

# Gravitational-Wave Primordial Cosmology workshop

virtually at Institut d'Astrophysique de Paris  
May 17-19 2021

**Guided discussion**



European Research Council  
Established by the European Commission

**GEODESI**



Thanks to all speakers and participants!

Lots of discussions,  
we hope you enjoyed the workshop

Slides are online  
Videos will be

## From presentation of workshop:

It also aims at collectively identifying important open questions and assessing the potential of discovery of gravitational wave astronomy for primordial cosmology.

GWs are here to stay.

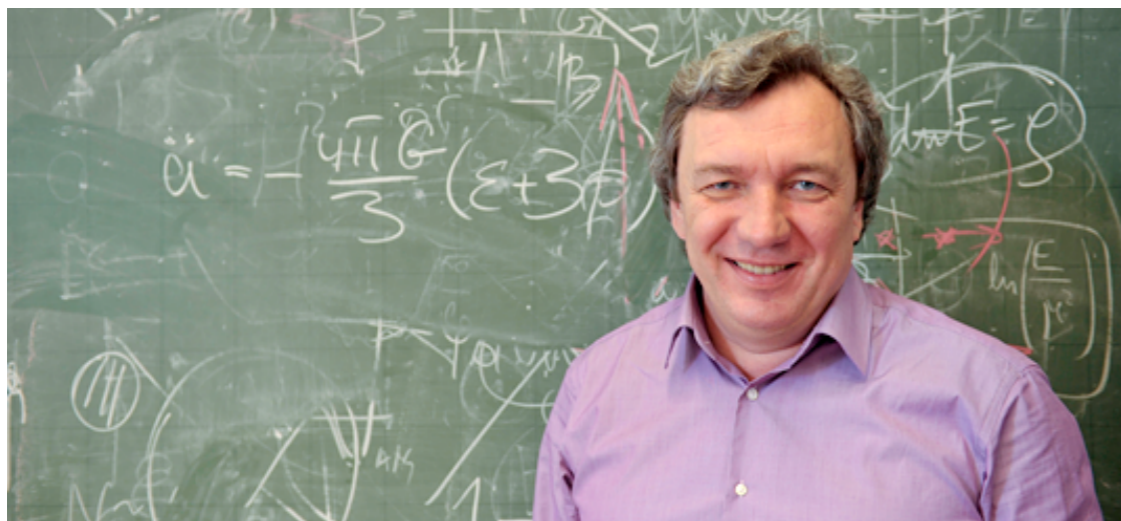
LISA is in our minds and extremely important,  
but ~ 10 years is tomorrow

“Forget about observability.  
**If the physics is beautiful, it is worth doing!”**

