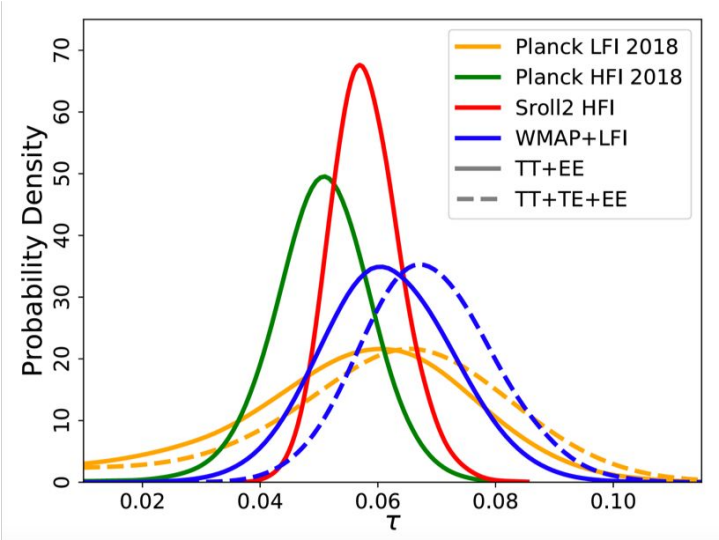
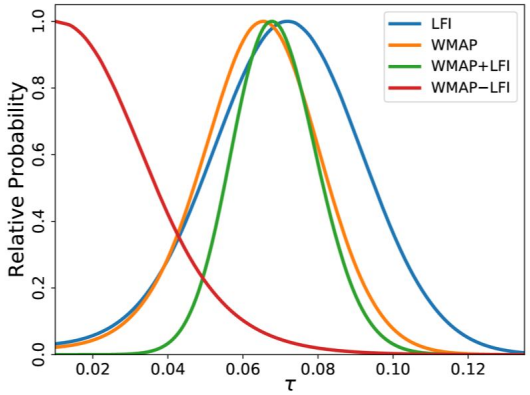
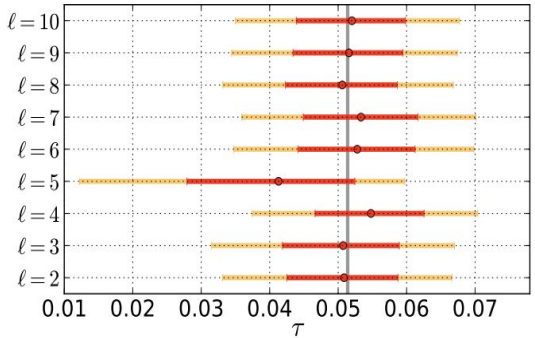
Targeting New Measurements (biased review)

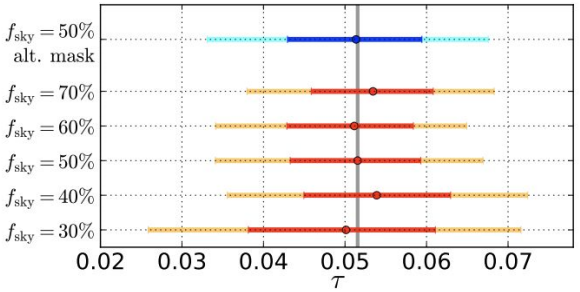
τ measurements from polarization challenging but…

Natale et al. 2023, Planck 2018 results V.









τ = 0.0544±0.0073 (Planck 2018)

