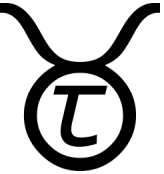


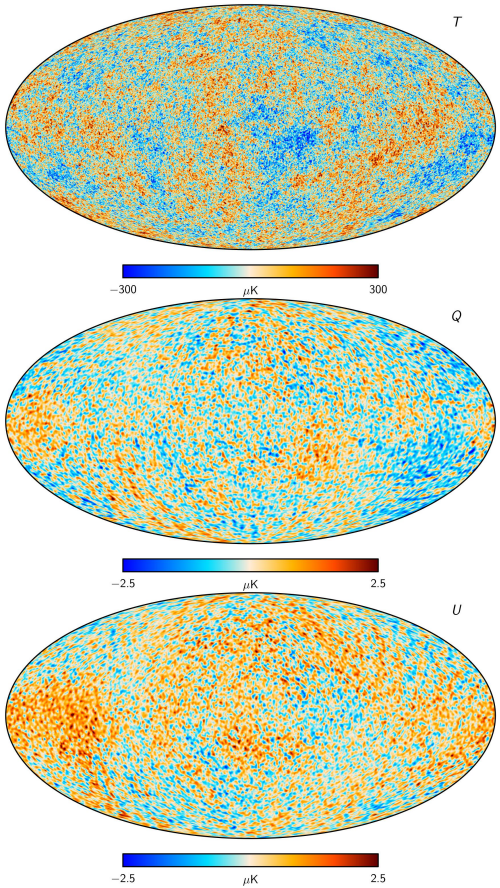
Stockholm University

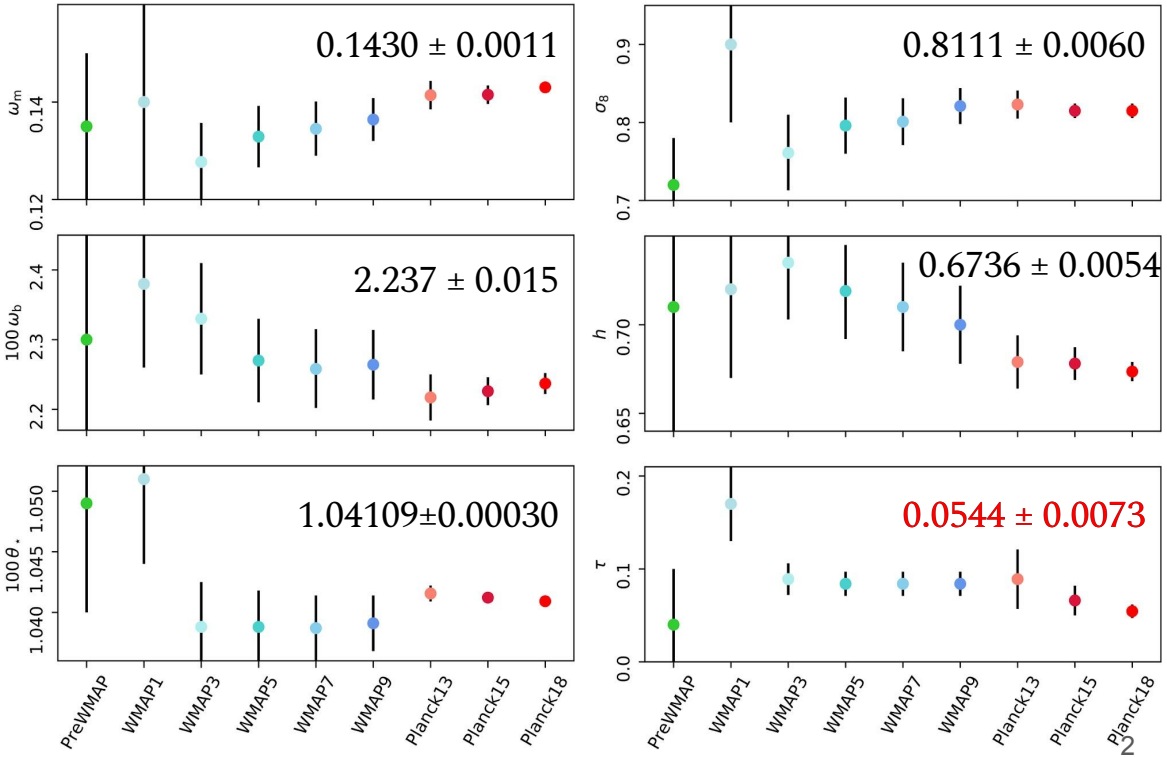
Oskar Klein centre

Taurus

Alexandre Adler, for the Taurus Collaboration

