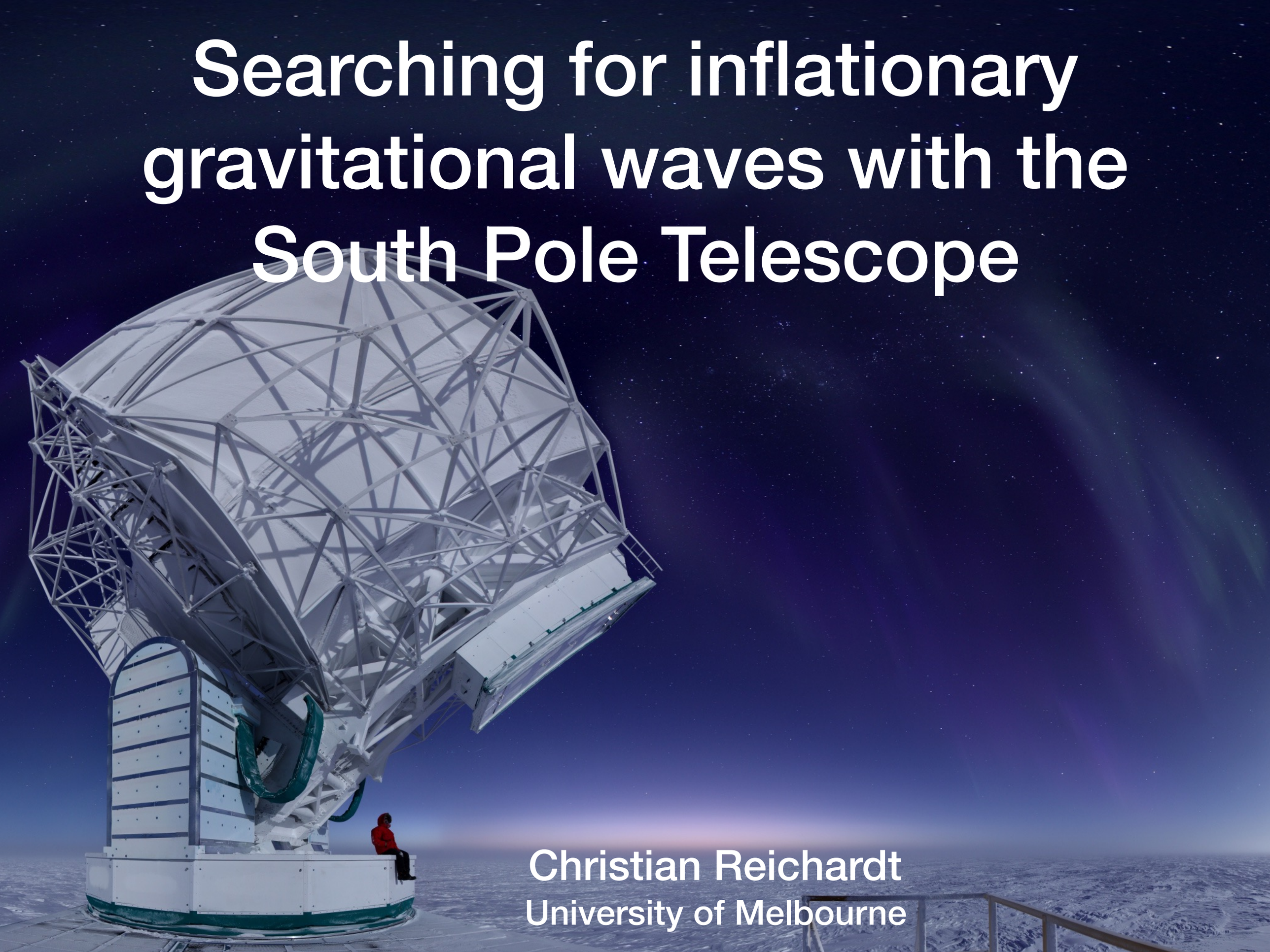
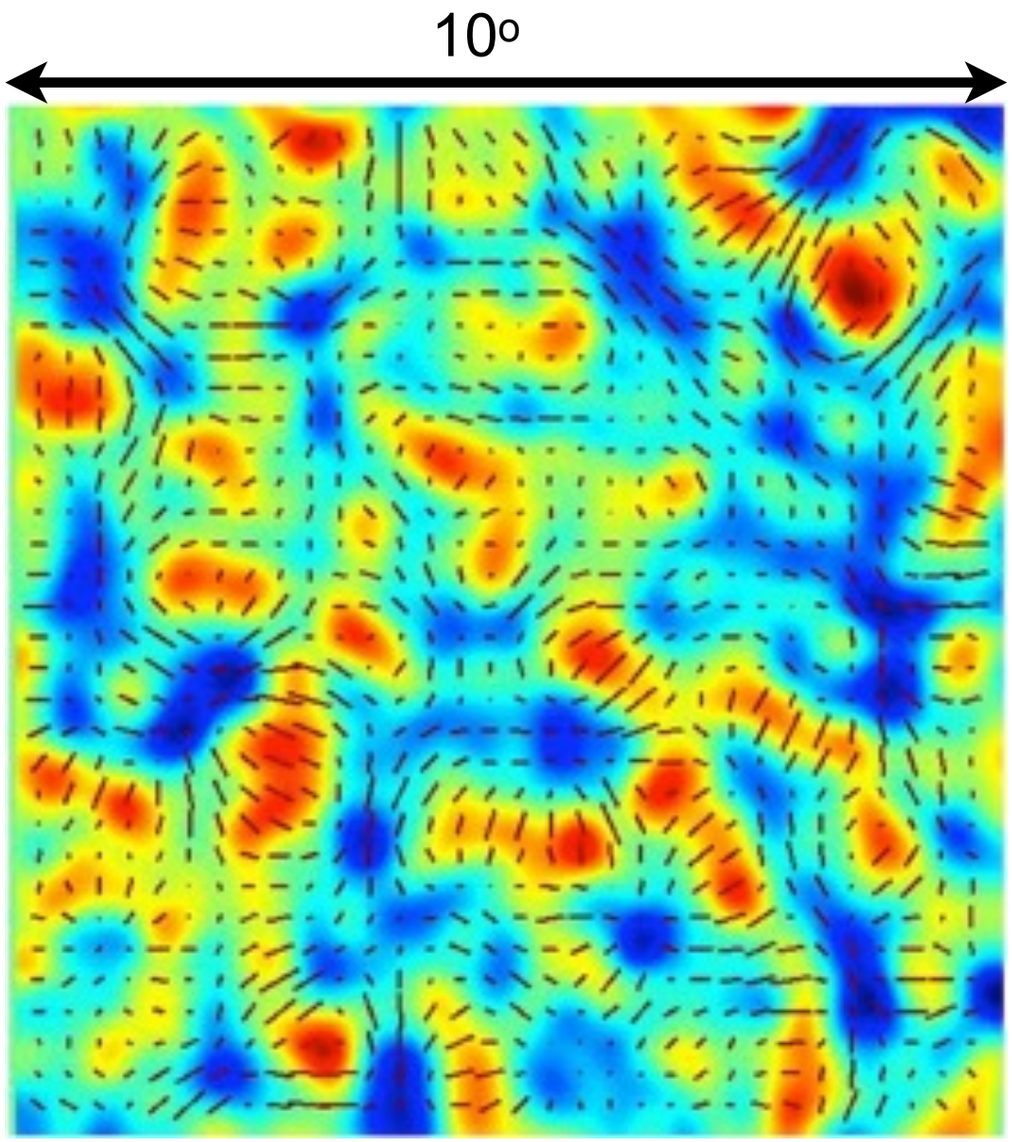
Searching for inflationary gravitational waves with the South Pole Telescope



