Introduction to CMB sessions at COSPAR

Graça Rocha

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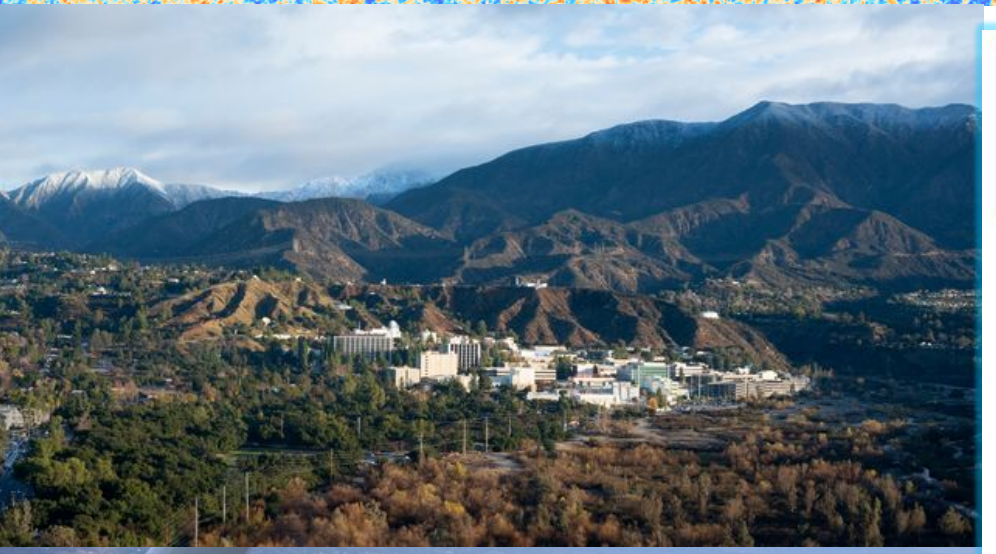
on behalf of the Planck Collaboration

WELCOME!

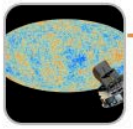


COSMOLOGY

2018 Gruber Cosmology Prize

Detailed information on the 2018 Gruber Cosmology Prize is forthcoming

"The Planck project has made definitive measurements of the properties of our expanding universe. This stunning achievement was the result of a large group effort, and we are pleased to recognize both the Planck team as a whole and its principal science team leaders." Says Robert Kennicutt, University of Arizona, Chair of the Selection Advisory Board to the Prize



