New Measurements of CMB Polarisation from SPTpol

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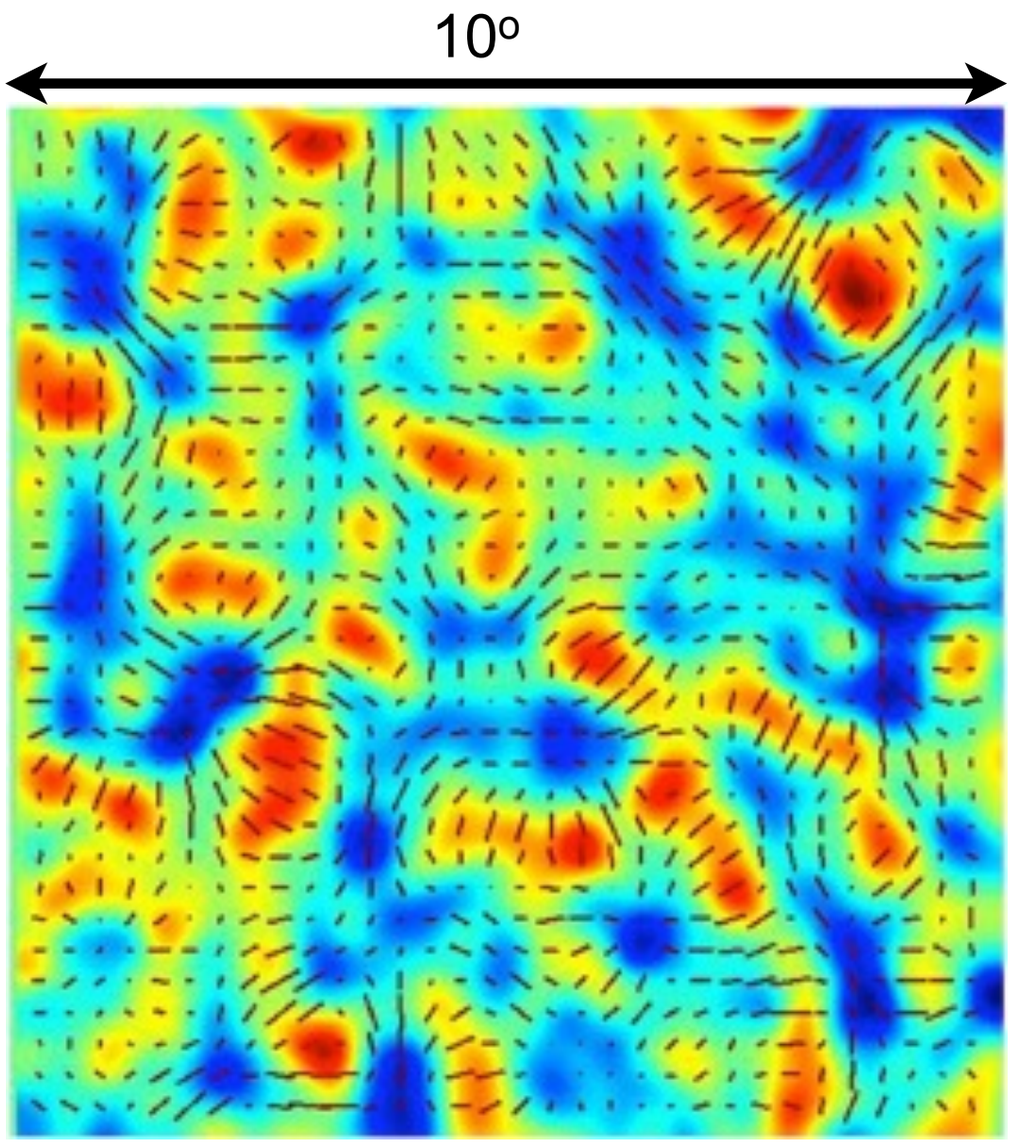
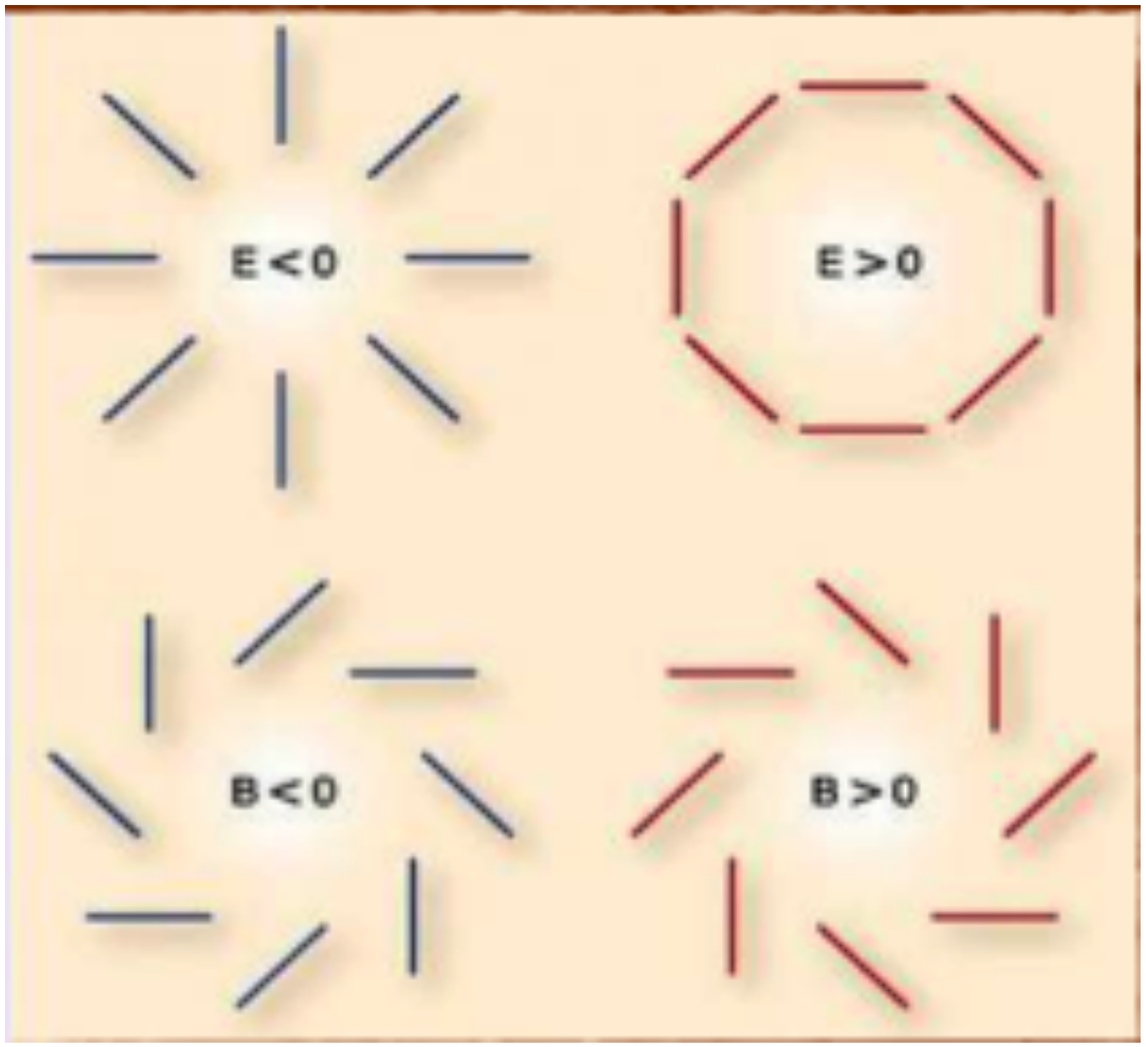
The CMB is polarised (~10%)