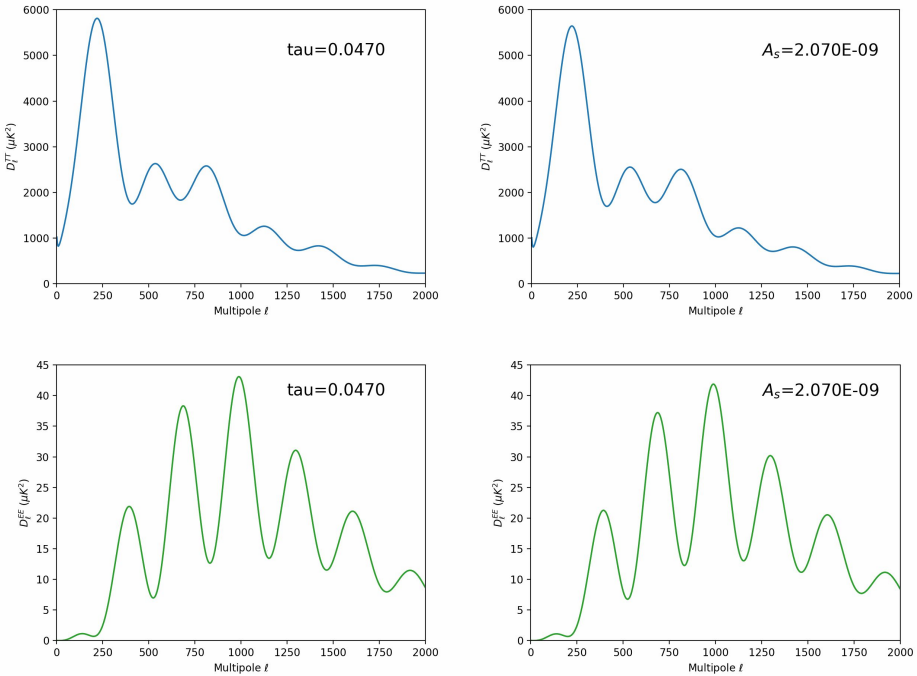
Planck's Precision



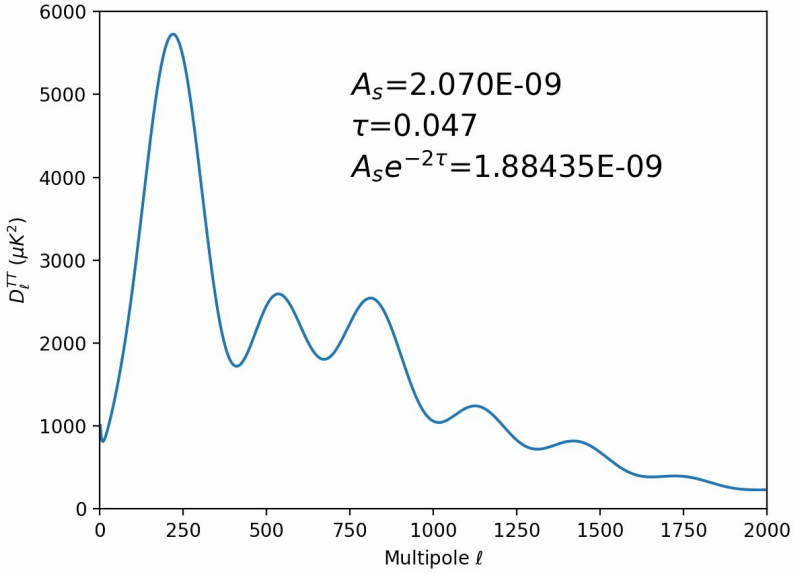


τ Trouble

The amplitude of fluctuations scales with A_s and τ

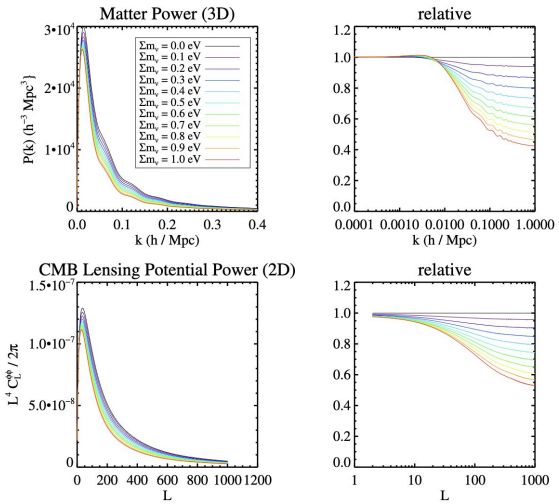


They are almost degenerate