Planck Team

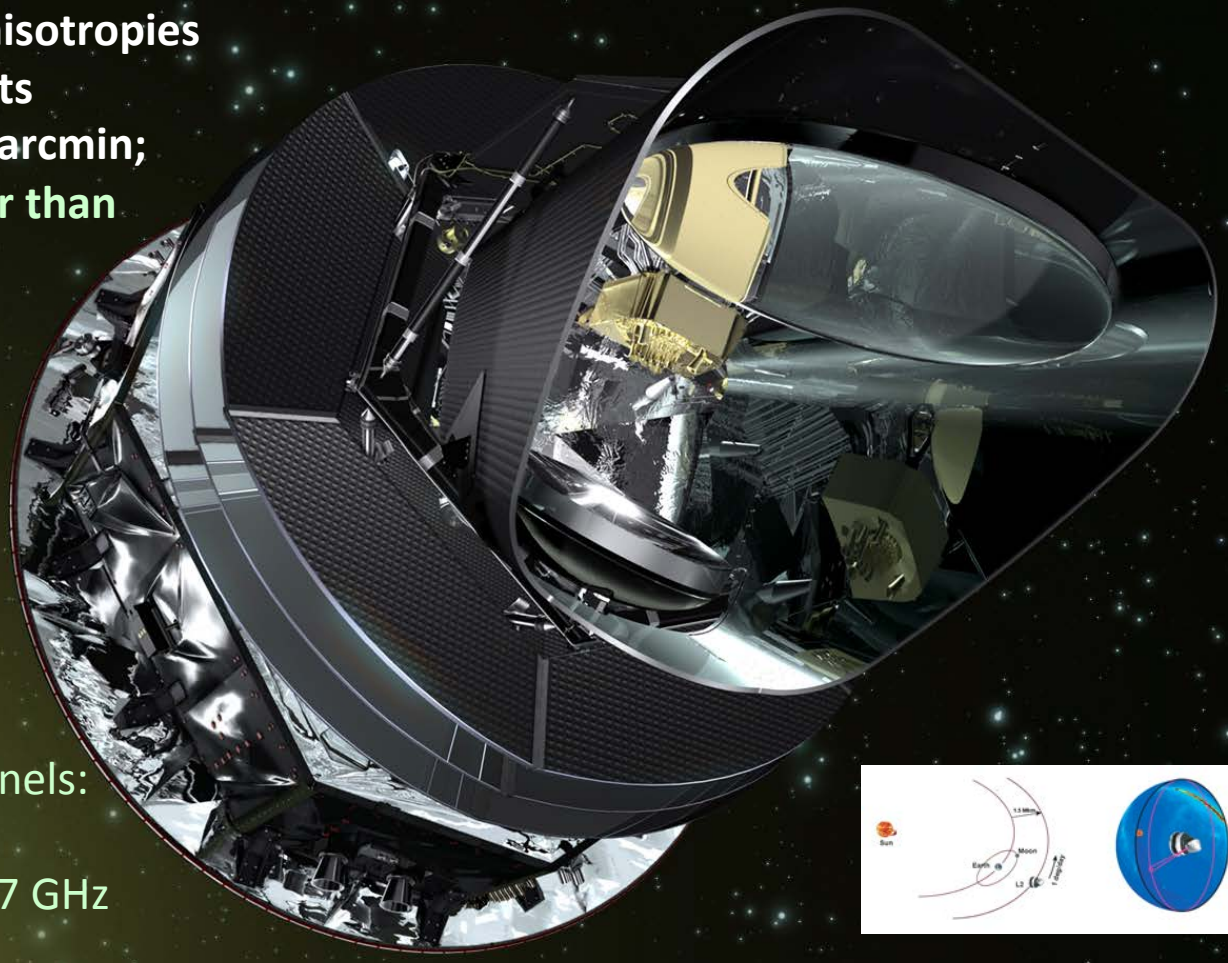
Nazzareno Mandolesi

Jean-Loup Puget

Planck team receives Gruber Cosmology prize for Precise Measure of the Universe's Contents and Contours.

✧ Primary scientific goal:

To measure the temperature anisotropies of the CMB to fundamental limits down to angular resolution of 5arcmin; also measure polarization better than ever before



✧ Fly at Sun-Earth **L2** point

✧ Use 4-stage cooling system

✧ Carry two instruments:

- Low Frequency Instrument (LFI), 20-K cryogenic amplifiers
- High Frequency Instrument (HFI), 0.1-K bolometers

✧ Observe at 9 frequency channels:

LFI - 30, 44, 70 GHz, and

HFI - 100, 143, 217, 353, 545, 857 GHz

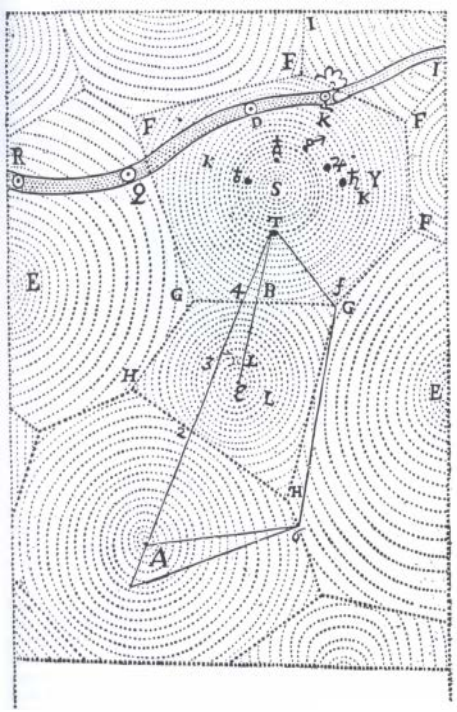
to deal with foregrounds

Planck is the 3rd Generation Space CMB Mission

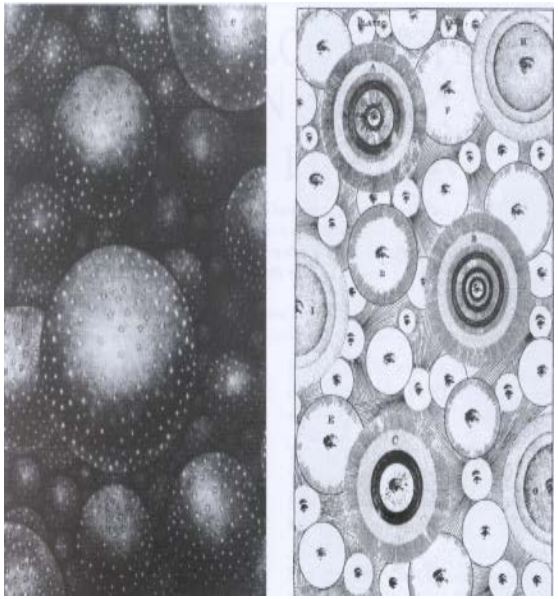
- Formally: "ESA mission with significant participation of NASA"
- Translation: thermal design, sorption coolers, all bolometers, delivery of ERCSC, supercomputing support, expertise and participation in data analysis, and science

Cosmology: the Journey

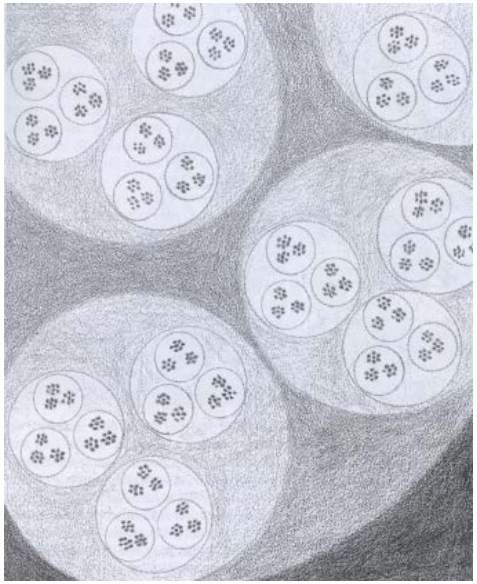
From early speculations without quantitative observational support