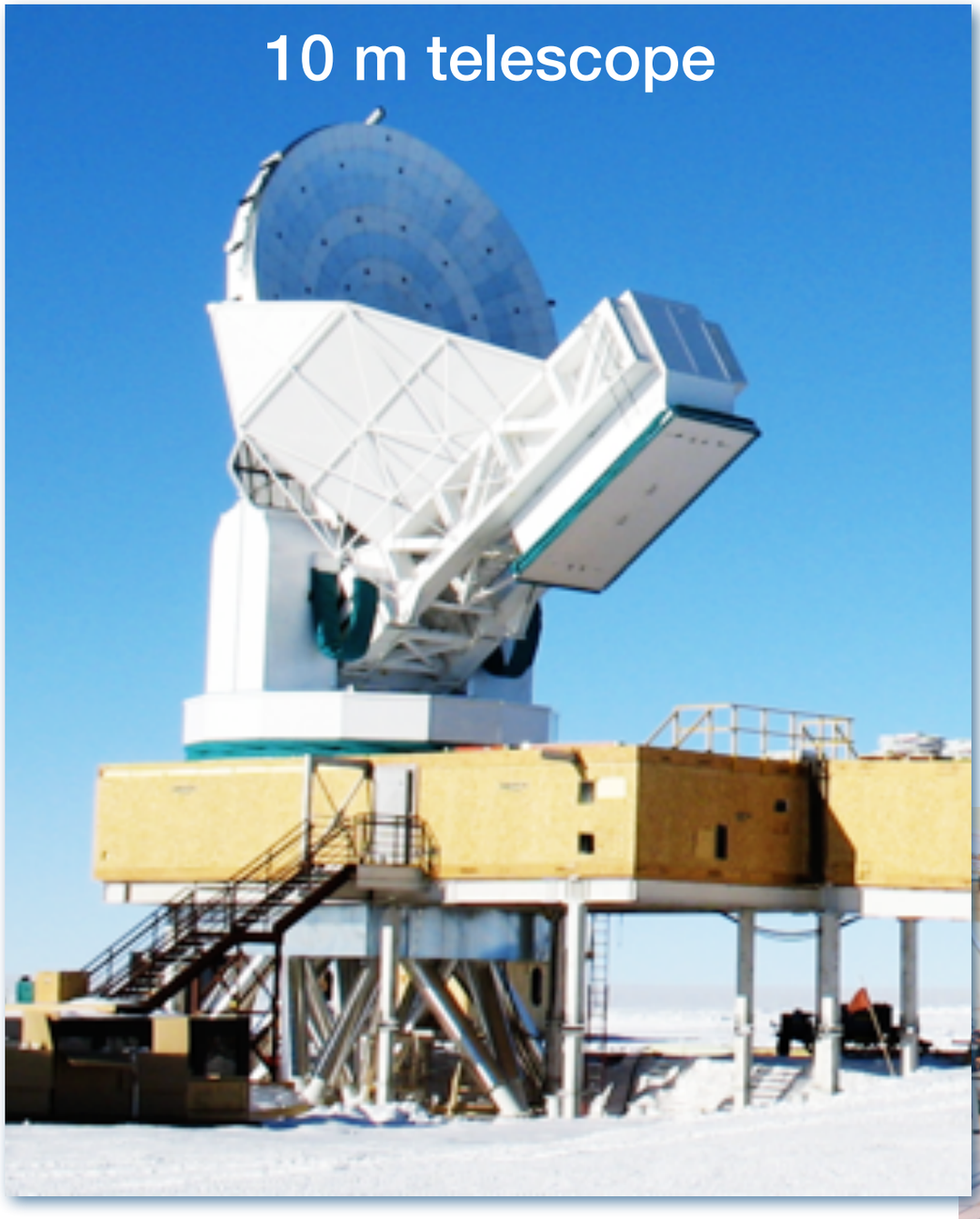
Smith et al 2008

- Any polarisation pattern can be decomposed into “E” (grad) and “B” (curl) modes



- Density fluctuations at LSS do not produce “B” modes!

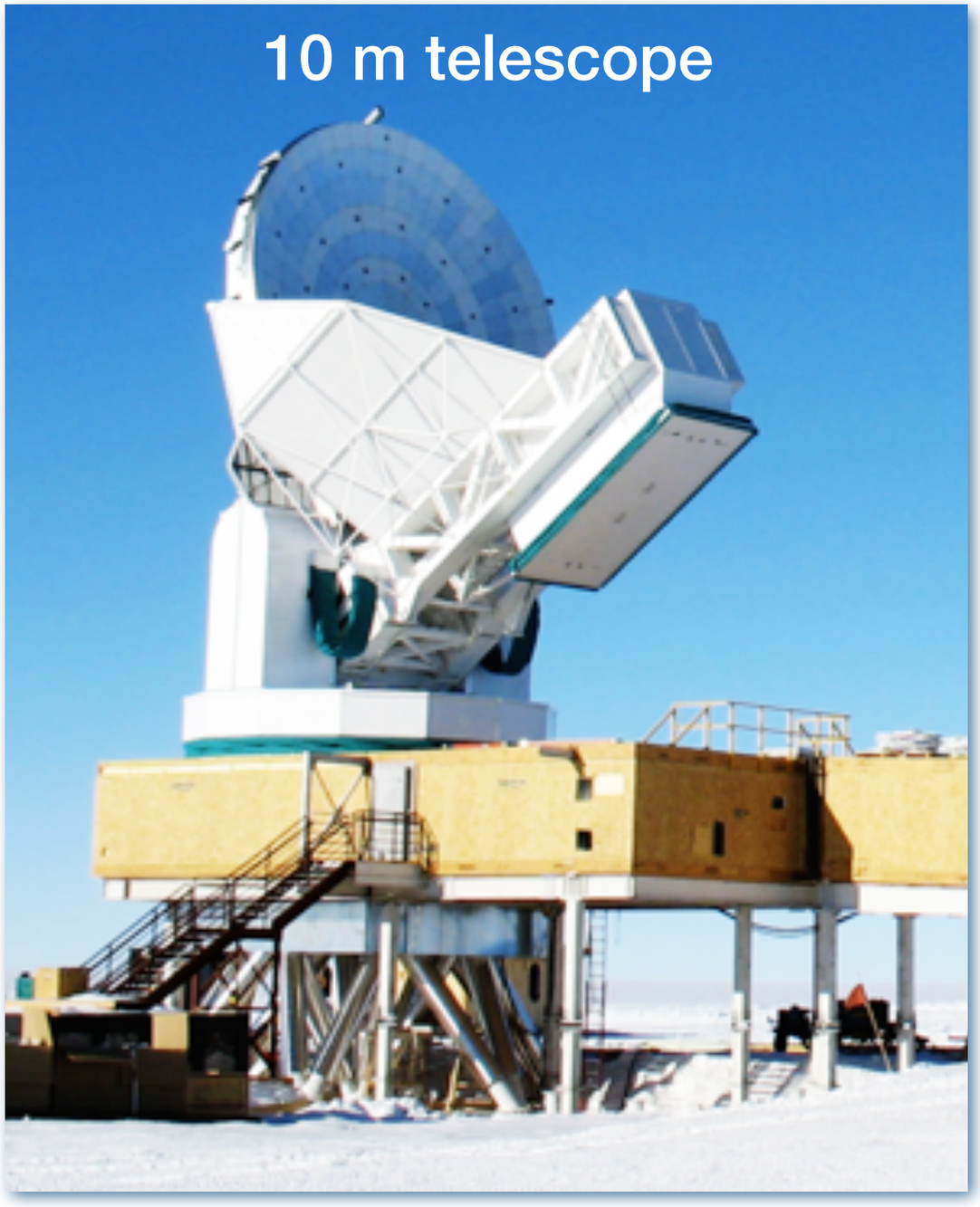
The South Pole Telescope (SPT)