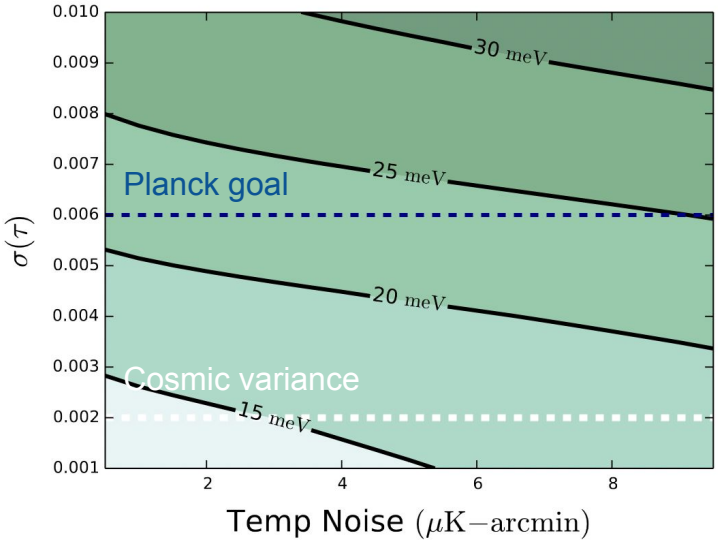


Neutrino Nuisance

Main obstacle to measuring sum of neutrino masses through their suppression of structure growth!



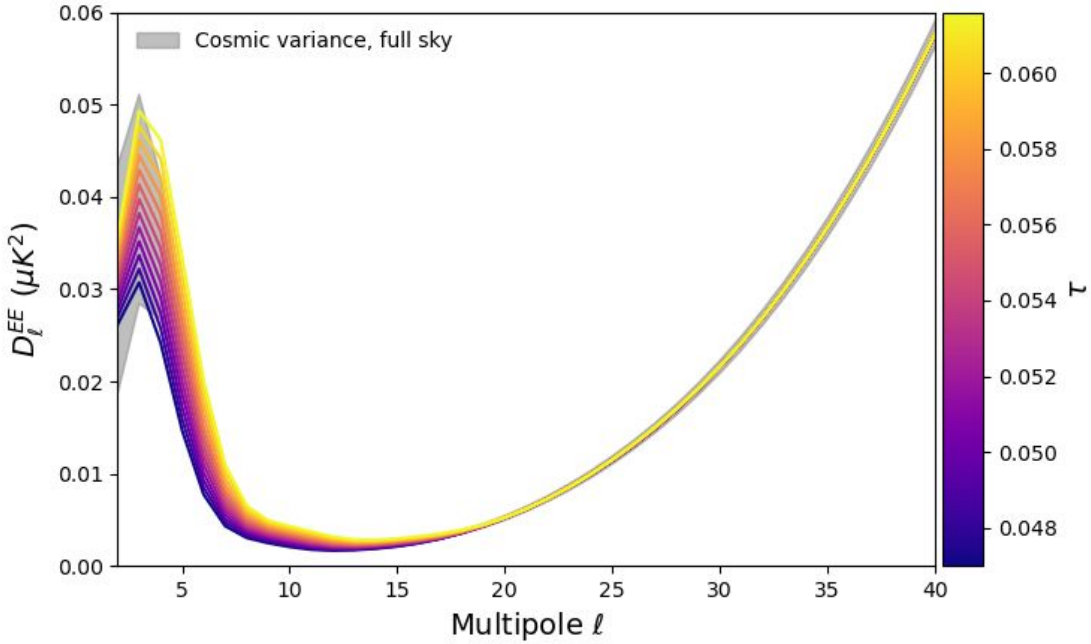
(CMB-S4 Science Book, 2016)



ibid.