Descartes *The World*
1636



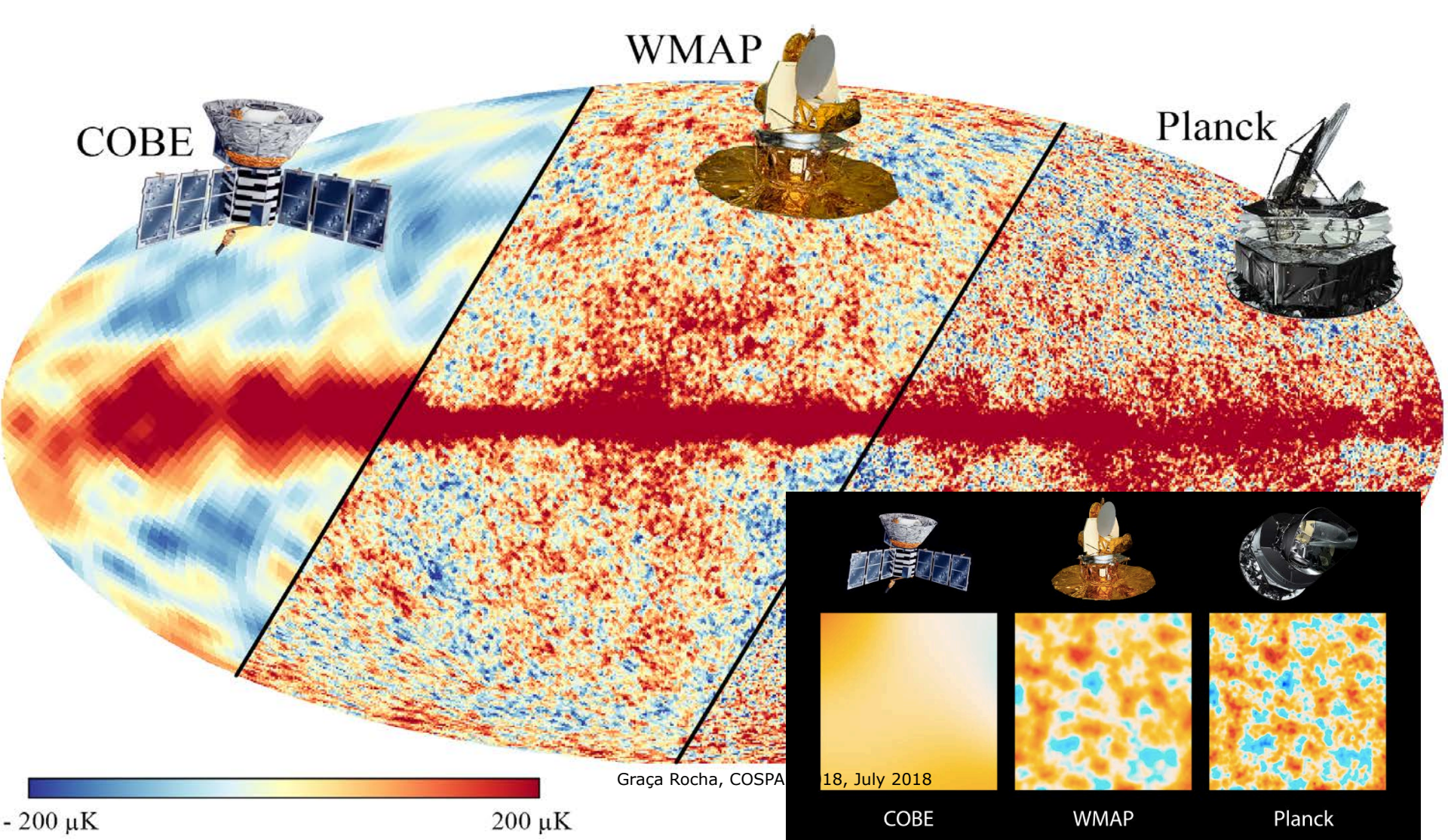
Wright *An Original Theory of the Universe*
1750