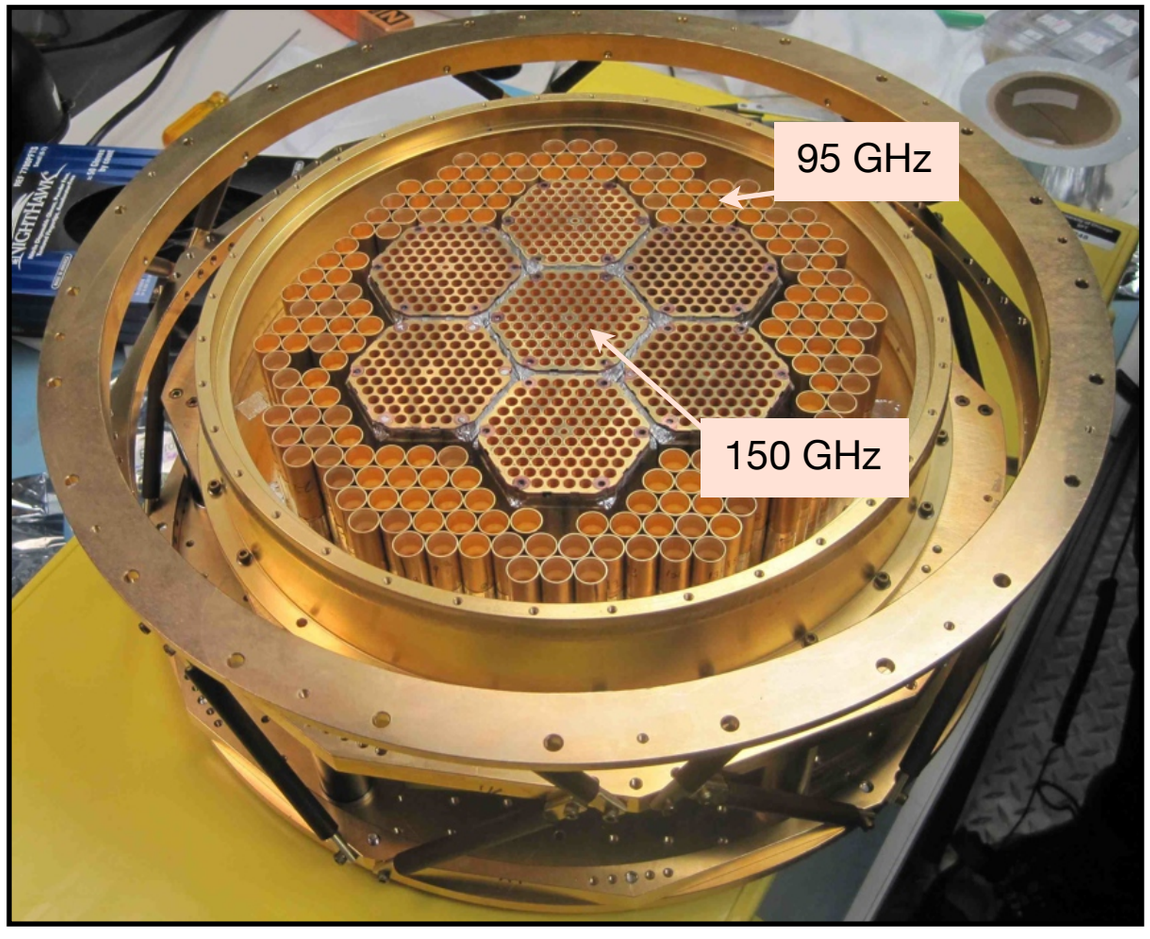
Sub-millimeter Wavelength Telescope:

- 10 meter telescope (1.1’ FWHM beam)
- Off-axis Gregorian optics design
- Fast scanning (up to 2 deg/sec in azimuth)
- 2” pointing accuracy

The South Pole Telescope (SPT)