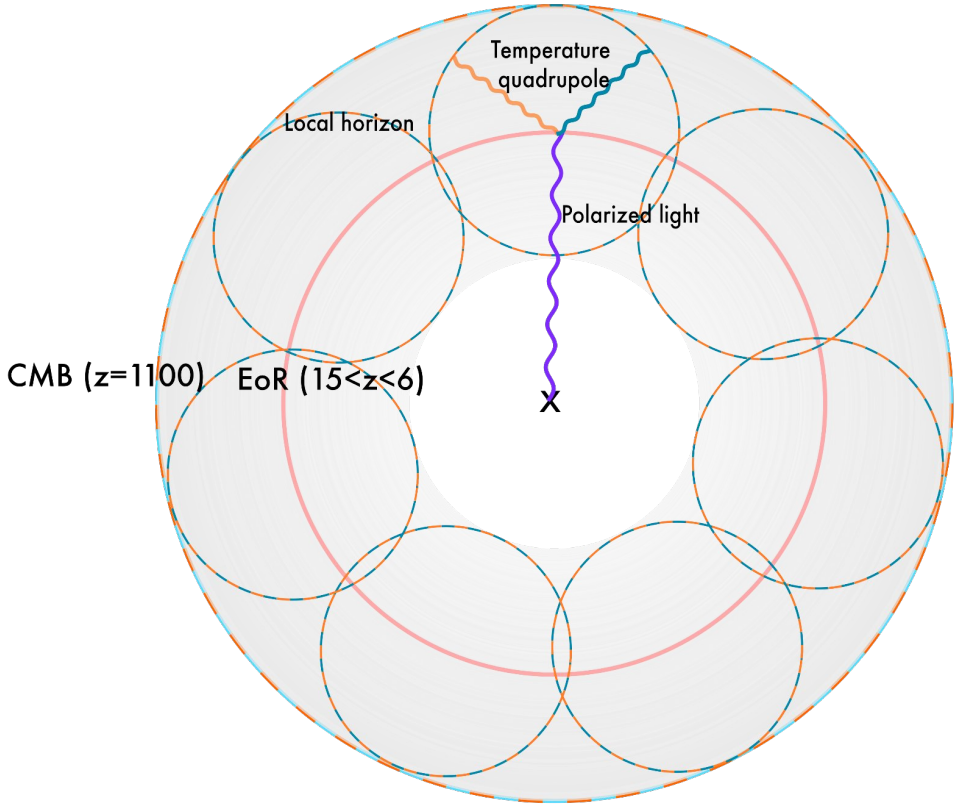
EE Excitement

The degeneracy is lifted at the very large angular scales: difference between models is smaller than cosmic variance up to l~20



Producing Polarisation

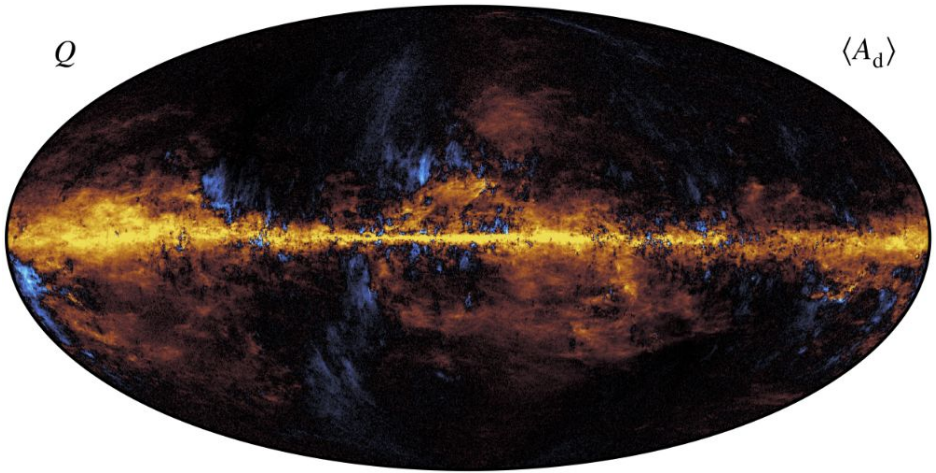
- The differential Thomson scattering cross-section is polarisation dependent
- Anisotropic radiation will produce a net polarisation
- Quadrupole -> Linear polarisation



Dust Disruption

Foregrounds are very bright, polarized, and have structure on large scales.