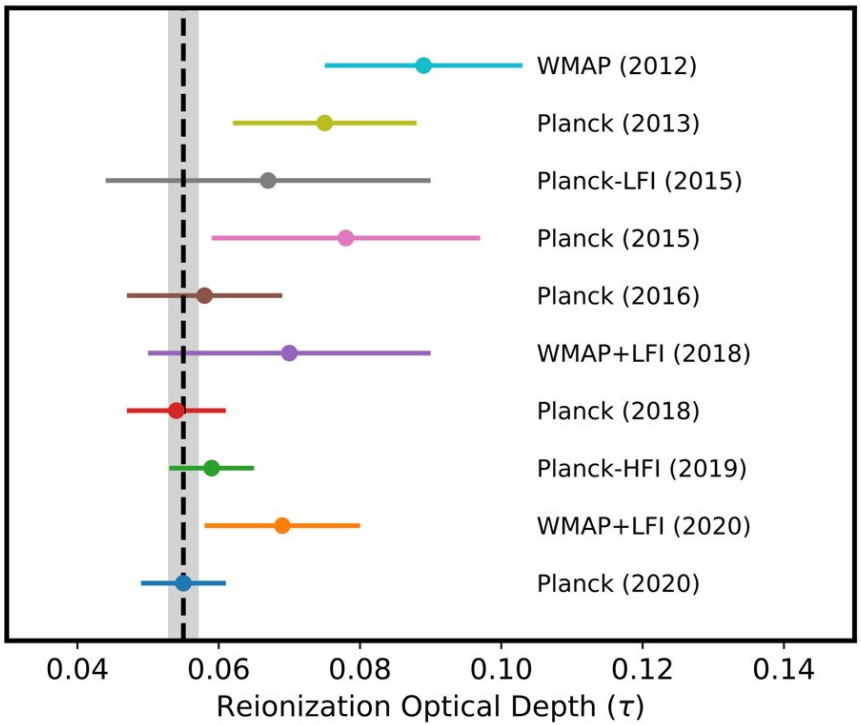
…

τ = 0.066 ± 0.013 (BeyondPlanck, WMAP+LFI)

τ = 0.053 ± 0.018 (Li+2025, CLASS x Planck)

Waiting for signal dominated τ measurement..