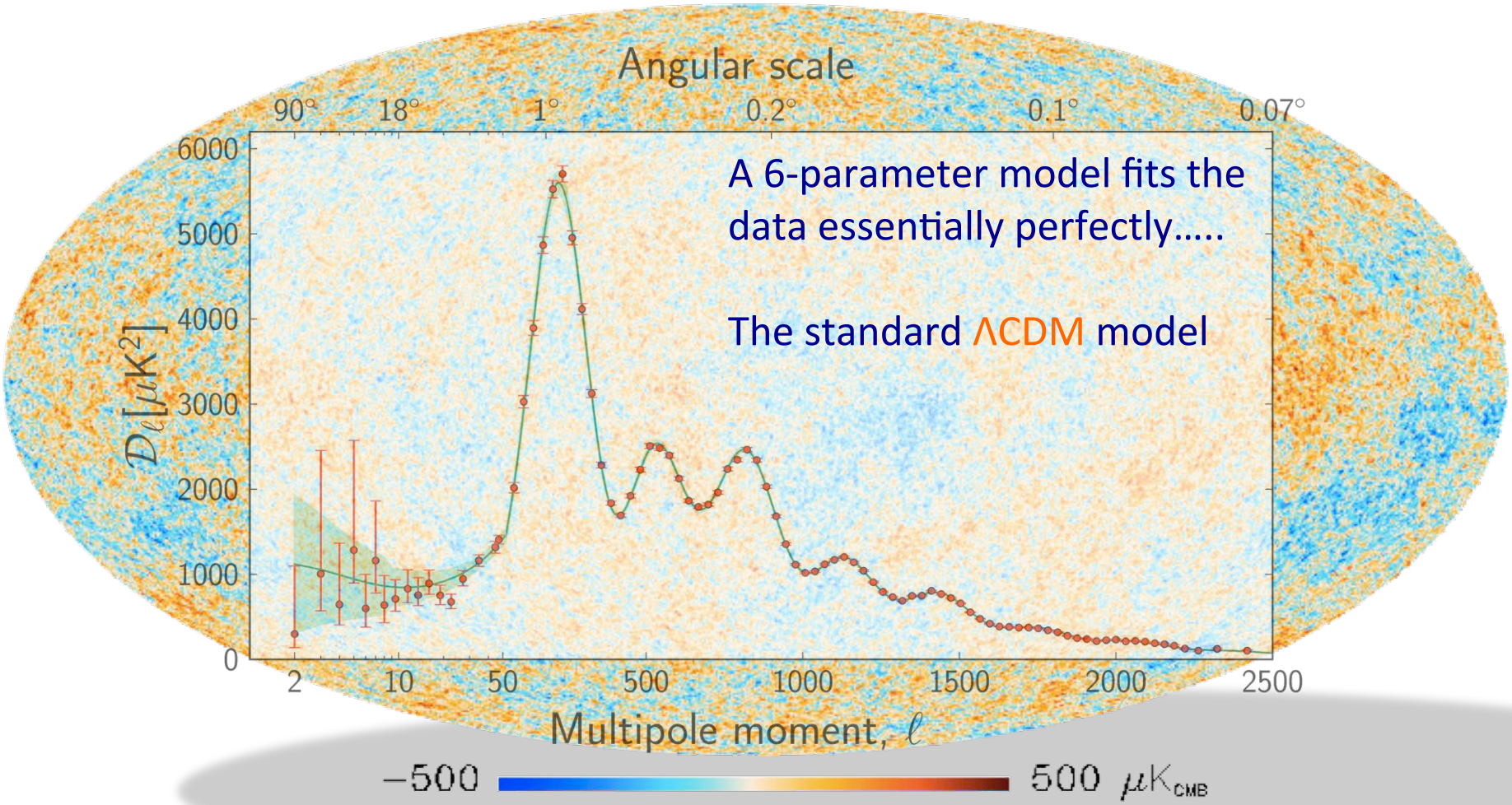
The hierarchical (fractal) Universe of Kant (1755) and Lambert
1761