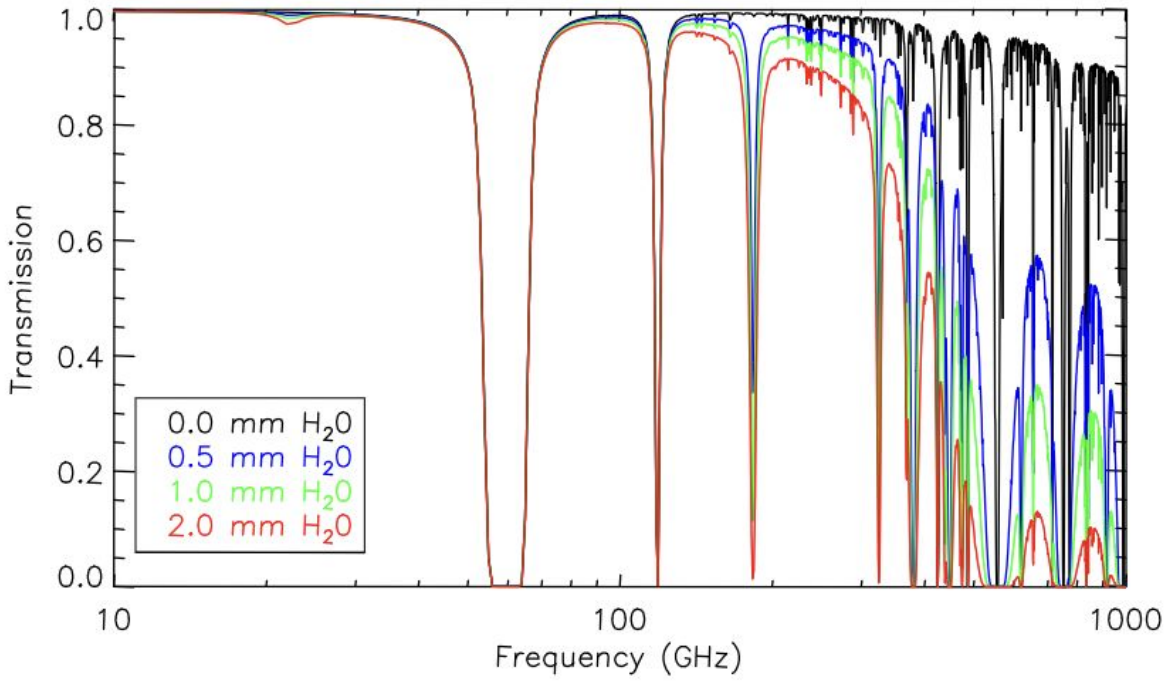
Cosmic variance scales as $1/f_{sky}$ so we can't just mask 90% of the sky.



Map of polarized thermal dust emission,
Beyond Planck XV, T. L. Svalheim et al. (2022)

Atmospheric Avoidance

The atmosphere absorbs due to water, CO, etc...

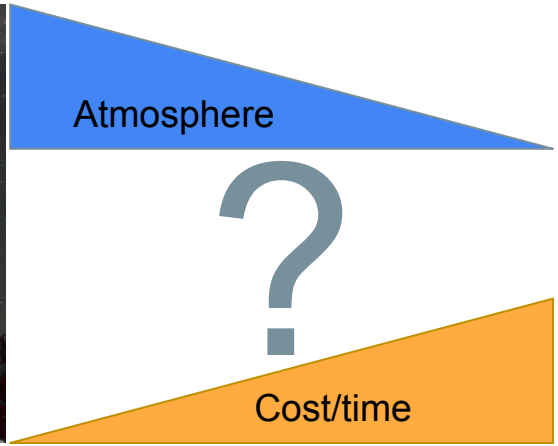


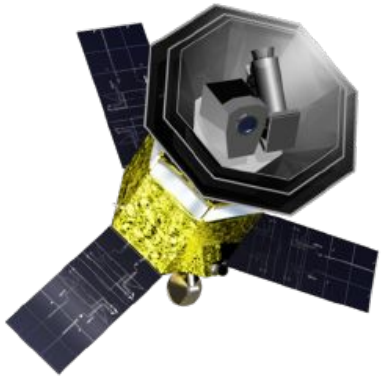
Simulations of atmospheric transmission from the Atacama desert. Errard et al. (2015)

Nominal Needs

An experiment with:

- Excellent sensitivity: many detectors that integrate for a long time
- Multiple frequency channels to disentangle foreground emission
- As large a sky coverage as possible