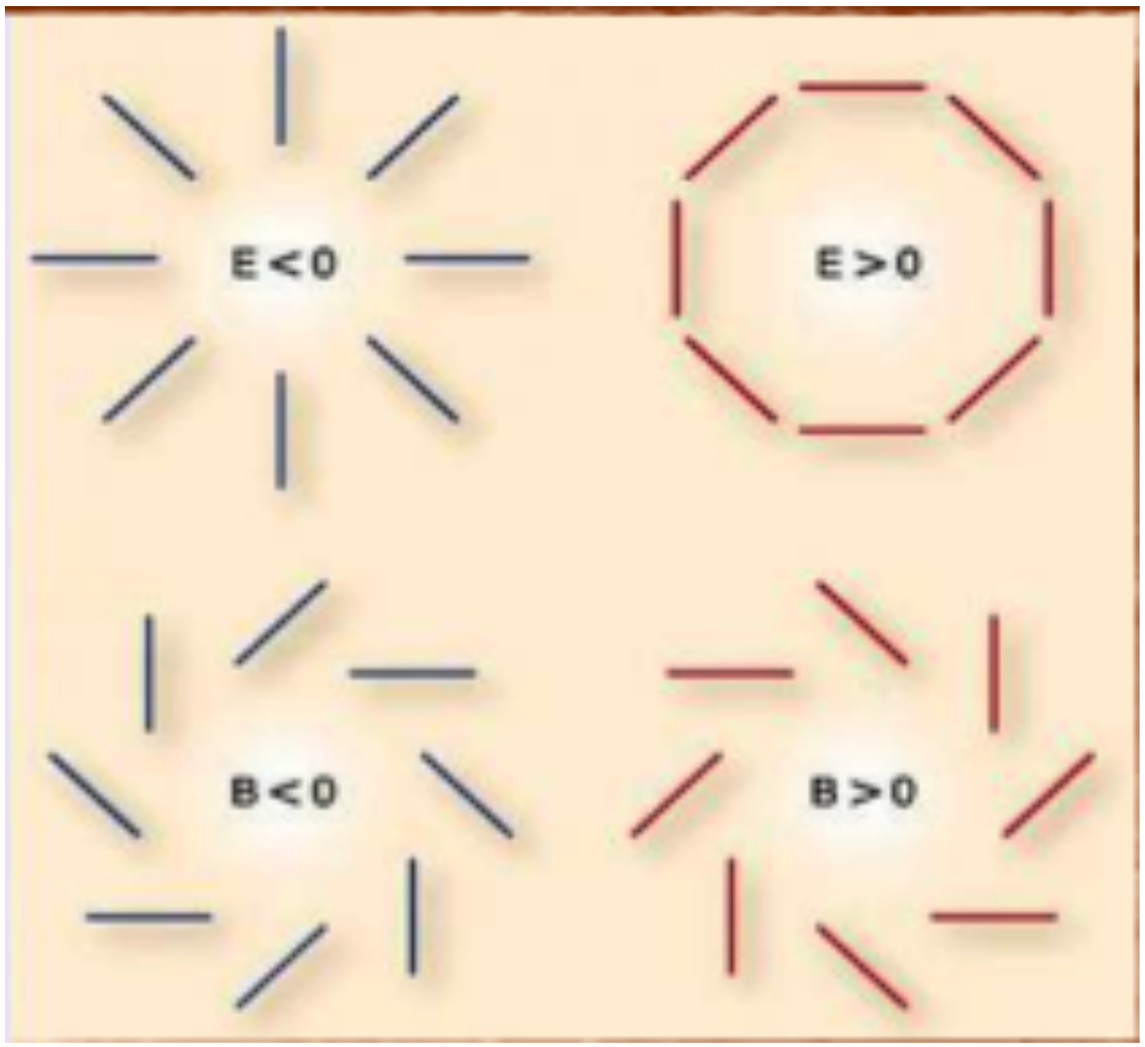
Christian Reichardt
University of Melbourne

The CMB is polarised (~10%)