credit Komatsu

# ***Lessons from the past***

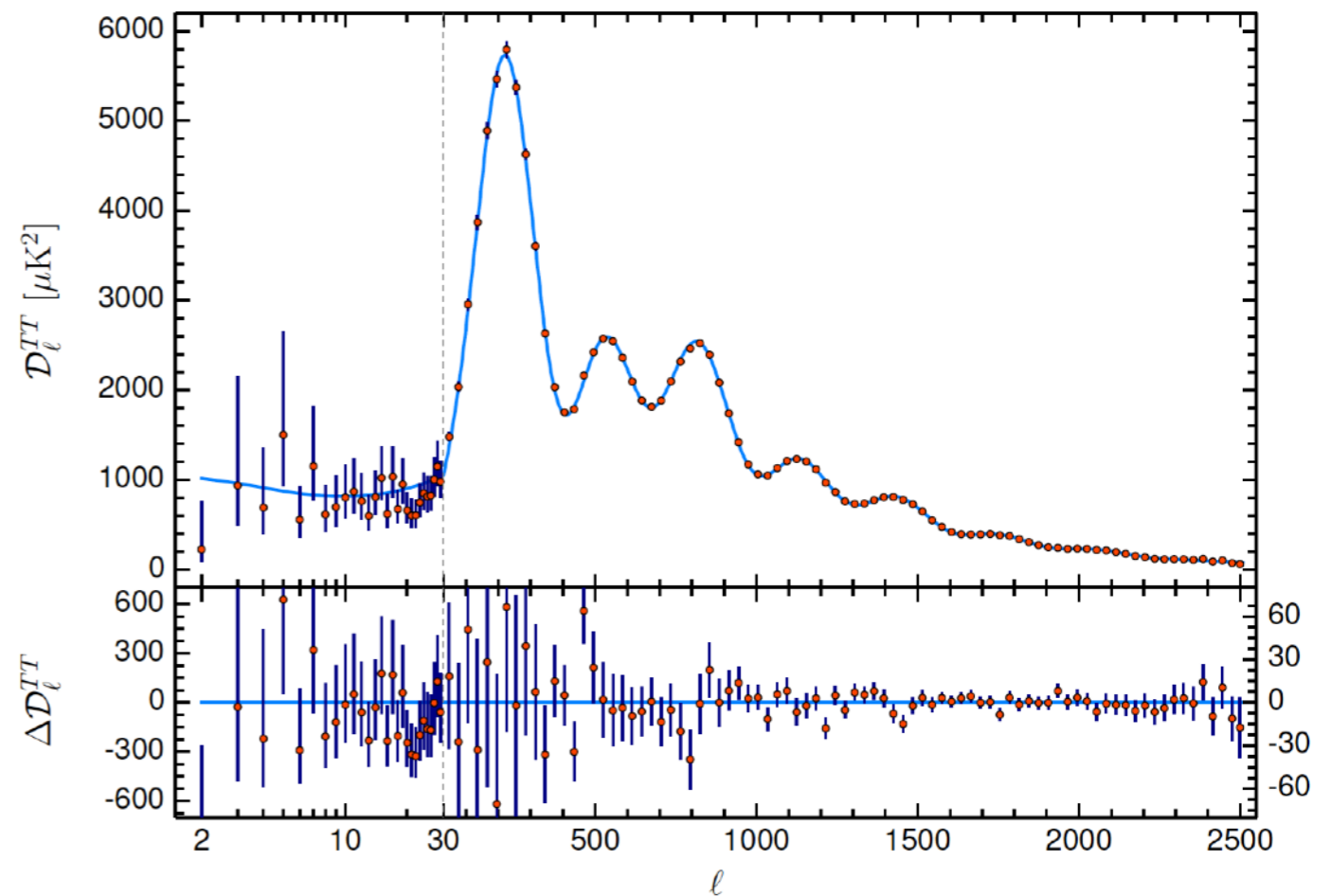
- Slava Mukhanov:
  - “I thought that it would take 1000 years to detect the logarithmic dependence of the power spectrum.”