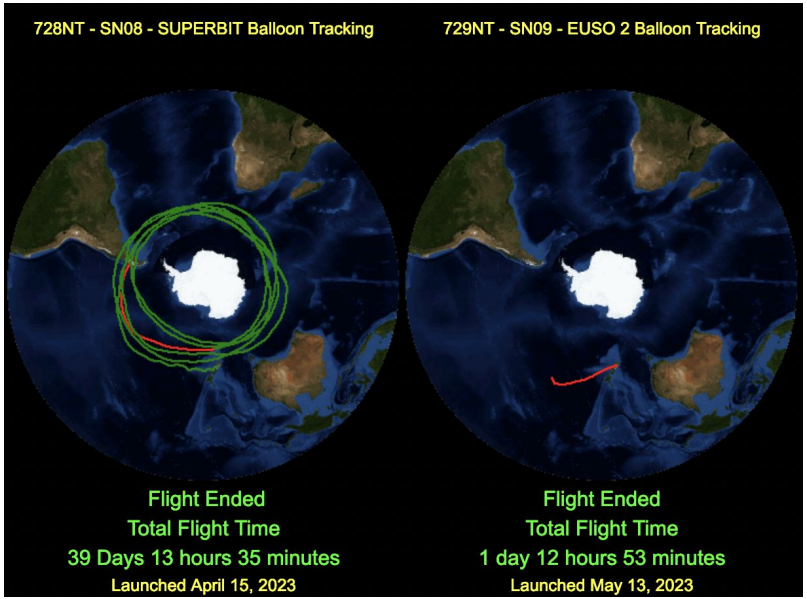


Blowing Balloons

Advantage over ground-based experiments: Very little atmosphere

Advantage over satellites: Much lower cost, newer tech

Inconvenients: Flying risk, limited mass, limited flight time, data recovery



Ballooning is a 50/50 proposal

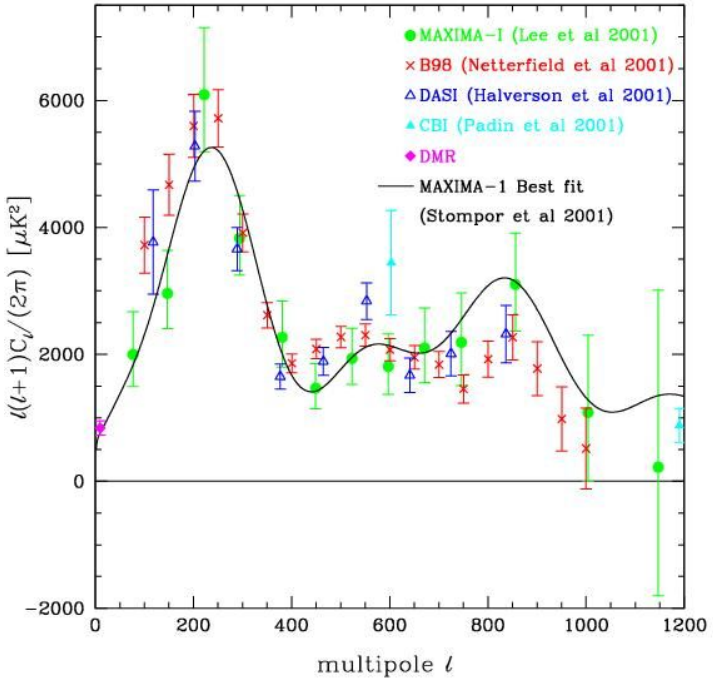
Cosmological Constraints

The first degree-scale CMB anisotropies came from balloons!

Boomerang (1998)

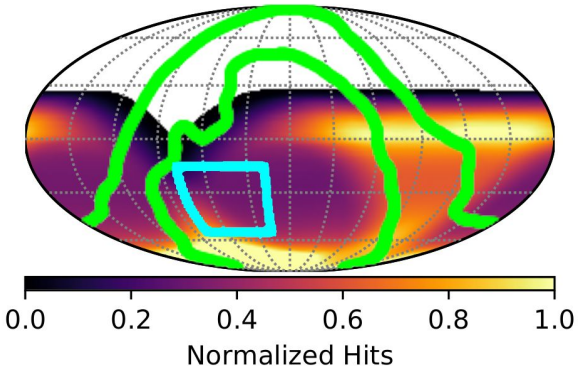
MAXIMA (1998-1999)

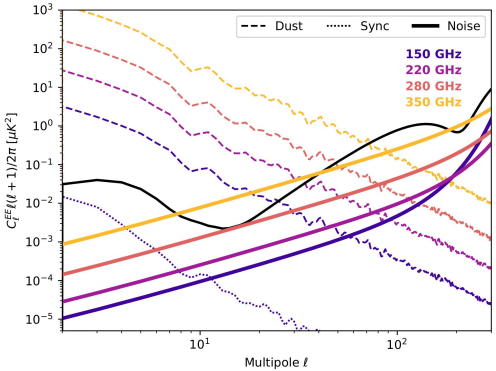
Archeops (2001-2002)