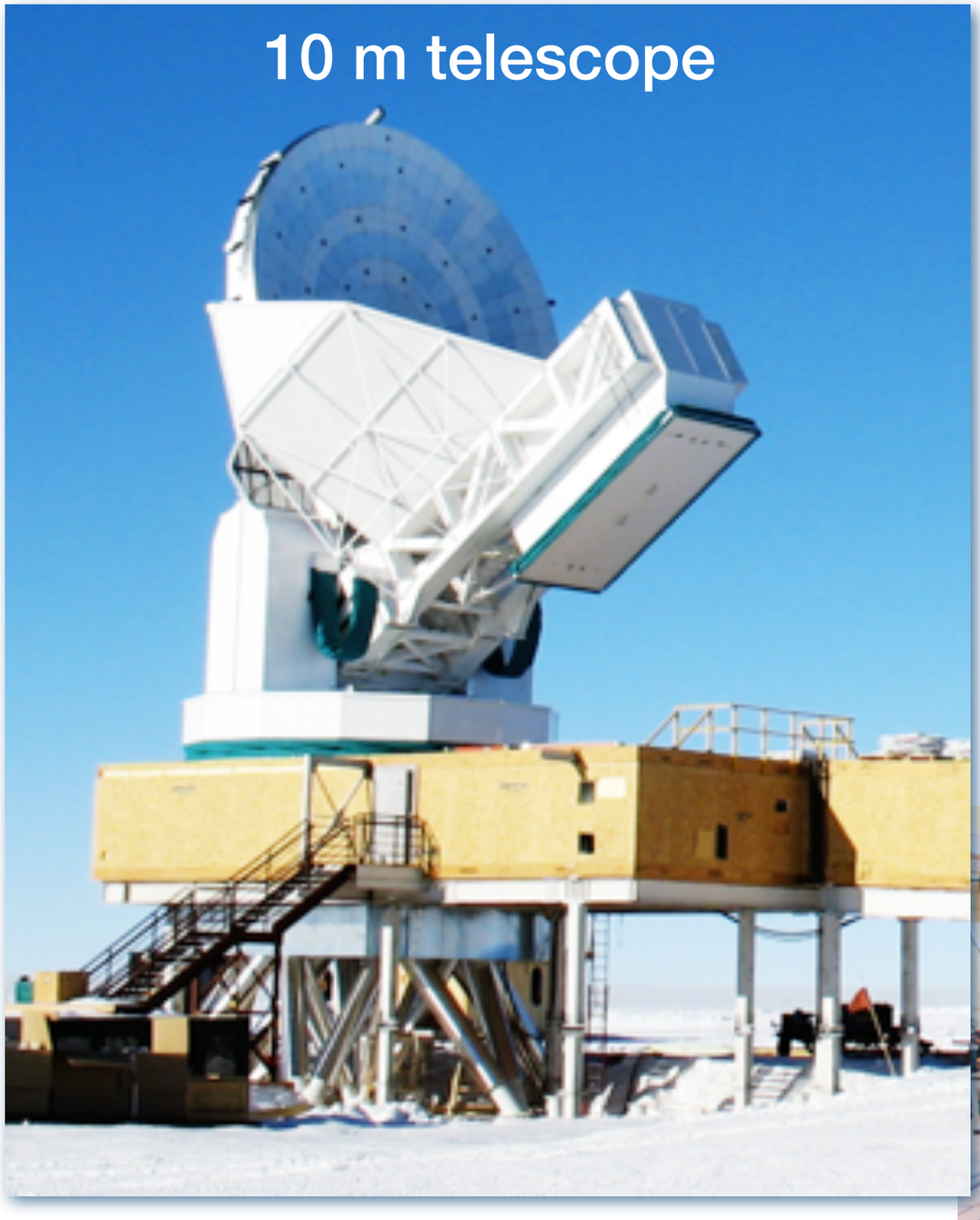
Smith et al 2008

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



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

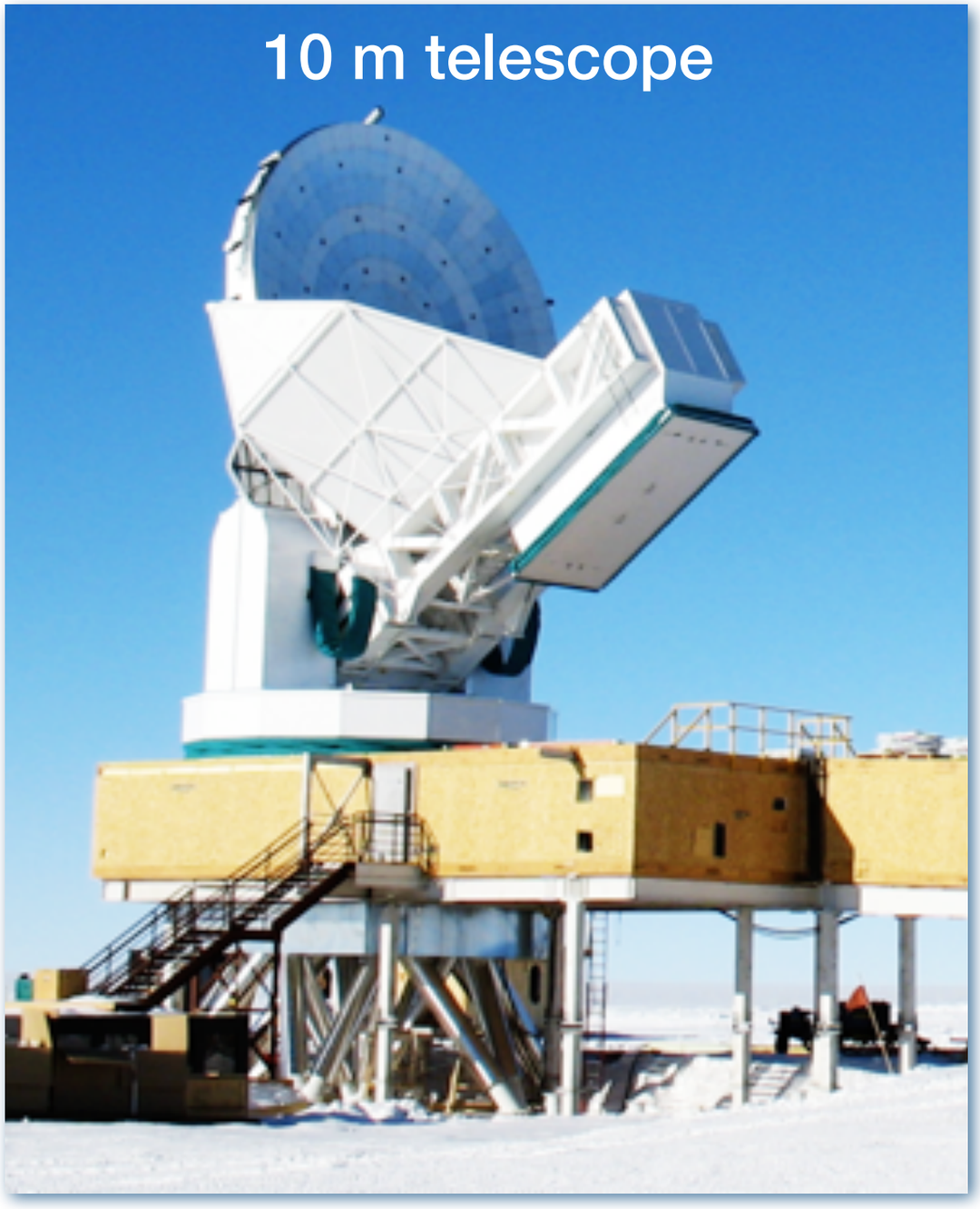
The South Pole Telescope (SPT)



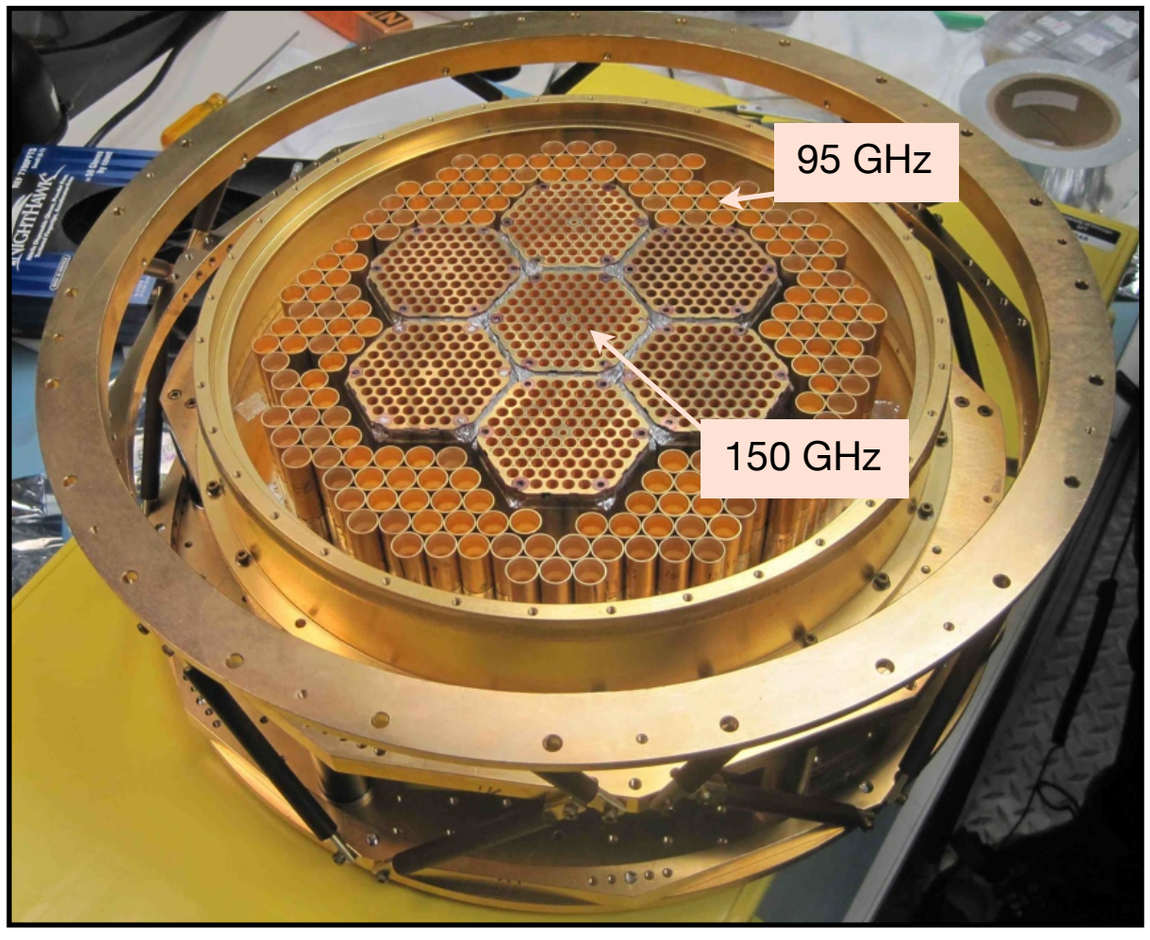
Sub-millimeter Wavelength Telescope:

- 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)