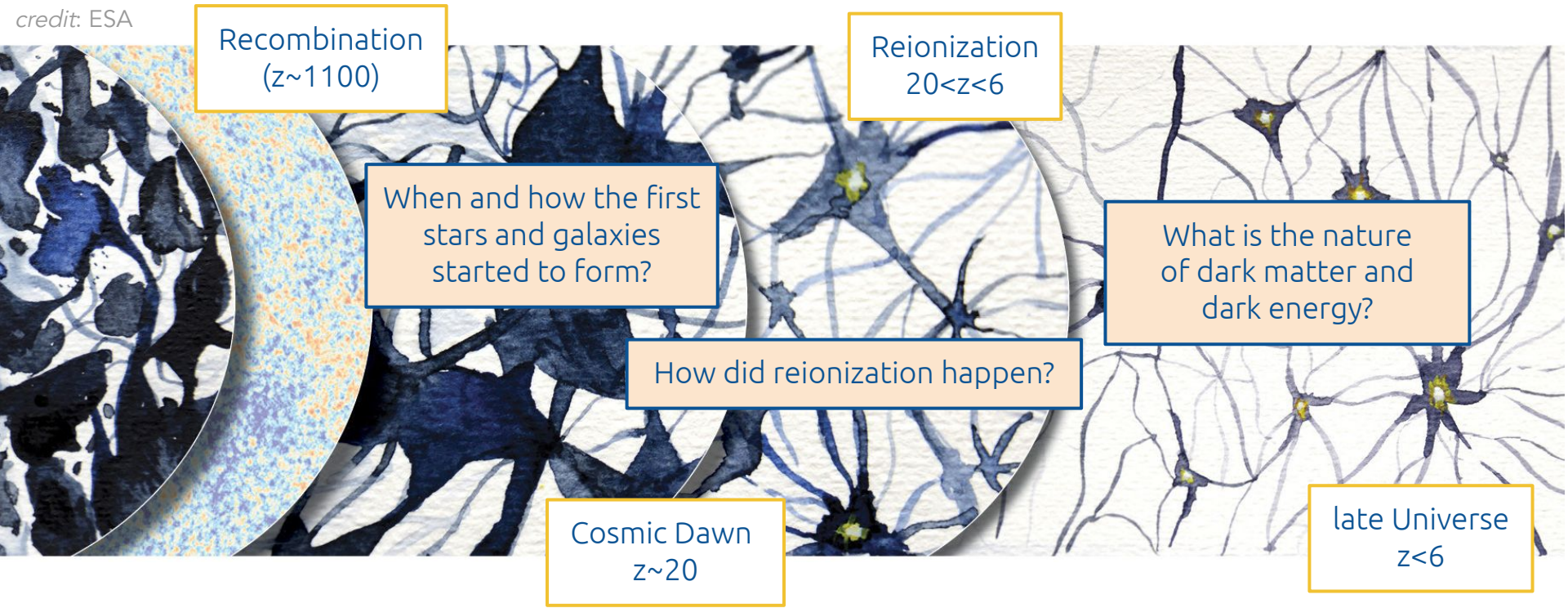
LiteBIRD Coll. PTEP 2023

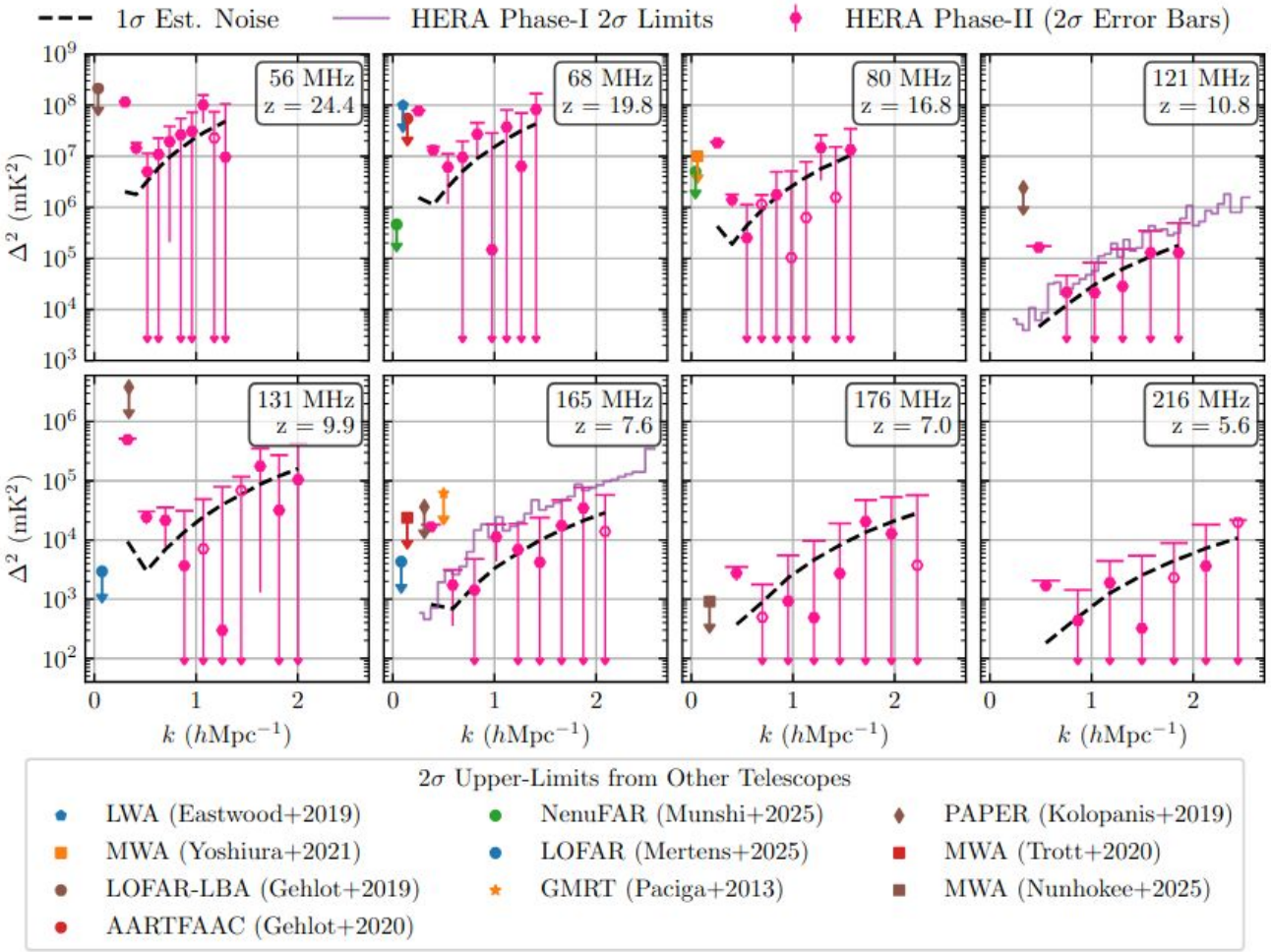


..will be learning about EoR

- kSZ
- JWST, Euclid, …
-

Hydrogen in cosmic history



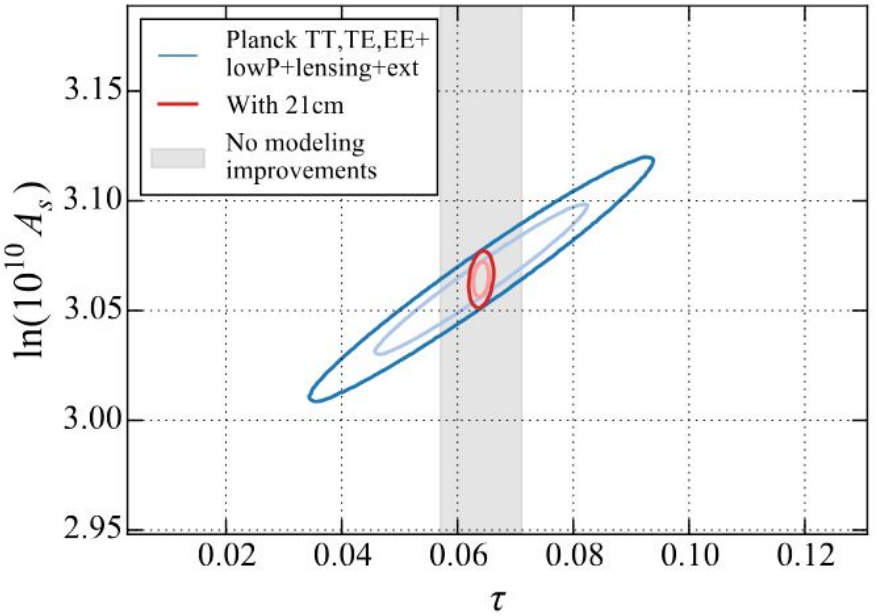


Abdurashidova et al. 2026

21cm constraints on τ

(non exhaustive list)

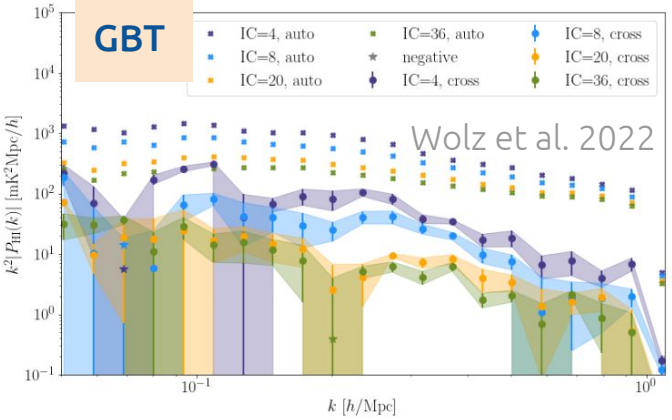
- 21cm ps to predict τ
  could also use global signal
  (even more difficult/controversial)
  Liu et al. 2016