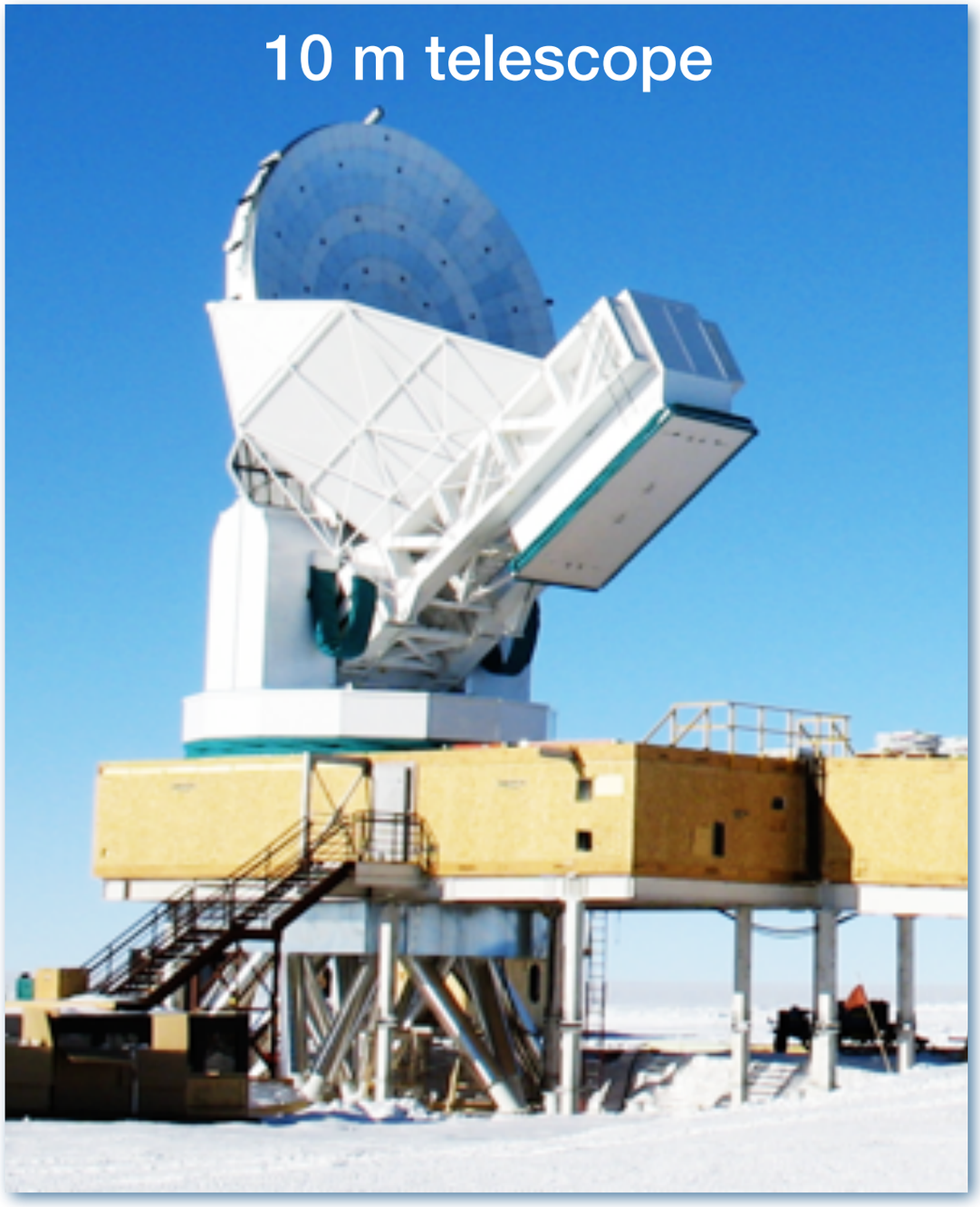


SPTpol - 2nd camera on SPT

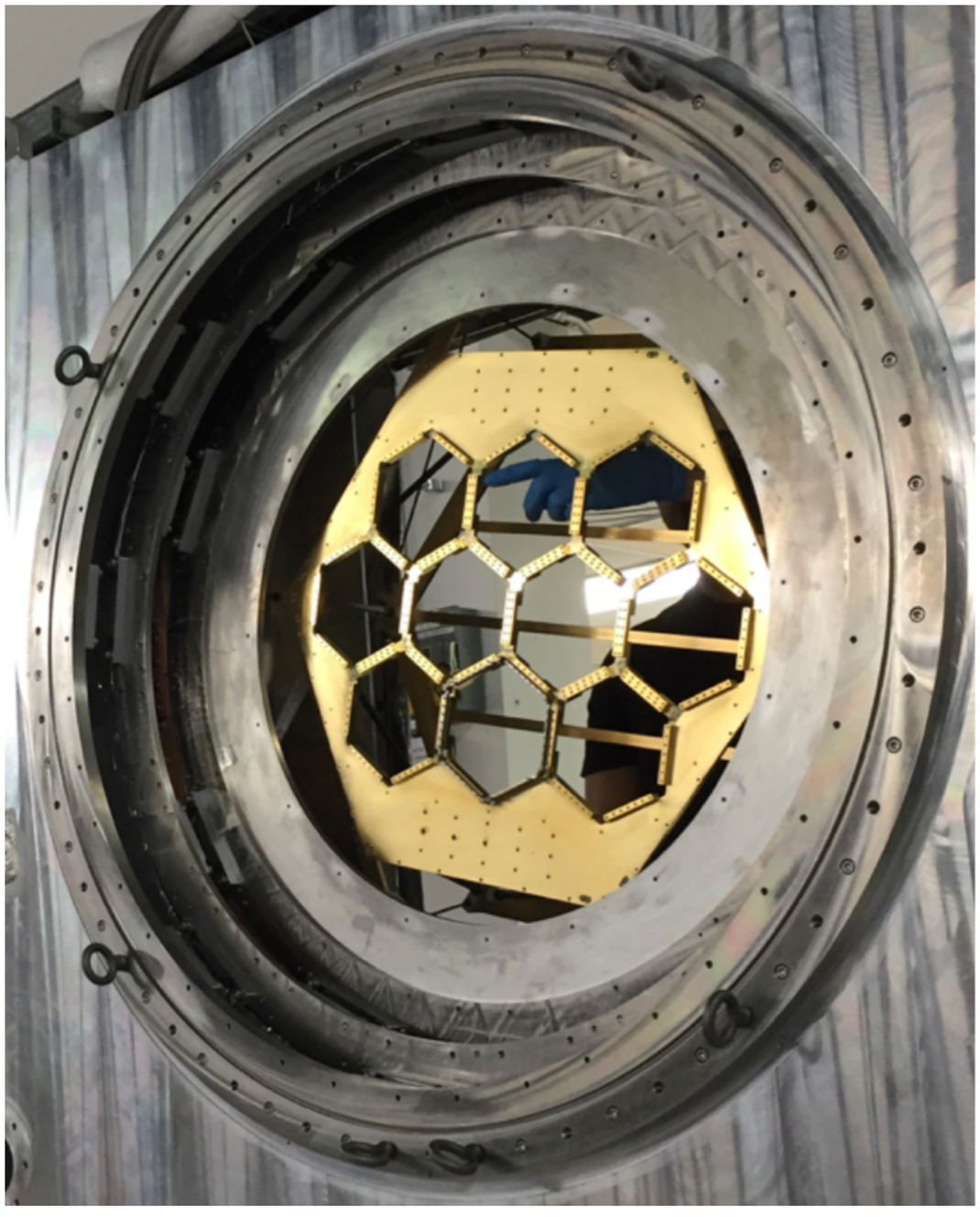


- 1536 ***polarization-sensitive*** bolometers
- 500 deg^2 survey
  8 μK-arcmin @ 95 GHz
  5 μK-arcmin @ 150 GHz

The South Pole Telescope (SPT)



SPT-3G - 3rd camera on SPT



- 10x more bolometers (16,200)
- 2500 deg^2 survey in 95, 150, 220 GHz
- Being installed now! First light in February!

The South Pole Telescope (SPT)

SPT-3G receiver starting trip to Pole:

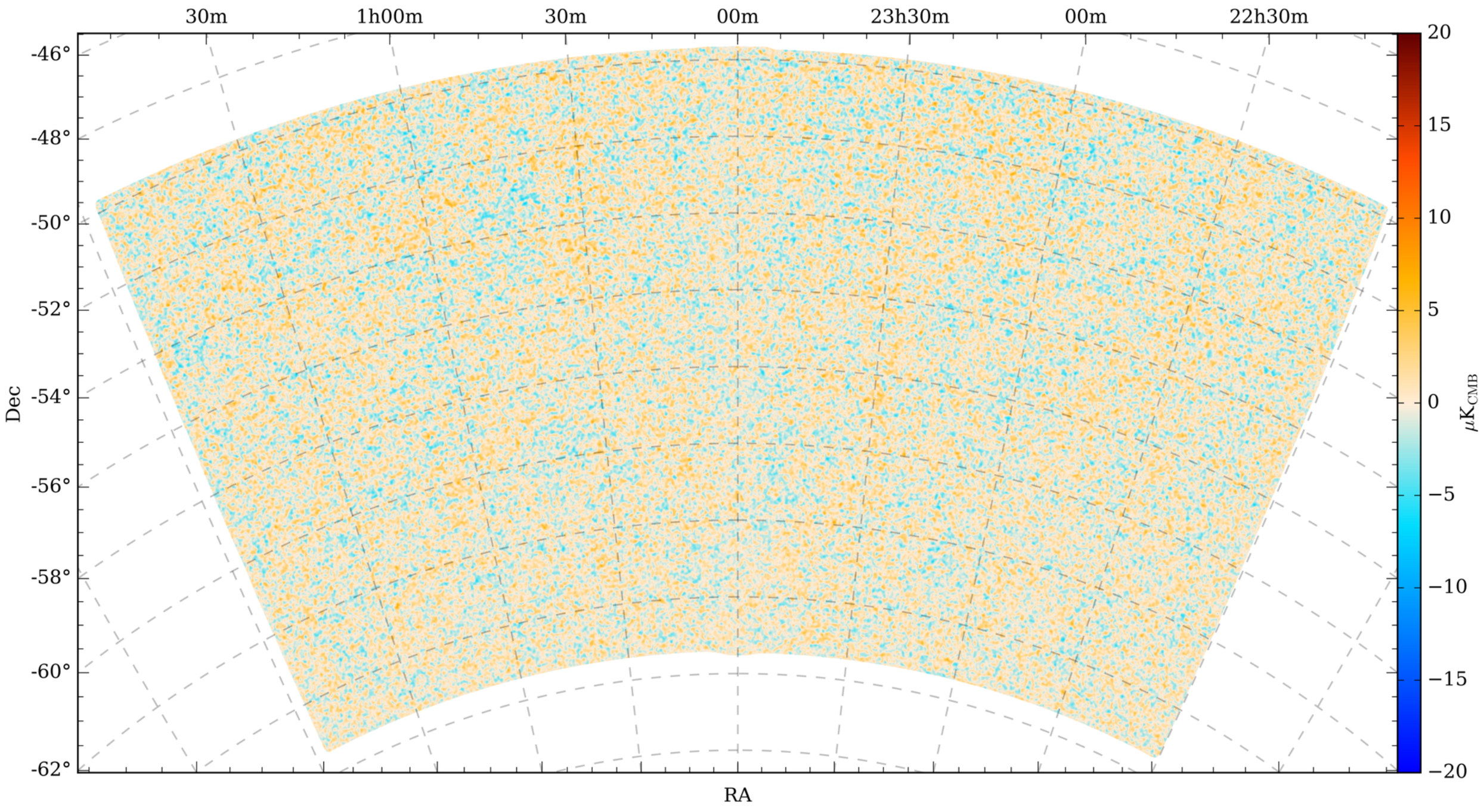
Left Chicago: Oct 30, 2016

Arr. Christchurch: Nov 2, 2016

People got to Pole in early November to begin work

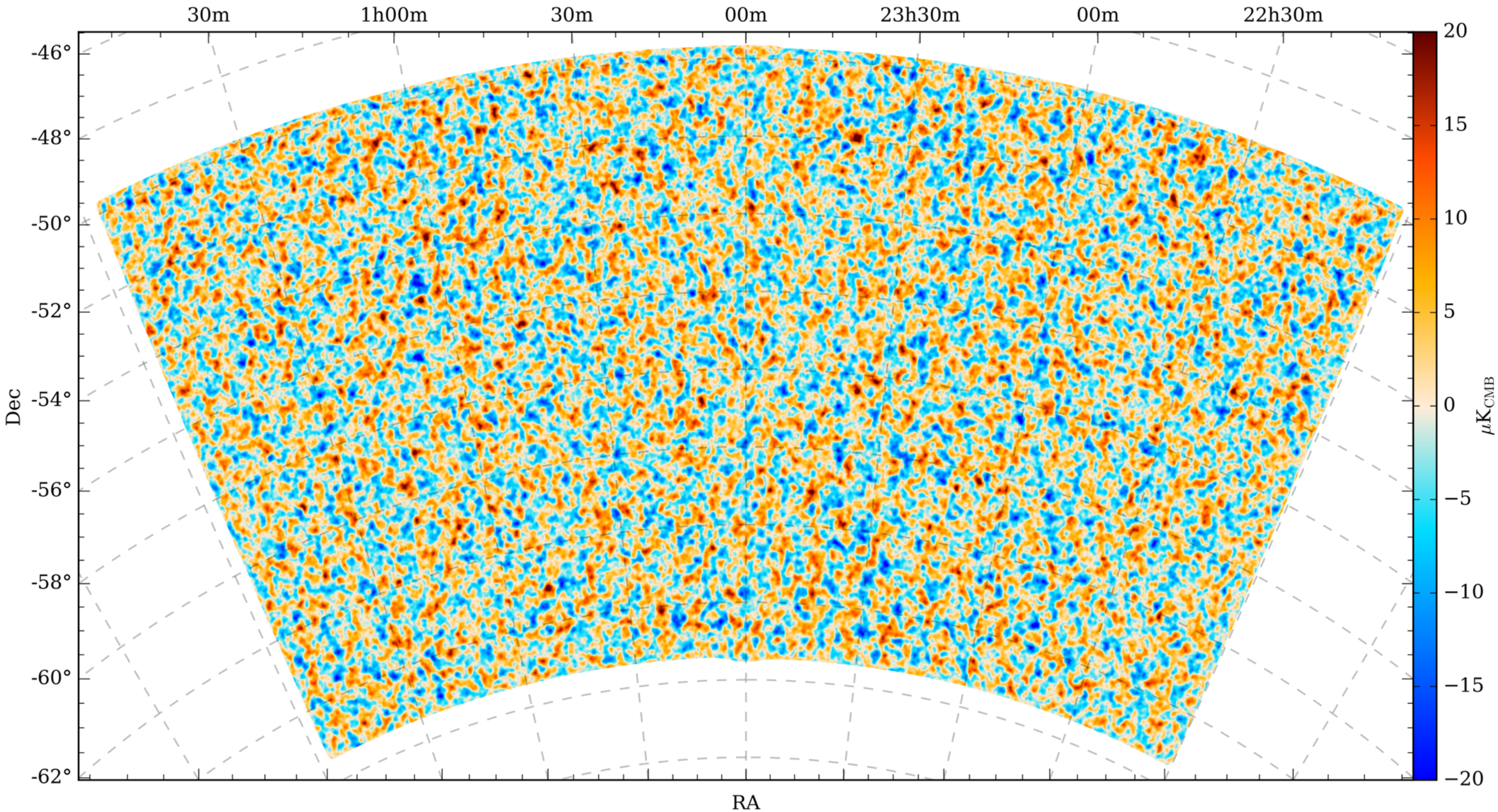
A tour of the SPTpol survey field using WorldWide Telescope