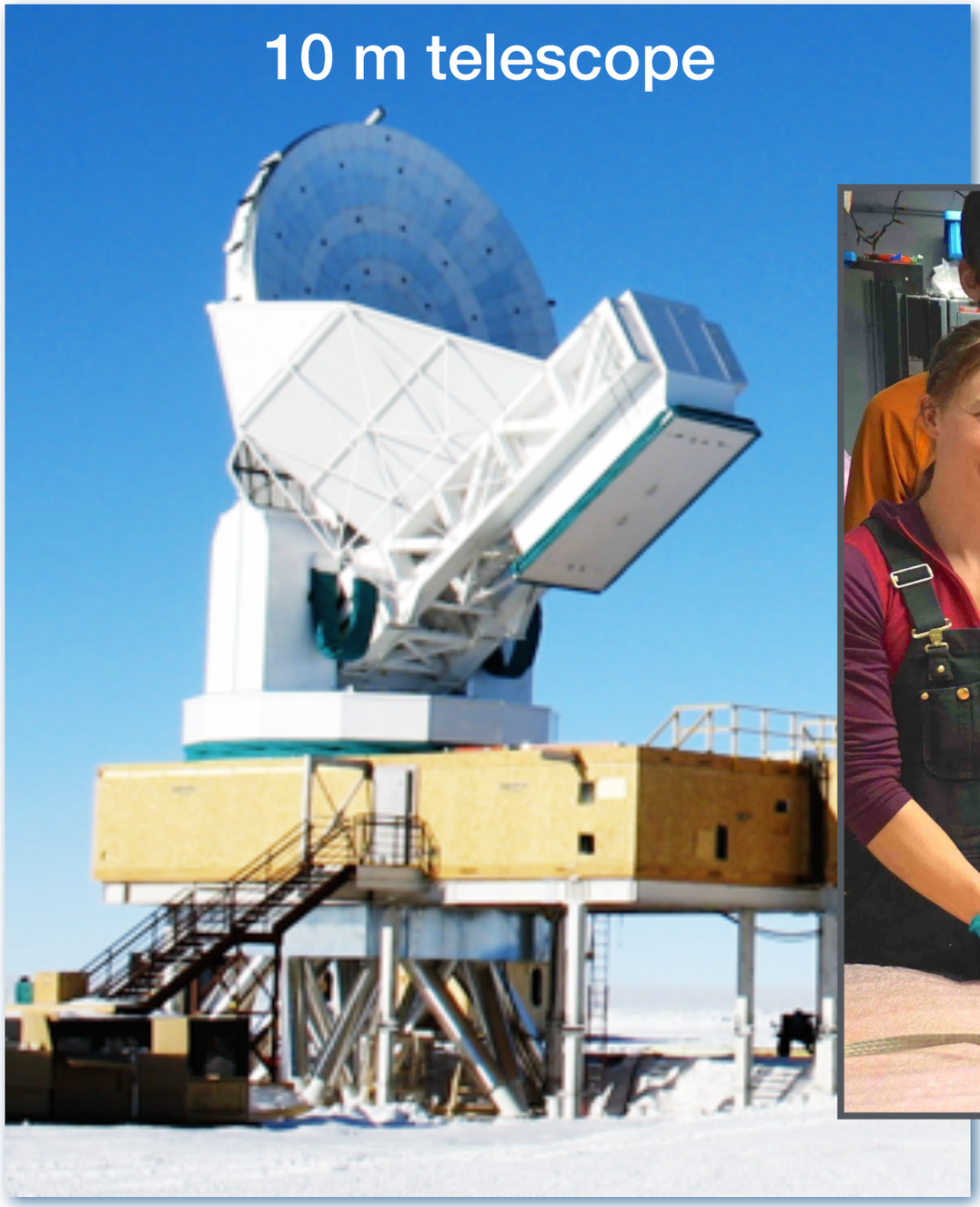


SPTpol - 2nd camera on SPT

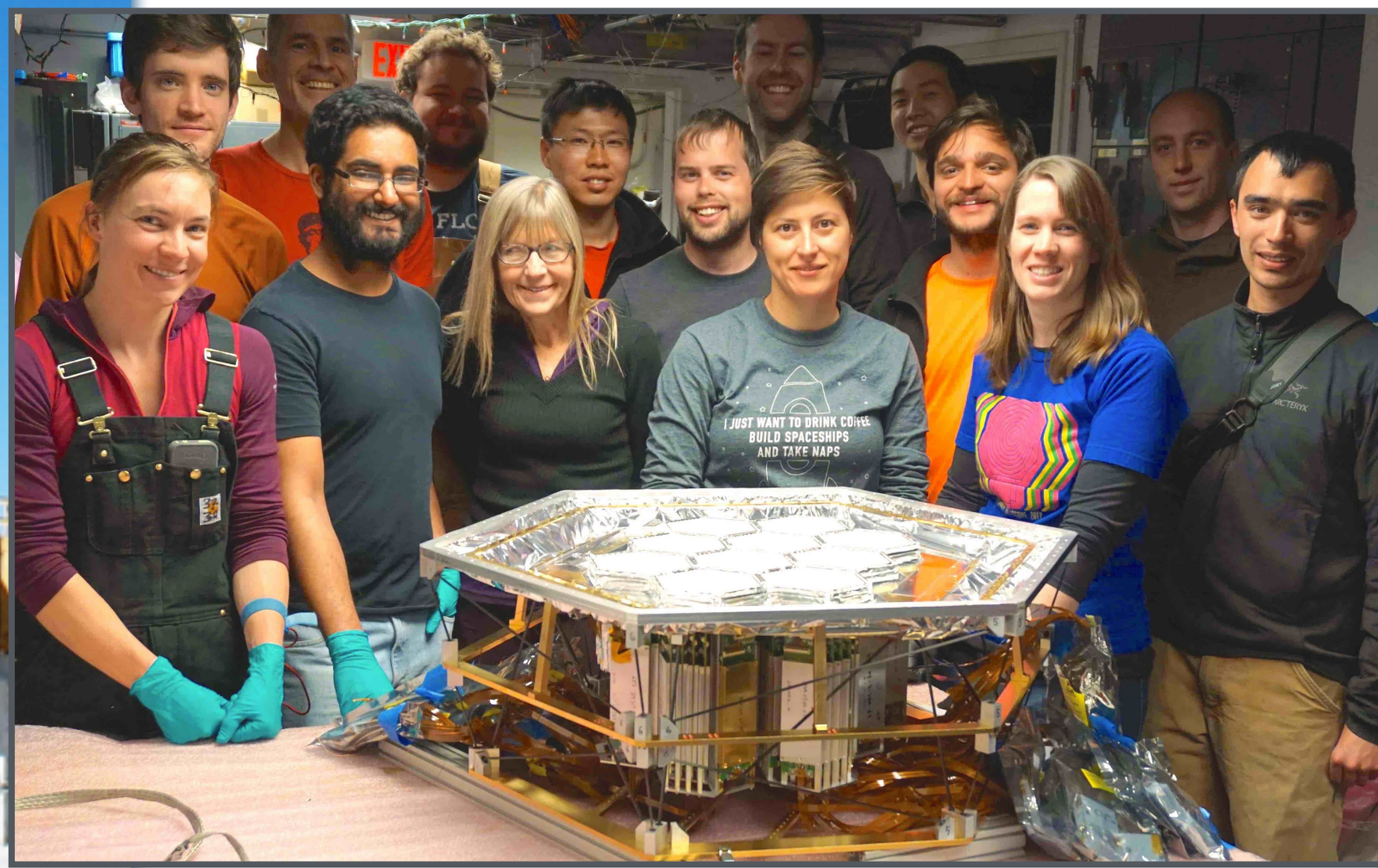


- 1536 ***polarization-sensitive*** bolometers
- 500 deg² survey
  8 μK-arcmin @ 95 GHz
  5 μK-arcmin @ 150 GHz

The South Pole Telescope (SPT)



SPT-3G - 3rd camera on SPT



- 10x more bolometers (16,200)
- 1500 deg^2 survey in 95, 150, 220 GHz
- Currently in 2nd year of observations