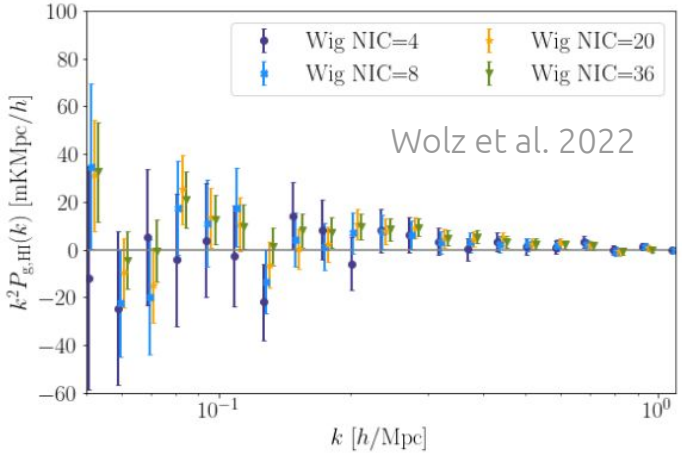


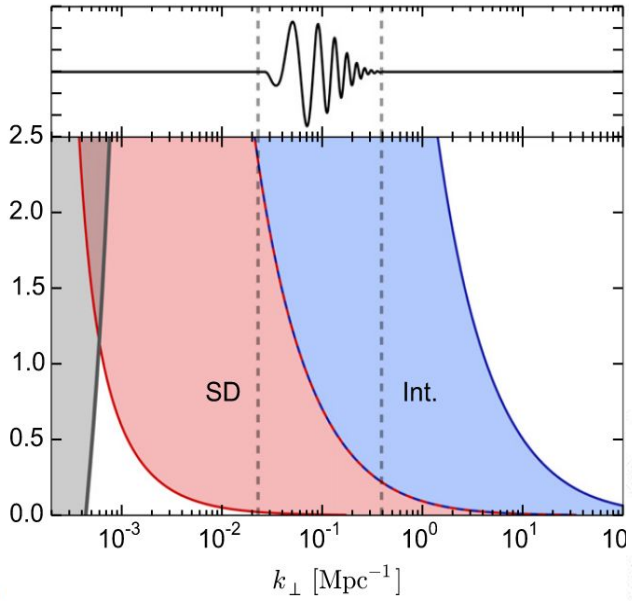
- CNN constraints on τ with a fractional error of 3.06% or better *Billings et al. 2021*
- scaled up version of HERA: στ = 0.002 − 0.004. SKA-like survey στ = 0.0009 (assuming a 5 − 10 year integration time, no improvement over Planck with only ~ 1000 hours) *Sailer et al. 2022*
- …

Single Dish vs Interferometry

GBT

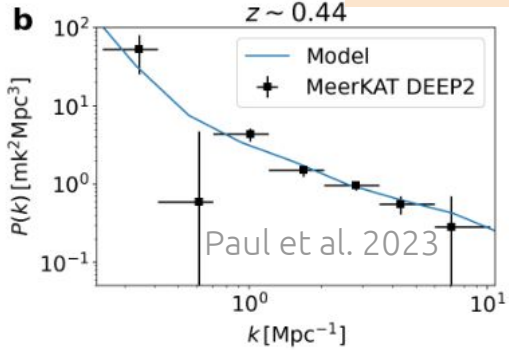


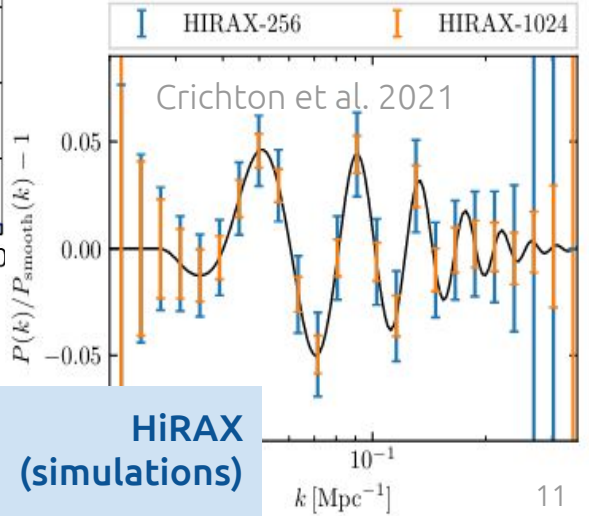




Bull et al. 2015

MeerKAT





HiRAX (simulations)