E-modes - A noise map



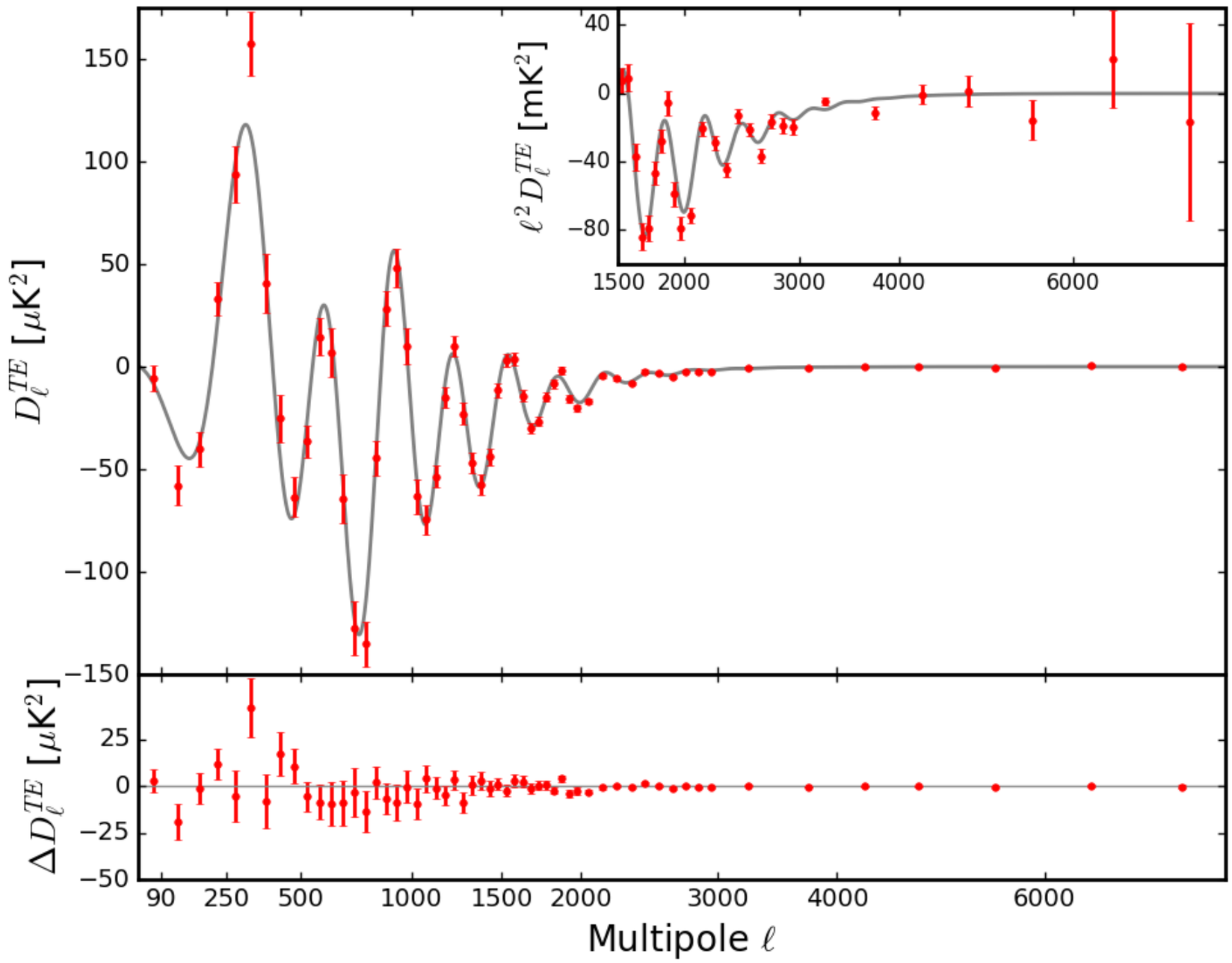
- Map from the first half of the season minus the second half
- Noise: 9.4 μK-arcmin between 2000 < ℓ < 4000.

E-modes measured with SPTpol



- High signal-to-noise!

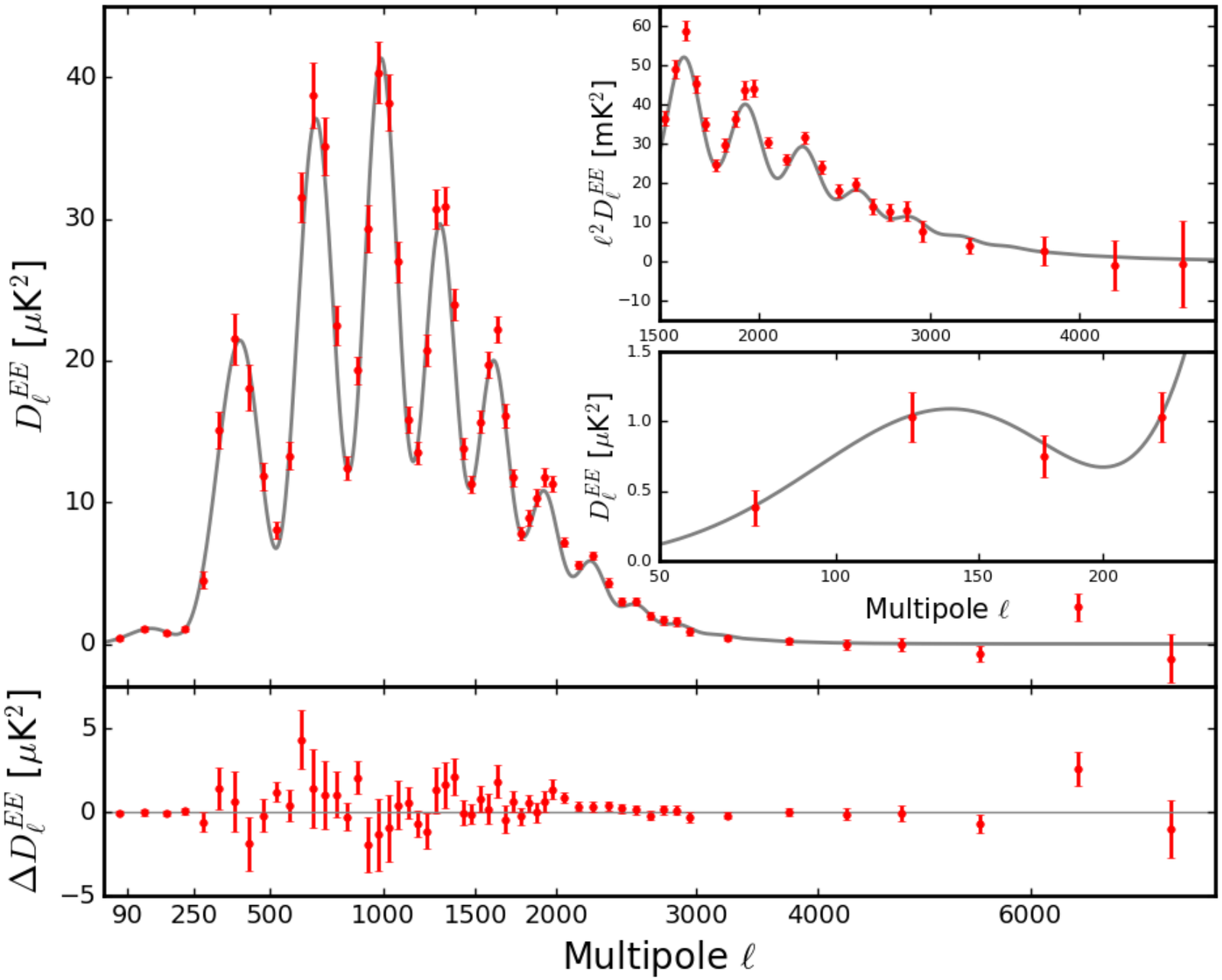
TE Power Spectra



Henning et al.,
In prep

- **Model not fit to data! (Planck plikHM_TT_lensing_lowTEB)**
- **Sample-variance limited at ℓ < 2050**