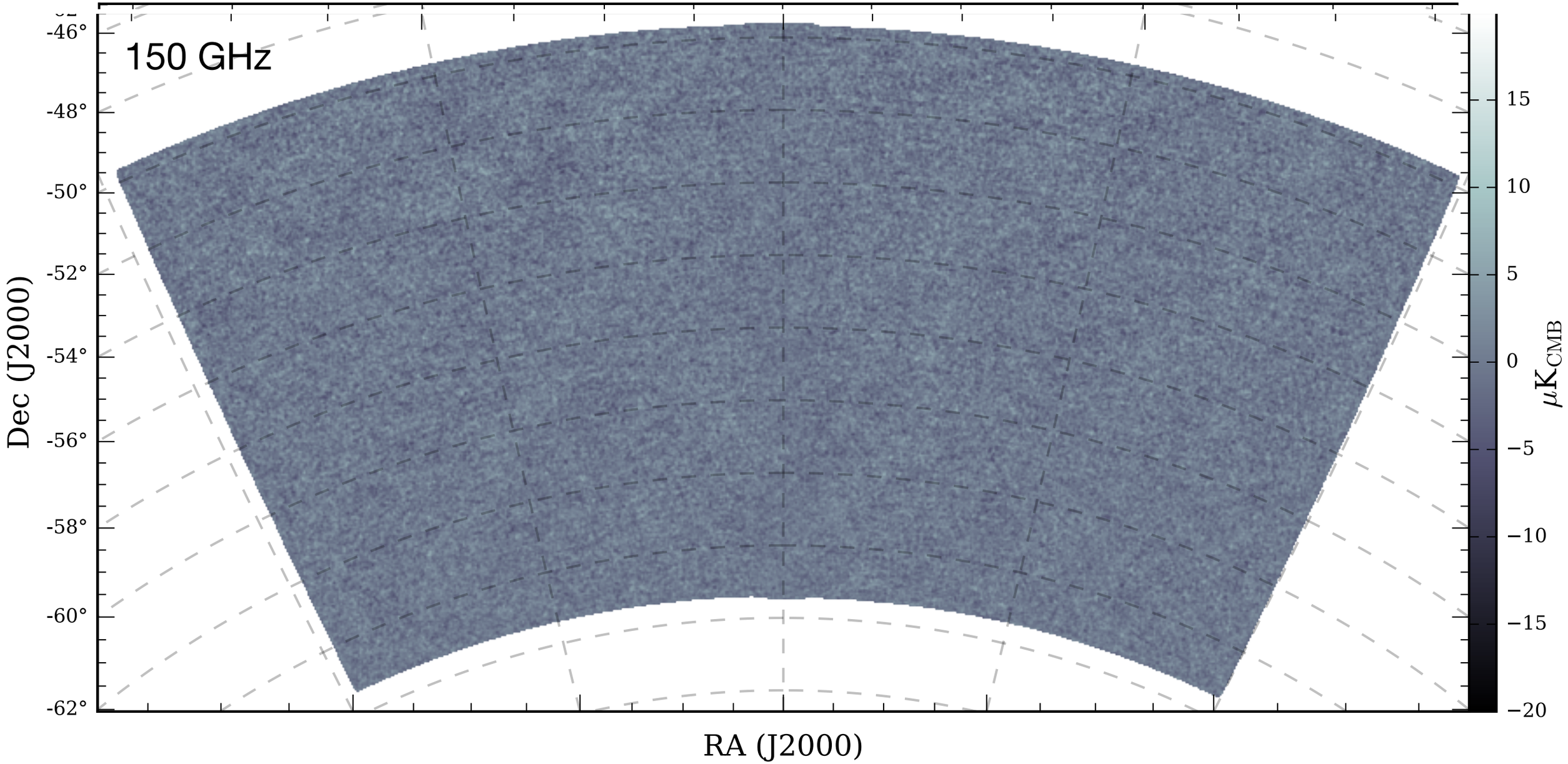
Latest from the Pole

Sunrise

Credit: Josh Montgomery

E-modes - A noise map

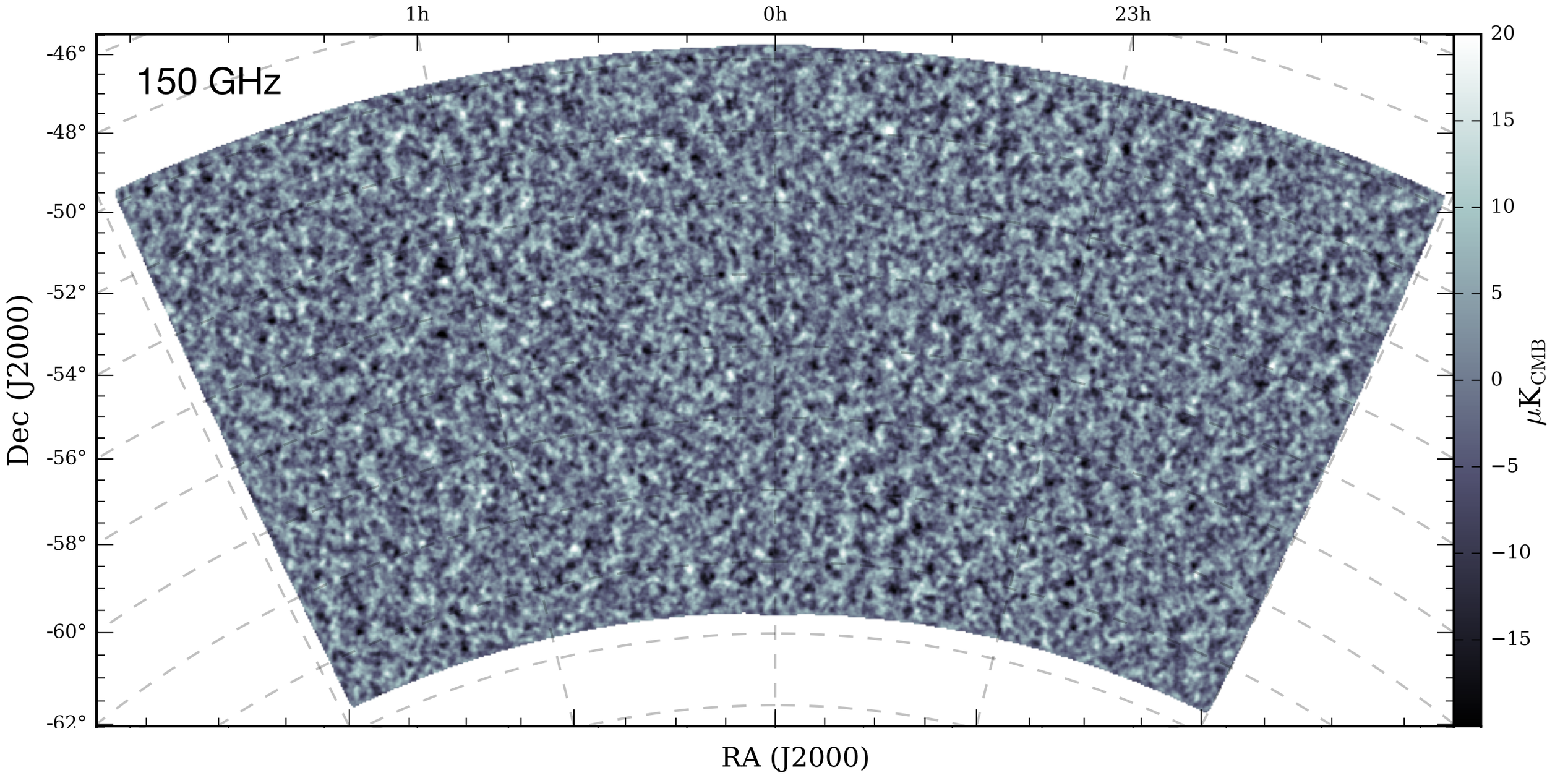
Work led by J Henning



- Map from the first half of the season minus the second half
- Noise: 9.4 μK-arcmin between $1000 < \ell < 3000$.