Cosmology: the Journey

To the era of Precision Cosmology with observations of the CMB



Planck initial scientific results March 2013

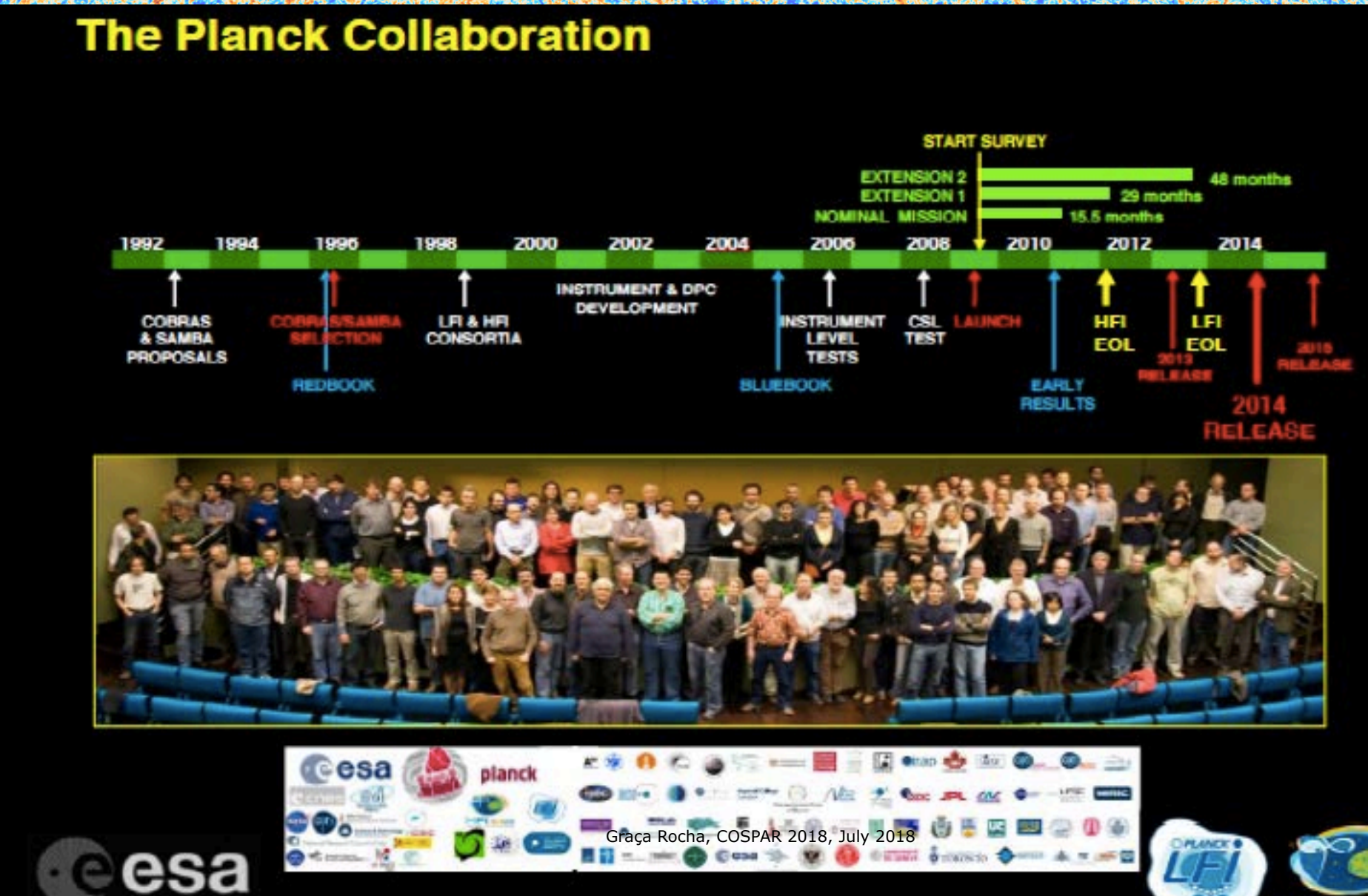


The launch
14th May 2009, 13:12:02 UT

Graça Rocha, COSPAR 2018, July 2018

Kourou, French Guyana, May 14, '09, 10.12am
LAUNCH!

Next: the hard work of data analysis…. Core team meetings



47th ESLAB SYMPOSIUM
The Universe as seen by Planck
2-5 April 2013

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The initial scientific results from the Planck mission

Today

A new and improved version of the Planck data has been released on July 17, 2018

The final official release from Planck

New scientific results based on this data are described in a set of papers that will be presented here in the session:

The Legacy of Planck mission

CMB – what's next?

Our picture of the Cosmos is not complete yet…..

There are still puzzles to solve: anomalies at large angular scales, tensions on cosmological parameters, eg. H_0, …….

Inflation models predict a significant stochastic background of gravitational waves that should have left a faint polarized CMB signal

Currently joint analysis of Planck/BICEP/Keck only places limits on the amplitude of these signals

A detection of this gravity wave so-called B-mode signature would reveal fundamental physics at energy scales inaccessible to any terrestrial laboratory

Efforts are on their way!

The future of CMB exploration

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Second part of this CMB session will give us an overview of the status of

The future of CMB exploration

Why the quest for B modes?

What are the main stumbling blocks? Foregrounds, systematics,..

CMB in the pursuit of the footprint of Inflation:

LITEBIRD, PICO, PIXIE, BICEP, POLARBEAR, SPT, CMB-S4…

Foregrounds:

PILOT, PASIPHAE..

esa

NASA

PLANCK LFI

HFI PLANCK

The Legacy of Planck

The scientific results that we present today are a product of the Planck Collaboration, including individuals from more than 100 scientific institutes in Europe, the USA and Canada

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Planck is a project of the European Space Agency, with instruments provided by two scientific Consortia funded by ESA member states (in particular the lead countries: France and Italy) with contributions from NASA (USA), and telescope reflectors provided in a collaboration between ESA and a scientific Consortium led and funded by Denmark.