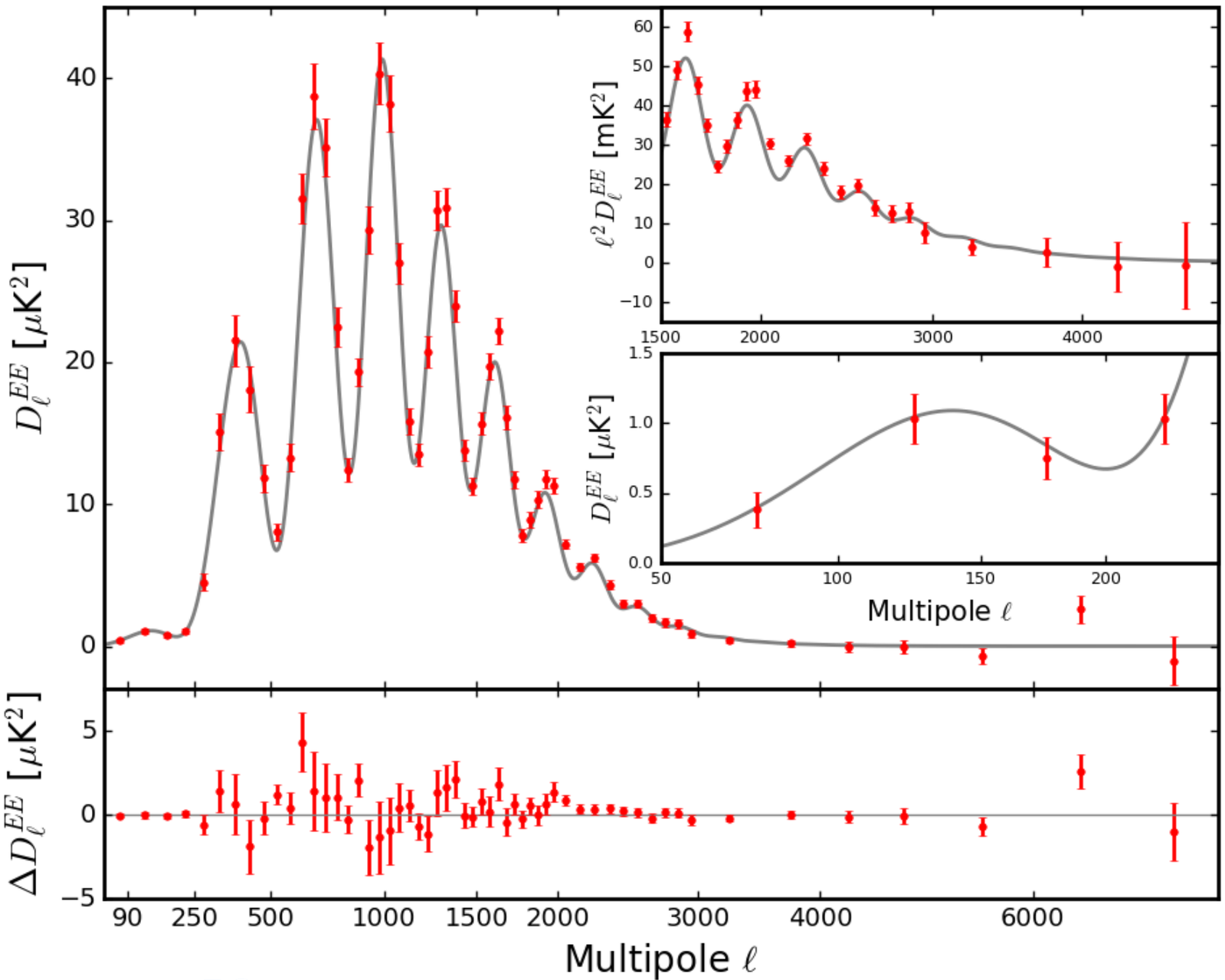
EE Power Spectrum



Henning et al.,
In prep

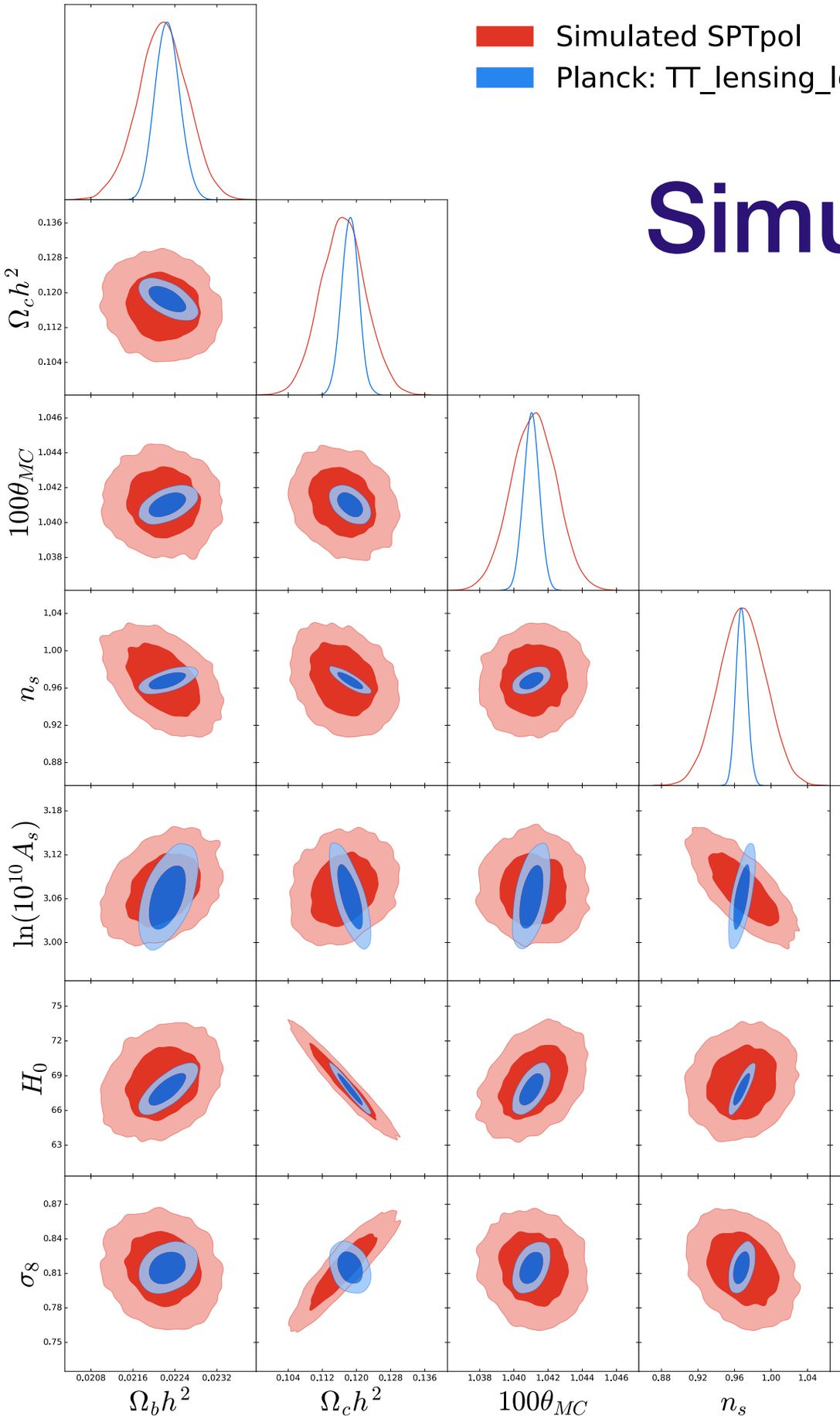
- Sample-variance limited at ℓ < 1750
- 9(?) acoustic peaks — as many as in Temperature!