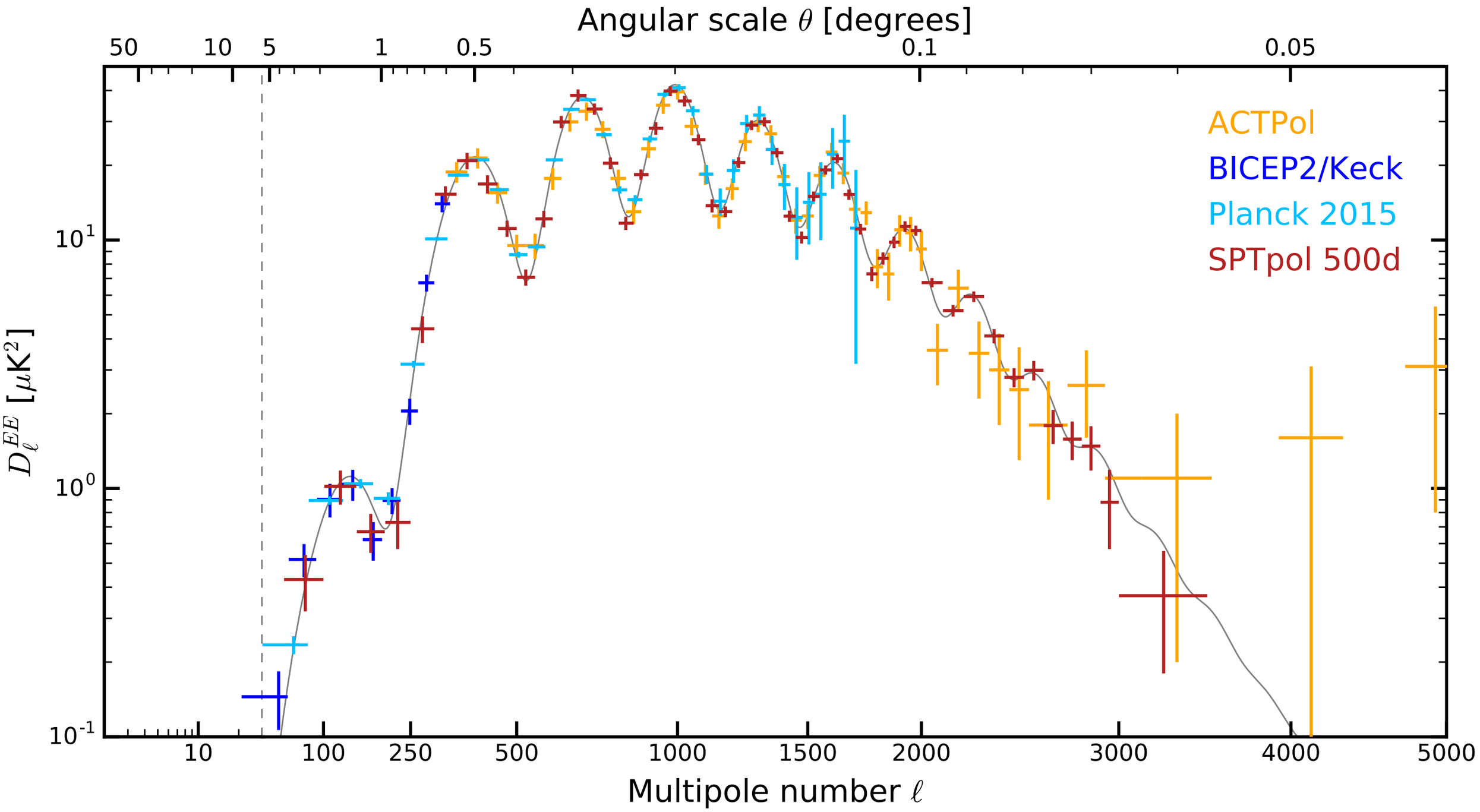
E-modes measured with SPTpol

Work led by J Henning



- High signal-to-noise!

E-mode power spectra



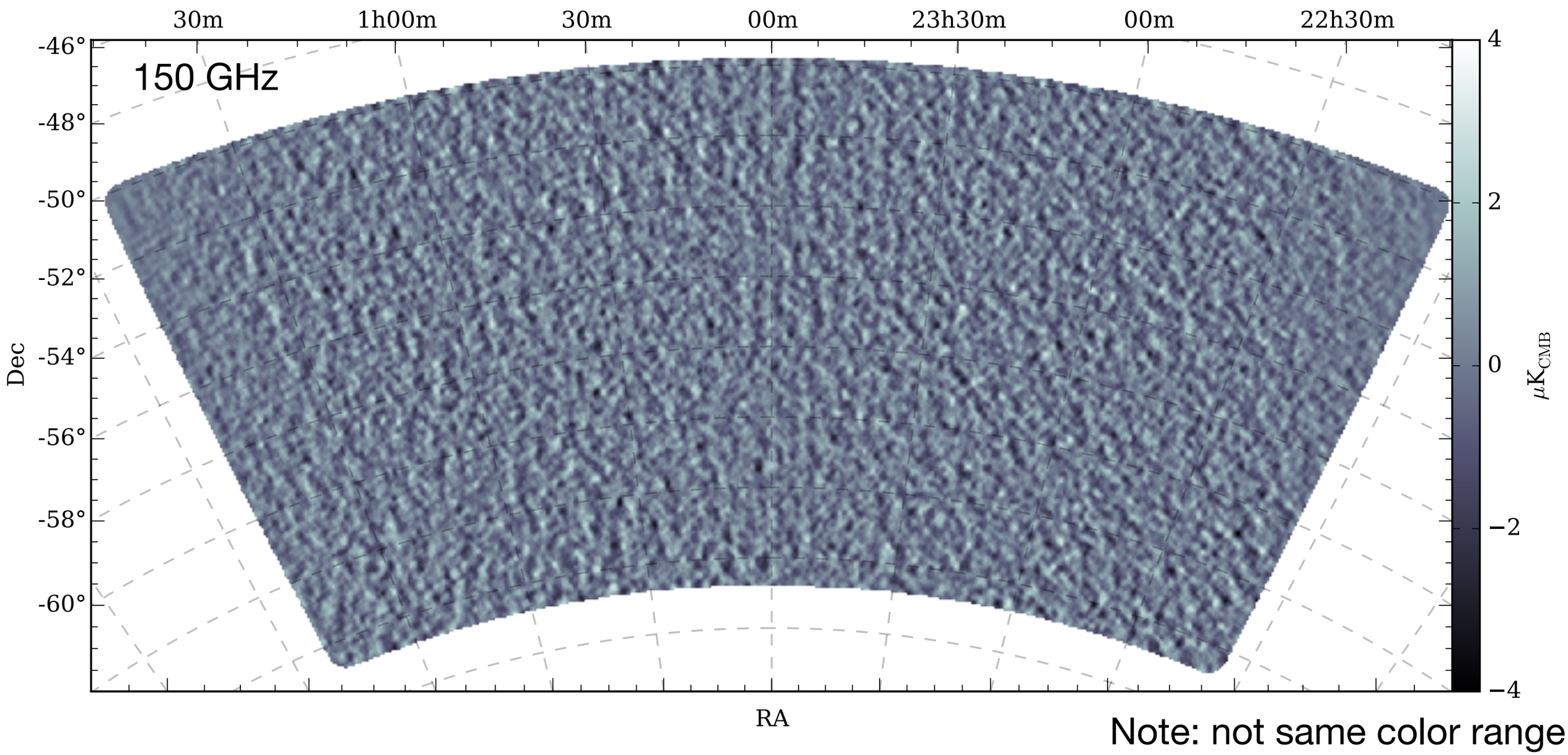
Best measurements at ell > 1050!

But what about B?
(with an focus on r)