$$\mathbf{n_s = 0.9649 \pm 0.0042}$$

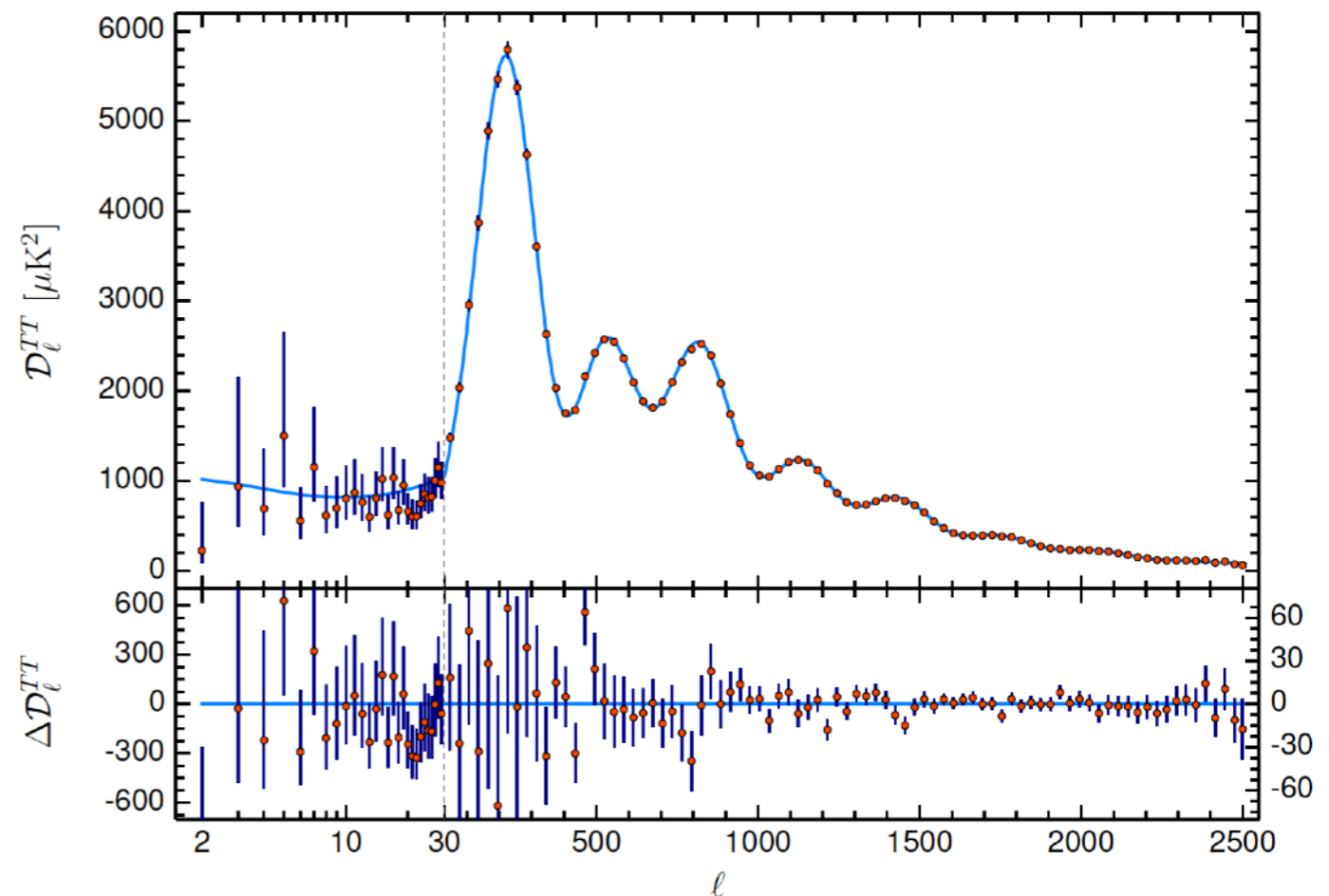
# Lessons from the past

- Rashid Sunyaev:
  - “I did not think that the acoustic oscillation would ever be observed.”



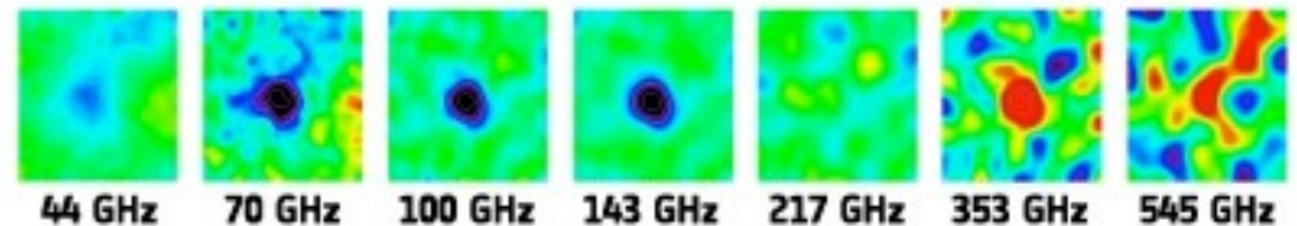
# Lessons from the past

- Jim Peebles (Annu. Rev.Astro.Astrophys. 2012):
  - “I did not continue with (computation of CMB), in part because I had trouble imagining that such tiny disturbances to the CMB could be detected...”