EE Power Spectrum



Henning et al.,
In prep

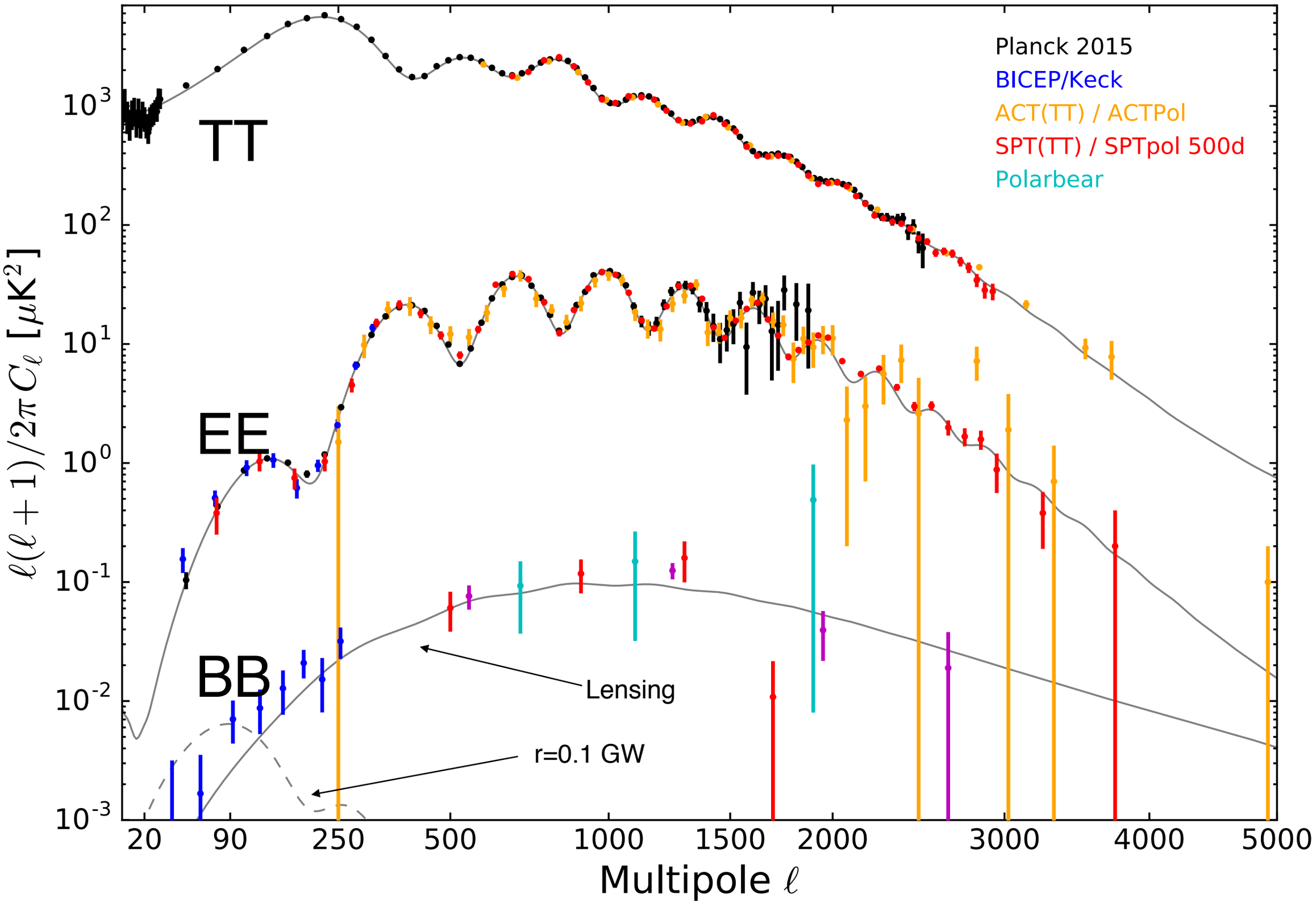
- D_ℓ^{PS} < 0.1 μK^2 at 95% confidence.
  - Poisson power crosses EE at ℓ ~ 3800.
  - Source mask: > 50 mJy (in T)



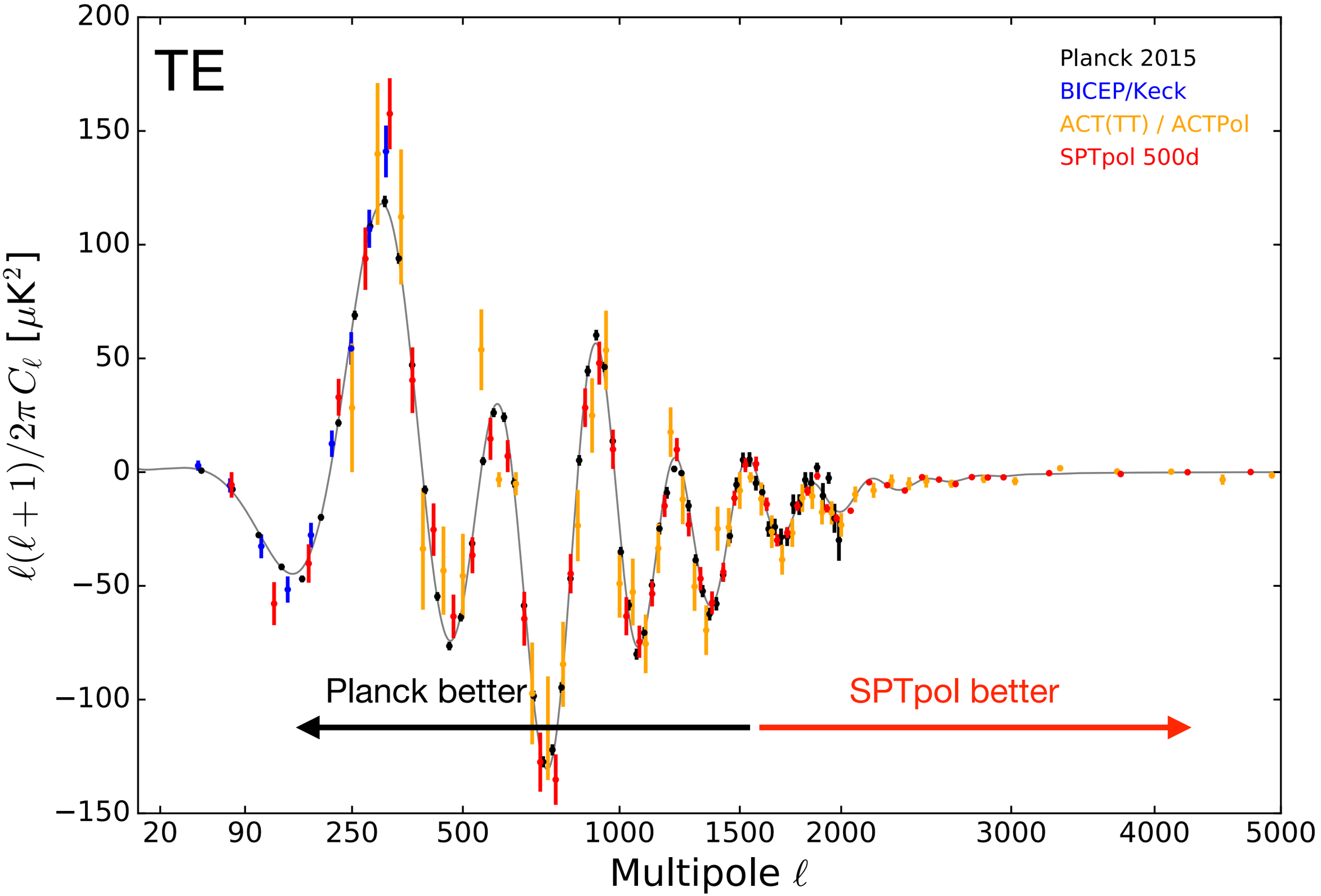
Simulated Constraints

- SPTpol EE+TE(Red)
  - **Simulated bandpowers**
  - Cov from real data
  - ΛCDM-τ
- Planck (Blue)
- Larger impact beyond LCDM