- Direct measurements
- Delensing for inflation

B-modes measured with SPTpol

Work led by JT Sayre



Note: not same color range

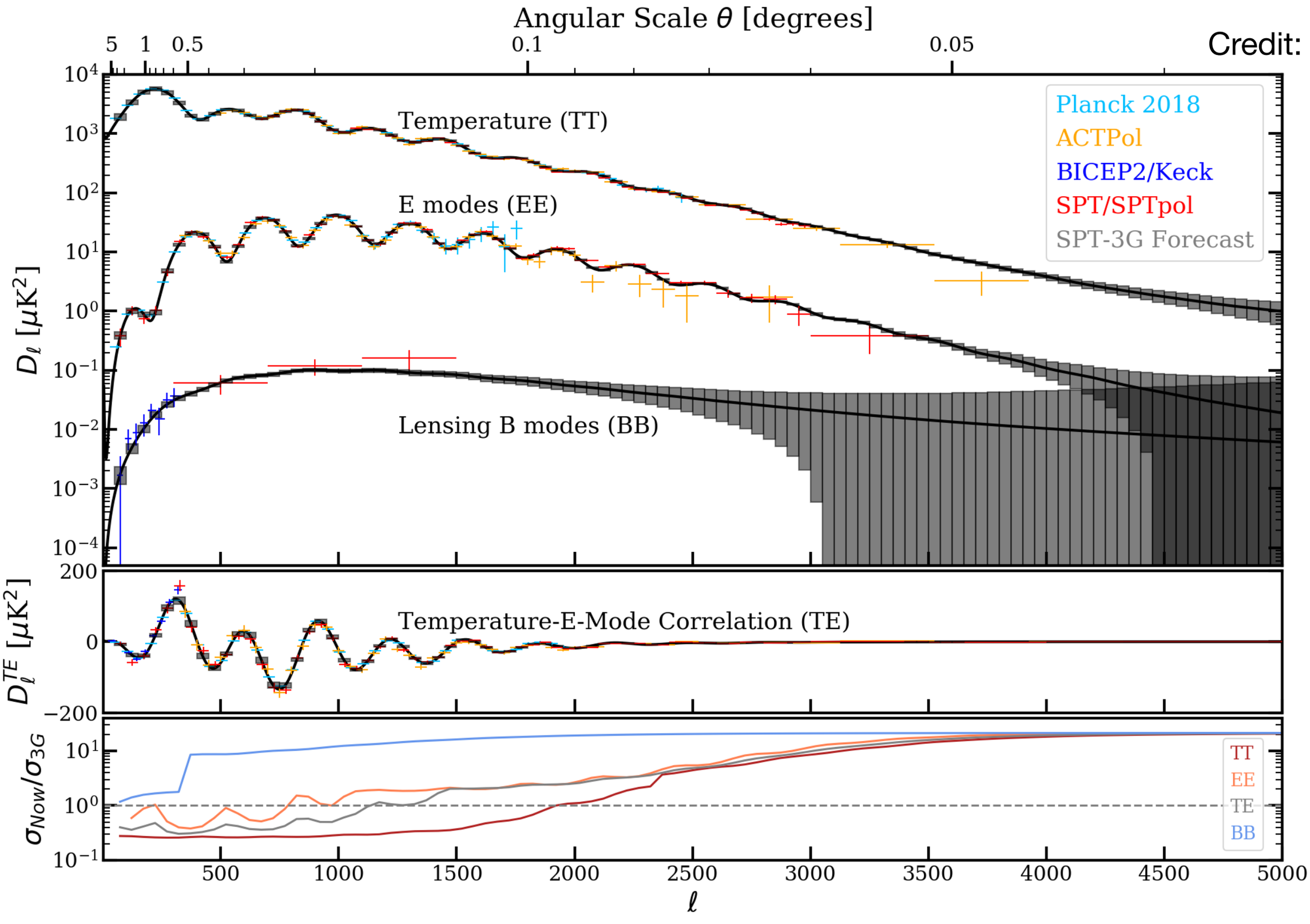
- Signal-to-noise < 1 per mode (but lots of modes)

Also have 95 GHz maps

New SPTpol B-mode power spectrum coming soon!