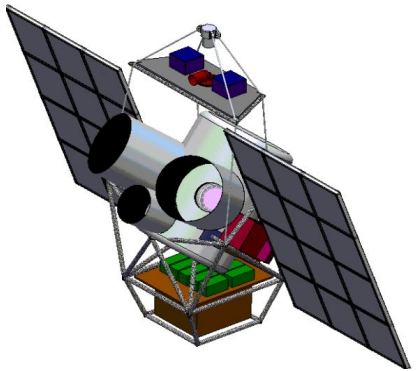


Taurus Time!

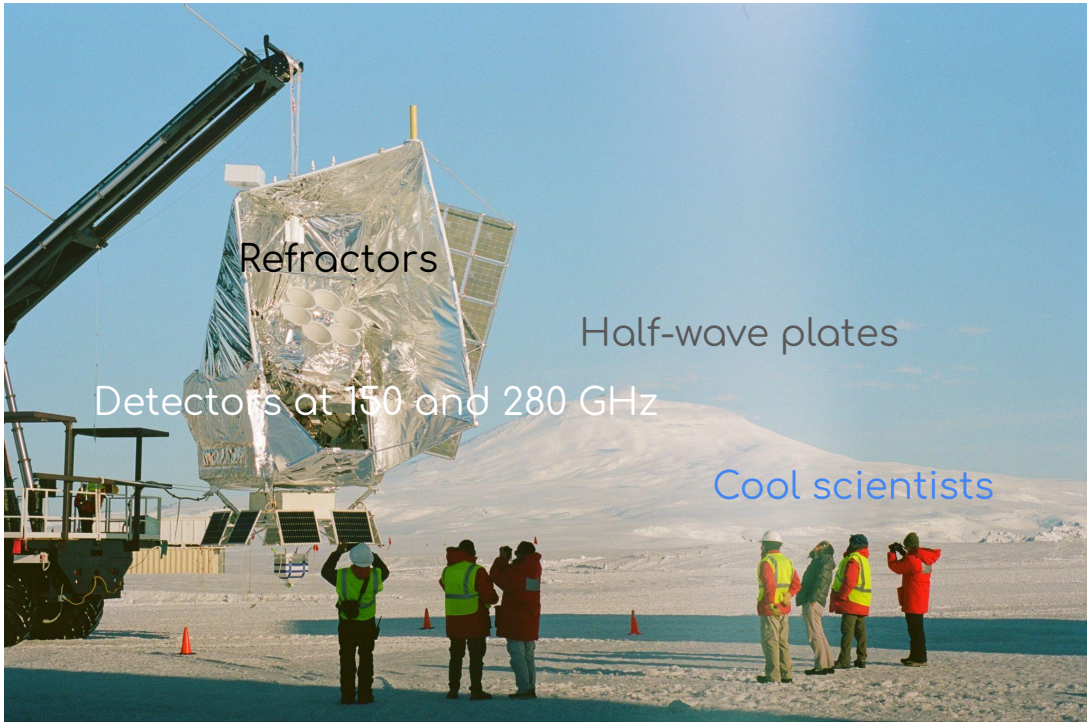
- Superpressure balloon flight: 30 days 35 km up
- Four frequency bands centred on 150, 220, 280 and 350 GHz to probe dust
- ~5000 detectors at 100 mK, each sensitive to two frequency bands
- Split between three refractors
- Scan at night, recharge during the day

