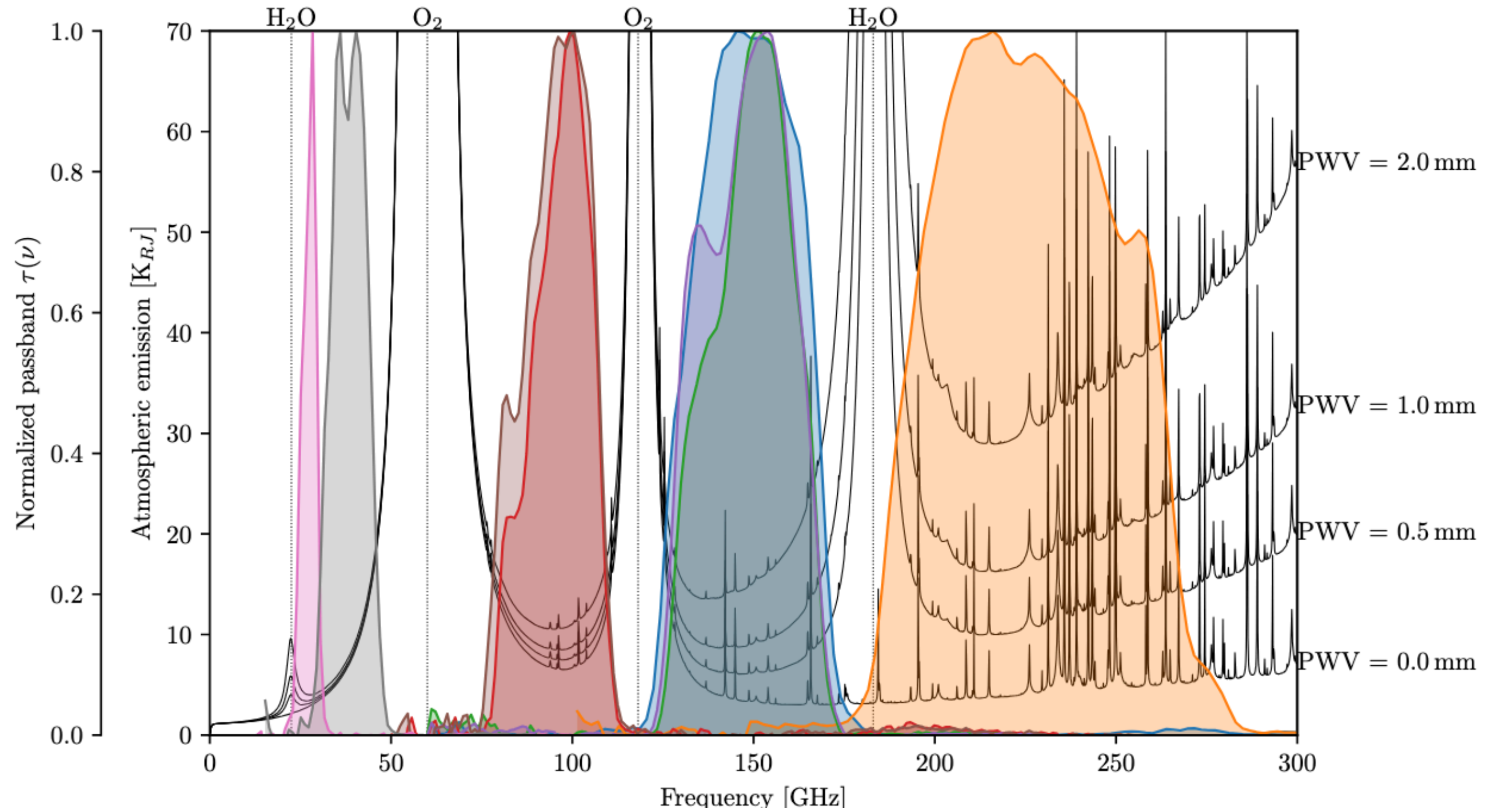


Table 2. Summary of Enhanced Science Goals from SO LAT Survey^a

	Current ^b	SO 2025–2034	Using Rubin, DESI, or <i>Euclid</i>	Reference
Primordial perturbations				
n_s	0.004	0.002	-	Shandera et al. (2019)
$e^{-2\tau} \mathcal{P}(k = 0.2 \text{ Mpc}^{-1})$	3%	0.4%	-	Slosar et al. (2019b)
$f_{\text{NL}}^{\text{local}}$	5	1	✓	Meerburg et al. (2019)
Relativistic species				
N_{eff}	0.2	0.045	-	Green et al. (2019)
Neutrino mass^c				
$\sum m_\nu$ (eV, $\sigma(\tau) = 0.01$)	0.1	0.03	✓	Dvorkin et al. (2019)
$\sum m_\nu$ (eV, $\sigma(\tau) = 0.002$)		0.015	✓	
Accelerated expansion				
$\sigma_8(z = 1 - 2)$	7%	1%	✓	Slosar et al. (2019a)
Galaxy evolution				
η_{feedback}	50–100%	2%	✓	Battaglia et al. (2019)
p_{nt}	50–100%	4%	✓	Battaglia et al. (2019)
Reionization				
Δz	1.4	0.3	-	Alvarez et al. (2019)
τ	0.007	0.0035	-	Alvarez et al. (2019)
Cluster catalog	4000	33,000	✓	
AGN catalog	2000	96,000	-	
Galactic science				
Molecular cloud B-fields	10s	> 860	-	Hensley et al. (2022)
$\sigma(\beta_{\text{dust}})$	0.02	0.005	-	Hensley et al. (2022)
Solar System Science				
Distance limit for $5 M_\oplus$ Planet 9	500 AU	900 AU	✓	Fienga et al. (2020)
Asteroid detections		$\sim 10,000$		
Transient detection distance				
Long GRBs, on-axis		1300 Mpc	-	
Low-luminosity GRBs		70–210 Mpc	-	
TDEs, on-axis		670 Mpc	-	