# *Lessons from the past*

- Yakov Zel'dovich:
  - “(Speaking to Sunyaev about the Sunyaev-Zel'dovich effect:) This is a small effect, but the physics is beautiful. Let's publish it.”



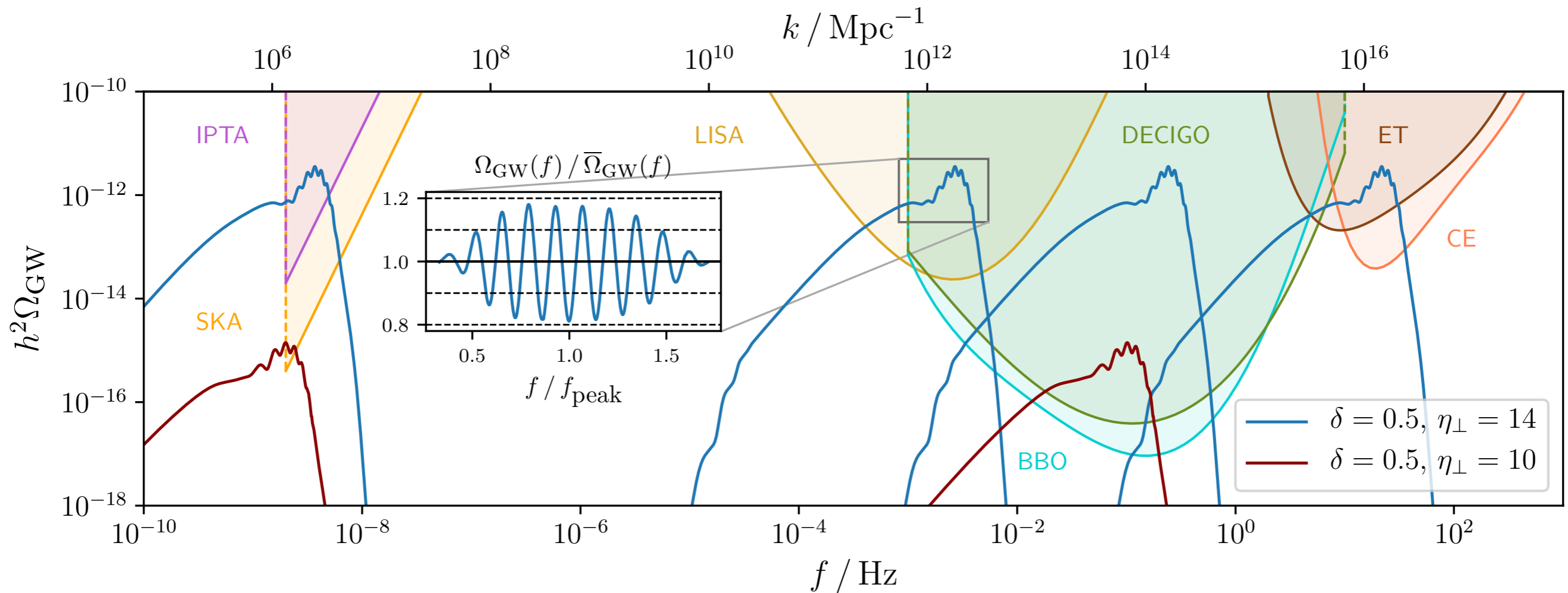
## ***Lessons from the past***

If experimentalists are convinced that it is worth measuring, they will get there much sooner than theorists think

Theorist's job is to **identify things that are worth measuring**, no matter how small this is judged today



# Biased example



Linear oscillations in frequency profile:  
evidence of sharp feature and when during inflation

Fumagalli, Renaux-Petel, Witkowski (2020,2021)  
Braglia, Chen, Hazra (2020)

# ***Primordial dark ages***

Scientific case for different physics in dark ages  
of inflation (eta problem)

“It is speculative, can be anything”

- PBH were considered speculative, less now.  
Who knows what GW observatories will detect in next 30 years?
- Not anything goes: theoretical consistency, naturalness ...

Provide theoretically motivated targets for experimentalists to go there

Efforts needed in: production / propagation / detection