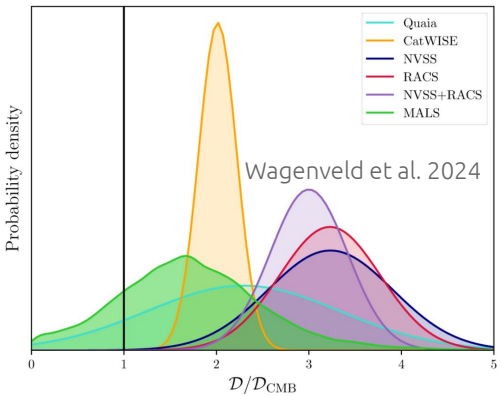
Radio Cosmology

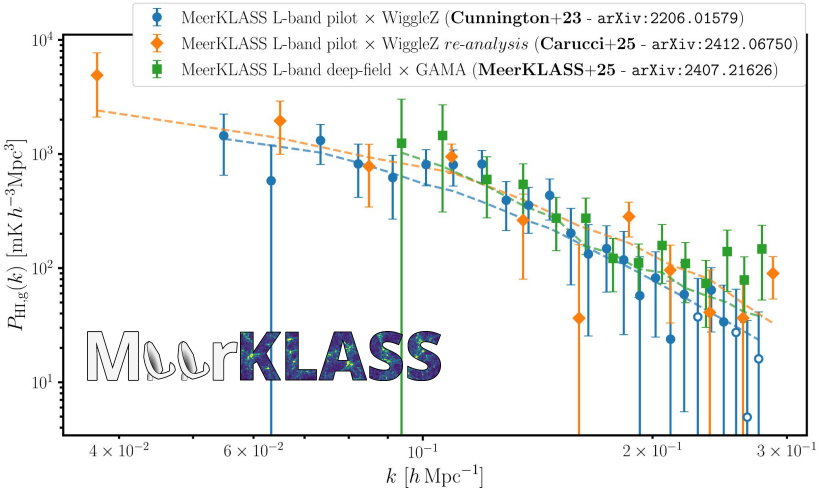
Study the large-scale evolution of the Universe. Is the cosmological model valid? What is the nature of dark matter and dark energy?

Large-scale studies from 21cm Intensity Mapping and Continuum, Dipole, Weak Lensing, primordial non-gaussianity, **FRBs, Dark Matter**, …

continuum clustering - RACS, EMU and LoTSS, cross-correlations with CMB lensing and galaxy surveys, constraining cosmology, leading the way to the SKAO

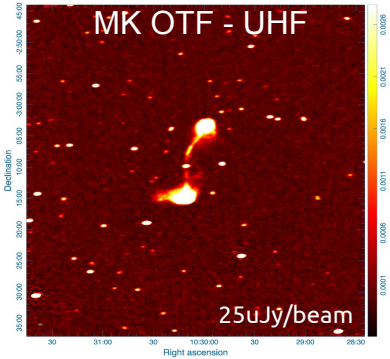
wide area surveys allow to probe cosmic rest frame - **dipole rIddle** (5.4 σ)





latest entries in the Cosmology SWG

On-the-fly mapping (OTF) continuum images from fast-scanning MeerKLASS observation. **Allows a high-impact early science result for SKAO.**



Single-dish 21cm Intensity Mapping was an idea 10 years ago, it is now one of the largest observing campaigns for MeerKAT. **Detection of the signal on cosmological scales at z~0.4**

Is radio cosmology in the era of precision cosmology?

- Radio Frequency Interference (will get worse and worse)
- Foreground models/cleaning (not as robust as for CMB/ much more difficult)
- Do we know our technology enough?

  Single dish: beam chromaticity, far sidelobes, soil contamination, standing waves, not yet characterized in detail

  Interferometry: cross-coupling, DD calibration effects, …

Yesterday: quite a number of effects becoming detectable and compelling astro / cosmo probes. **Anything missing?**

Has the time for spectral distortions finally come?

- TMS, COSMO, Bisou, Fossil, …