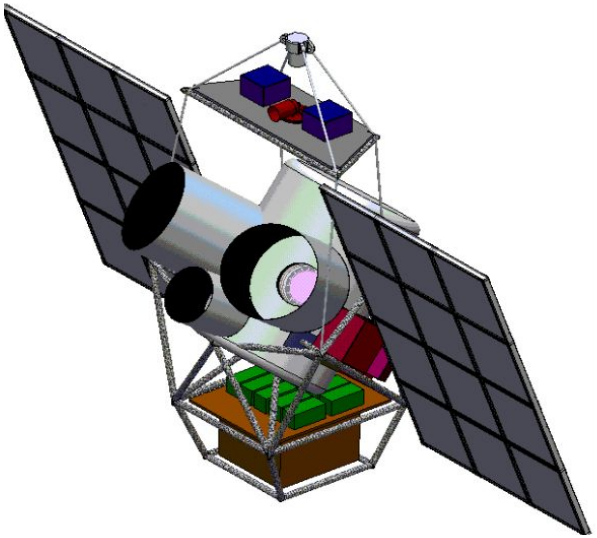






SPIDER's Sibling

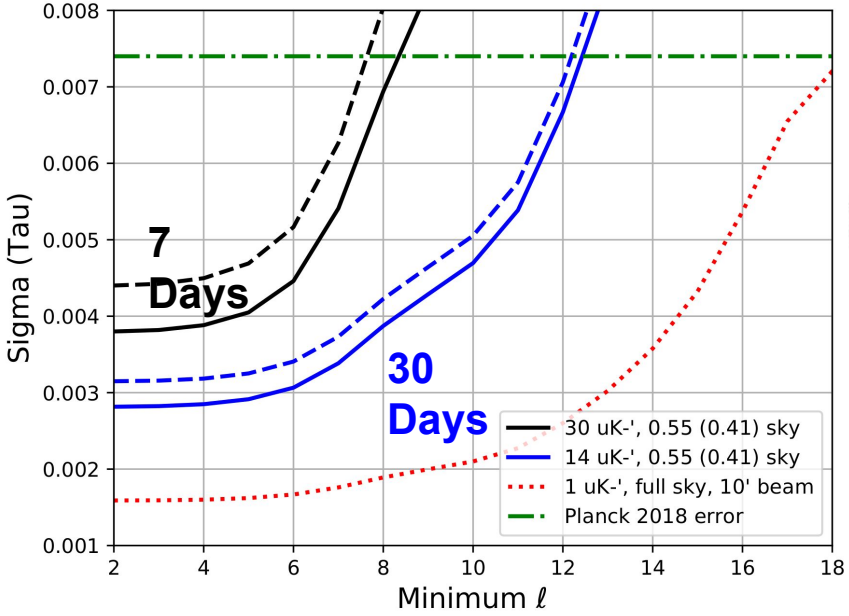


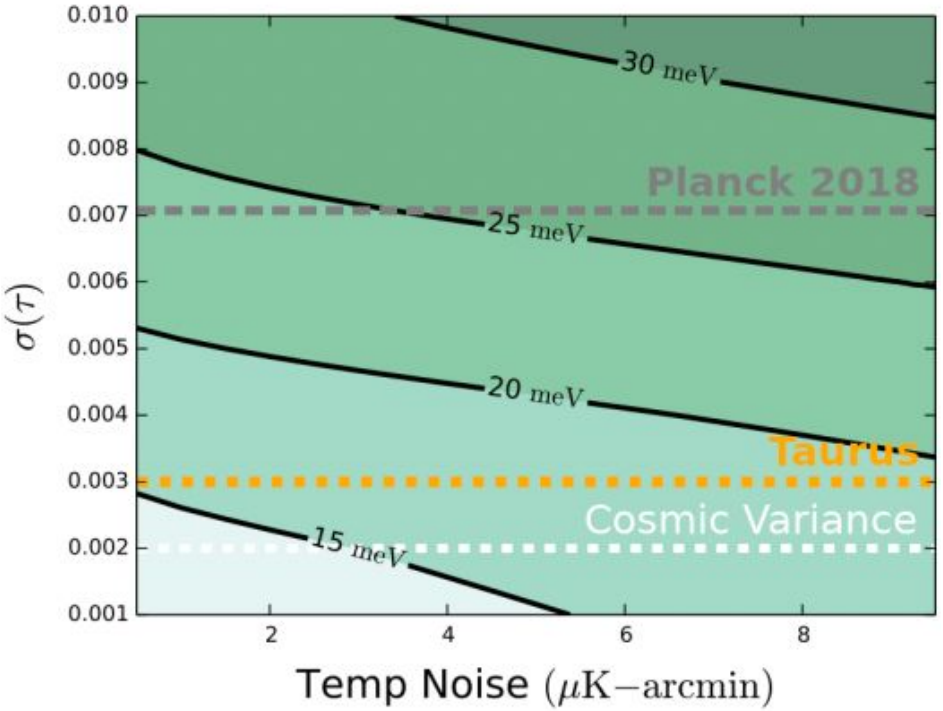


+depointing to help with scan-synchronous noise

+220, 350 GHz bands

Fiducial Forecast





Status

Ongoing design work: mechanical, optical, cryogenic

Cooling system testing soon

Detector manufacturing at NIST

Systematics simulations

We aim to fly from New Zealand in 2026!