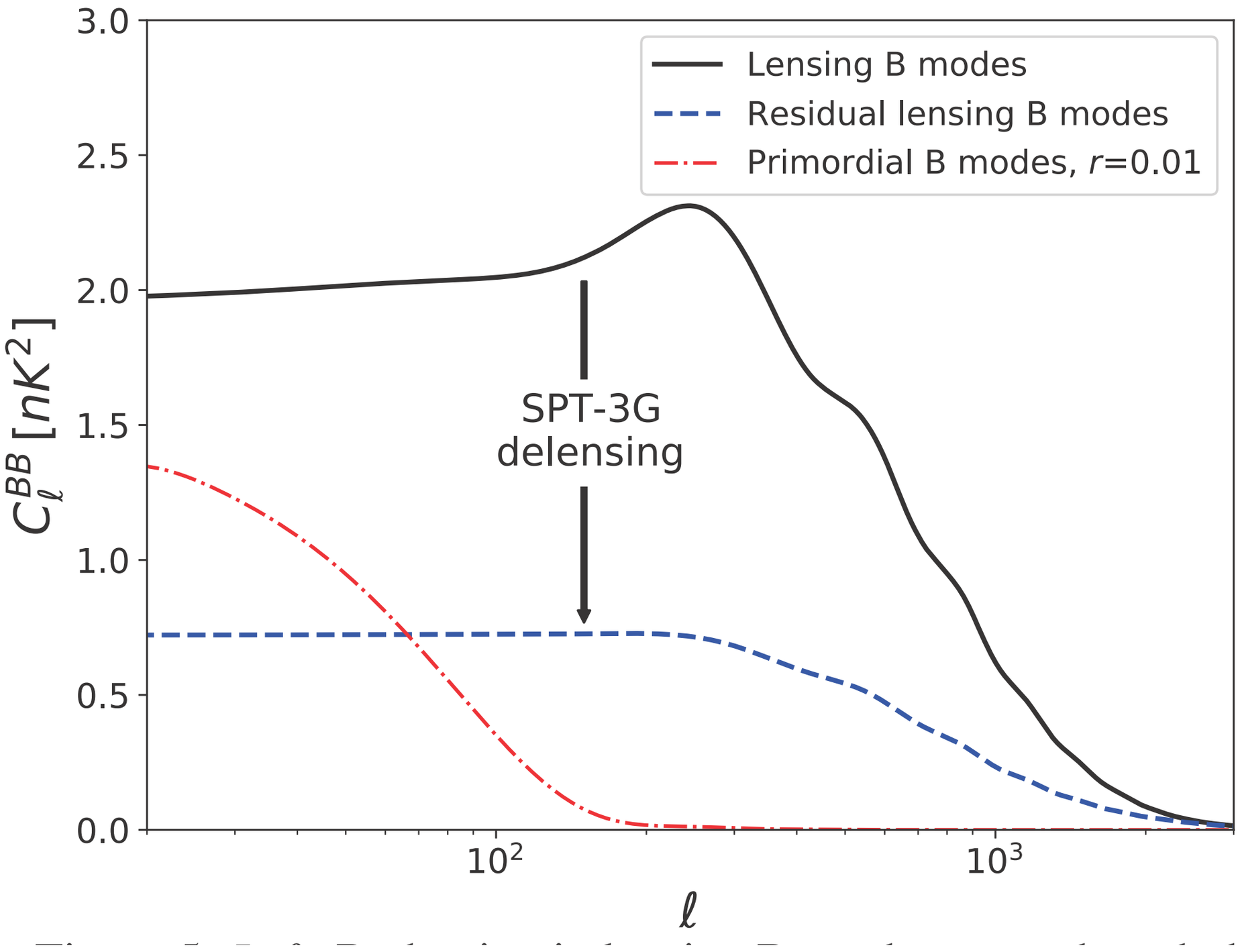
SPT-3G

Credit: K. Aylor



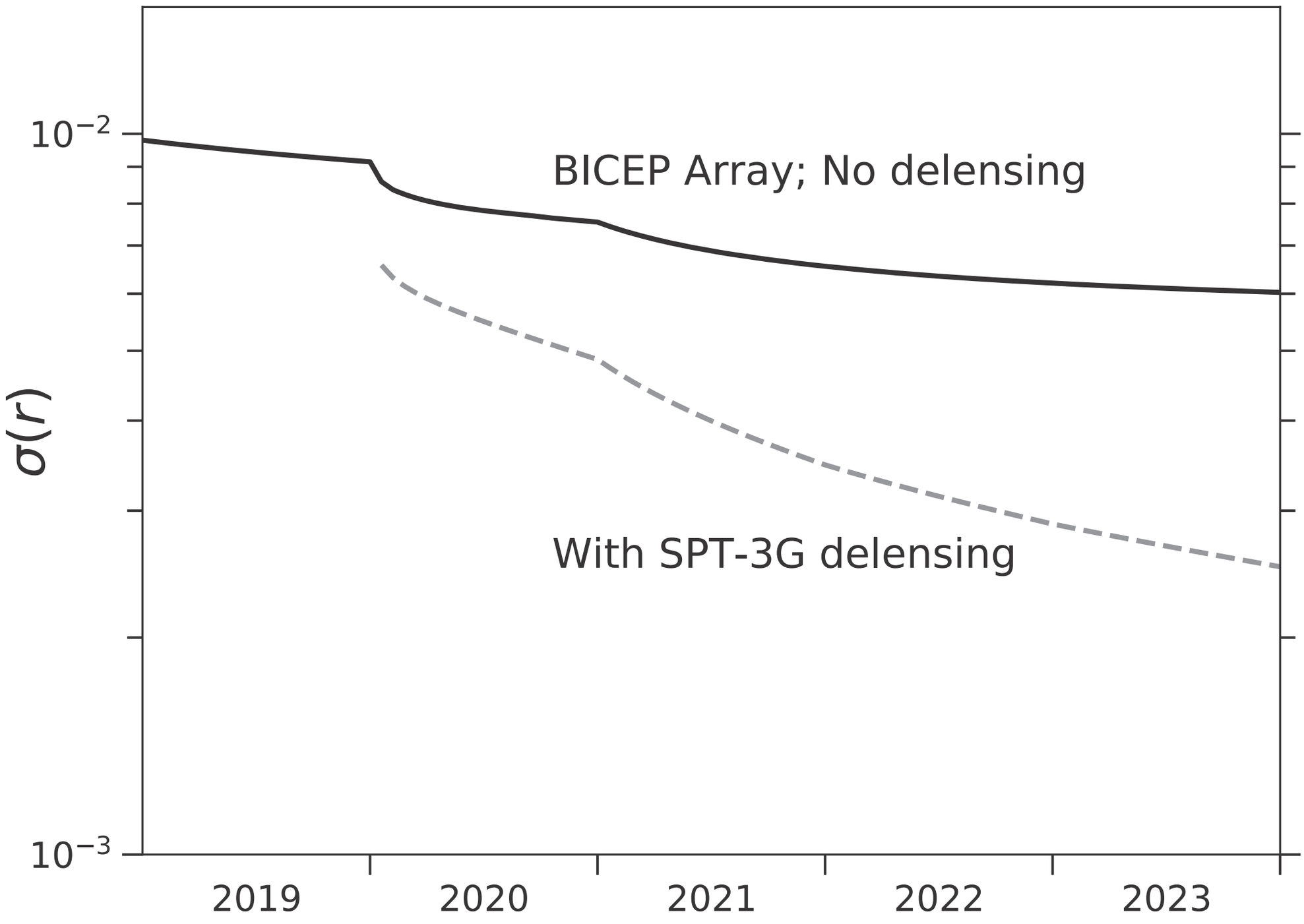
Delensing

Last COSMO: Alessandro showed delensing of 24% on the SPTpol 100d field (Manzotti et al. ApJ 2017)



SPT-3G will remove 2/3s of lensing BB power

New era: delensing crucial to IGW searches



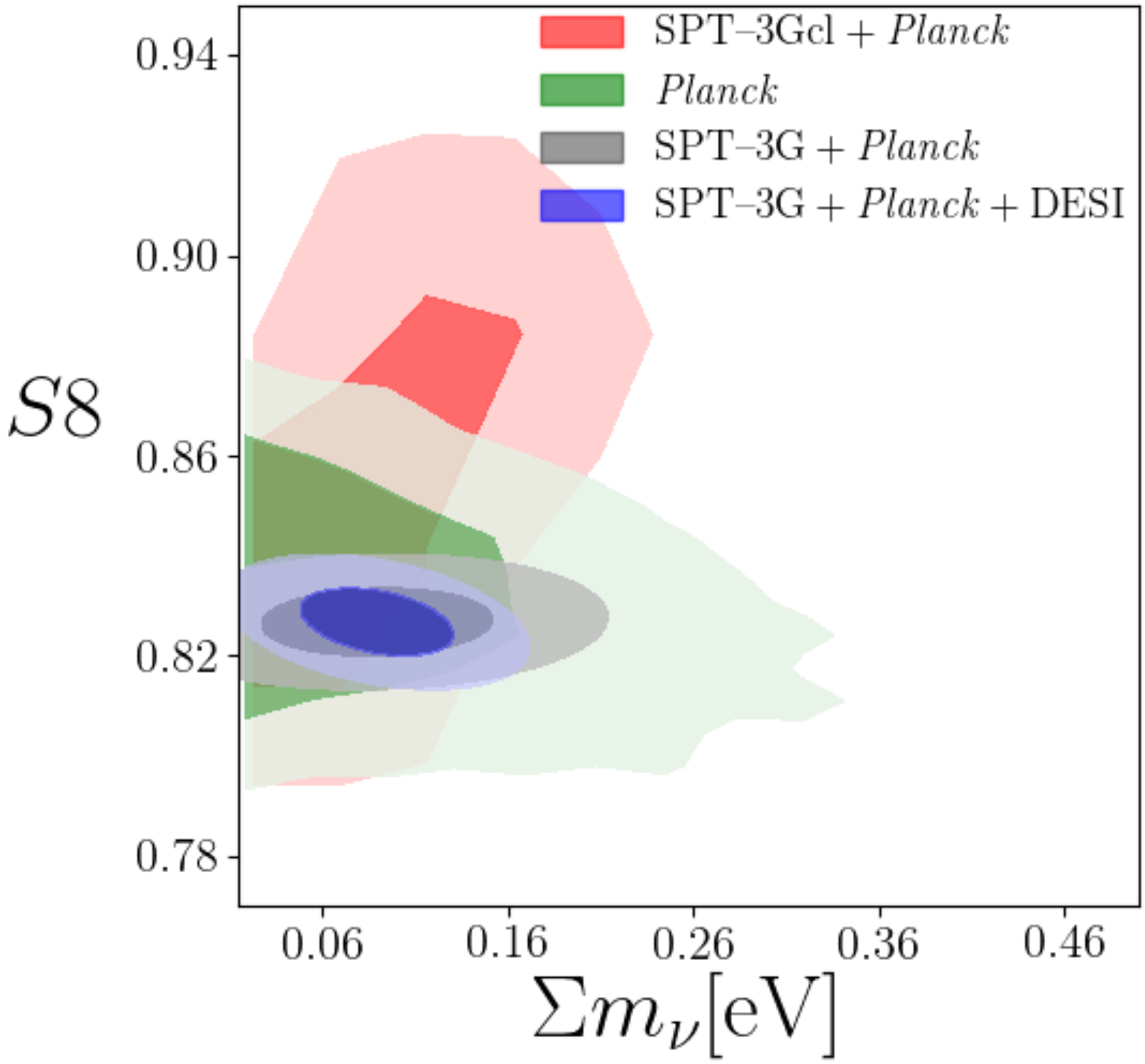
SPT-3G will remove 2/3s of lensing BB power

In conclusion

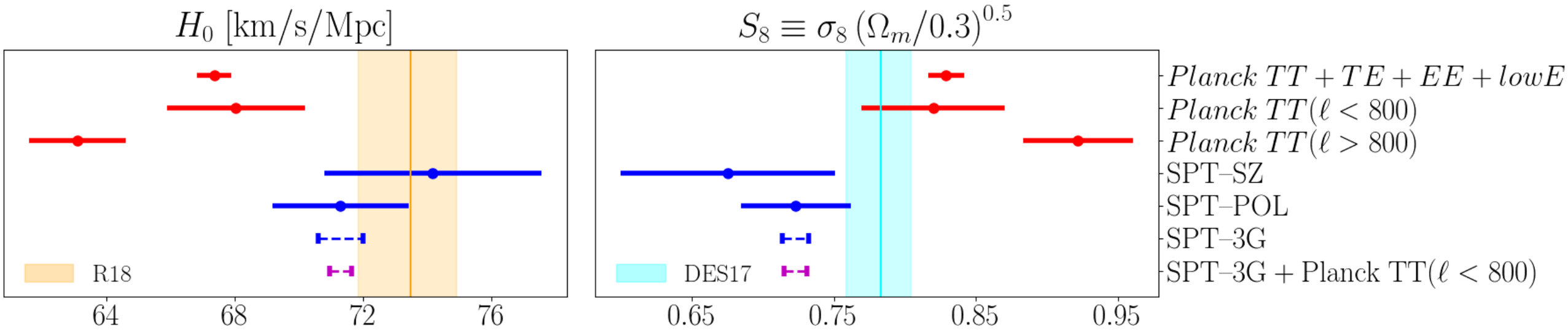
- SPTpol has made the best measurements of the E-mode damping tail
  - New B-mode spectra from SPTpol coming soon!
- SPT3G is on sky with x10 more detectors
  - significant upgrade in sensitivity!

Neutrino mass

Credit: K. Aylor



Hubble constant tension



Credit: K. Aylor