CMB Polarisation



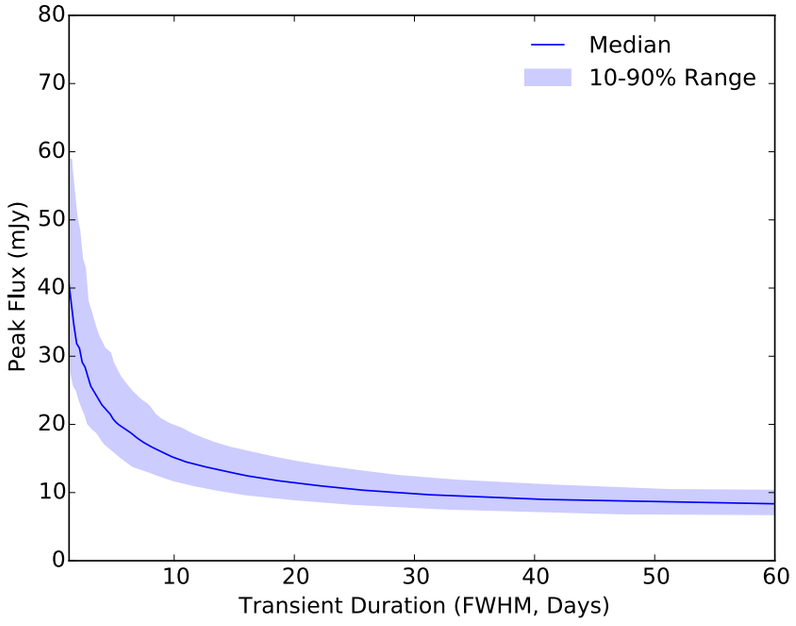
CMB Polarisation

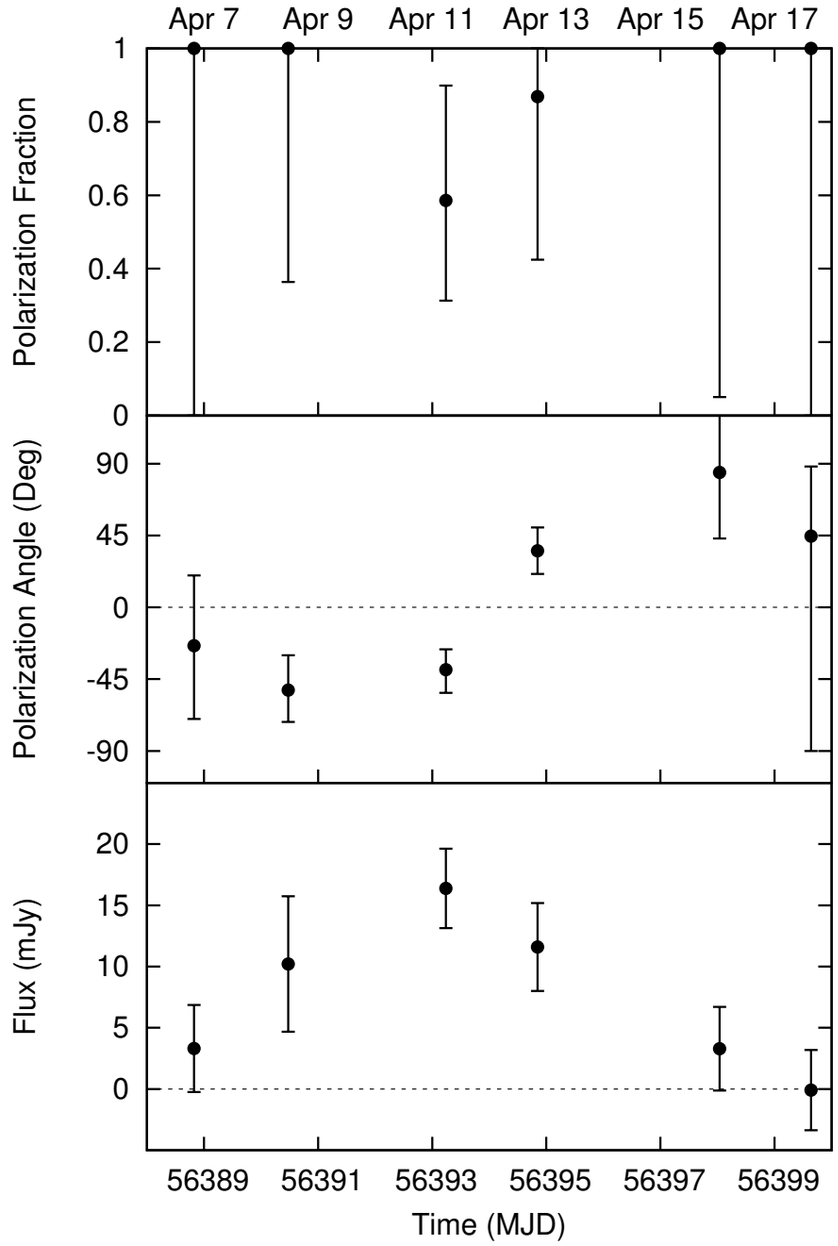


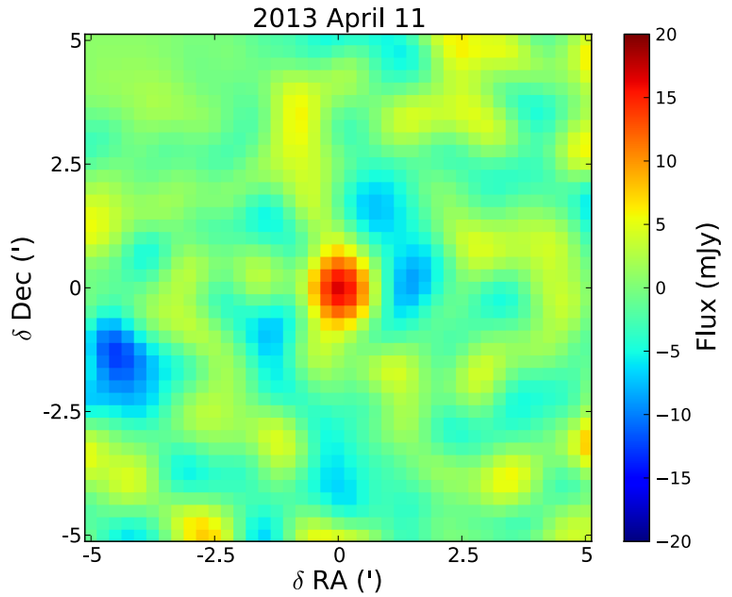
Whitehorn et al
arXiv:1604.03507

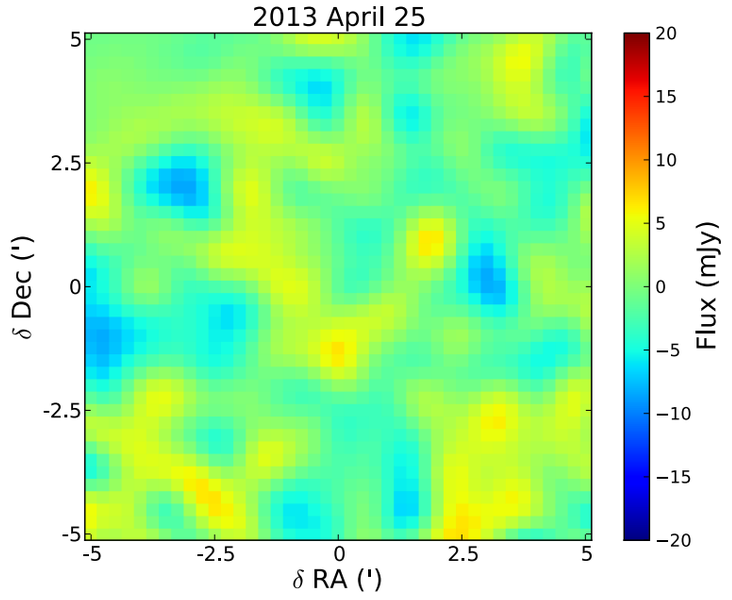
Transient Search

- Searches observations of 100 deg^2 field (2012-early 2013).
- SPTpol sensitive to ~ > 10 mJ transients over range of durations.
- Low significance candidate (PTE = 0.01)
  - broadly consistent with gamma-ray burst afterglow.









In conclusion

- The SPTpol 500d survey:
  - Detect 9 acoustic peaks in EE (as many as TT!)
  - Best measurements of polarised damping tail
- SPT-3G being commissioned as we speak
  - **10x more detectors** (95, 150, 220 GHz)
  - **18x lower noise than Planck** 143 GHz channel across 2500 deg^2
- Planning underway for stage IV experiment with ~2 million detector-year survey