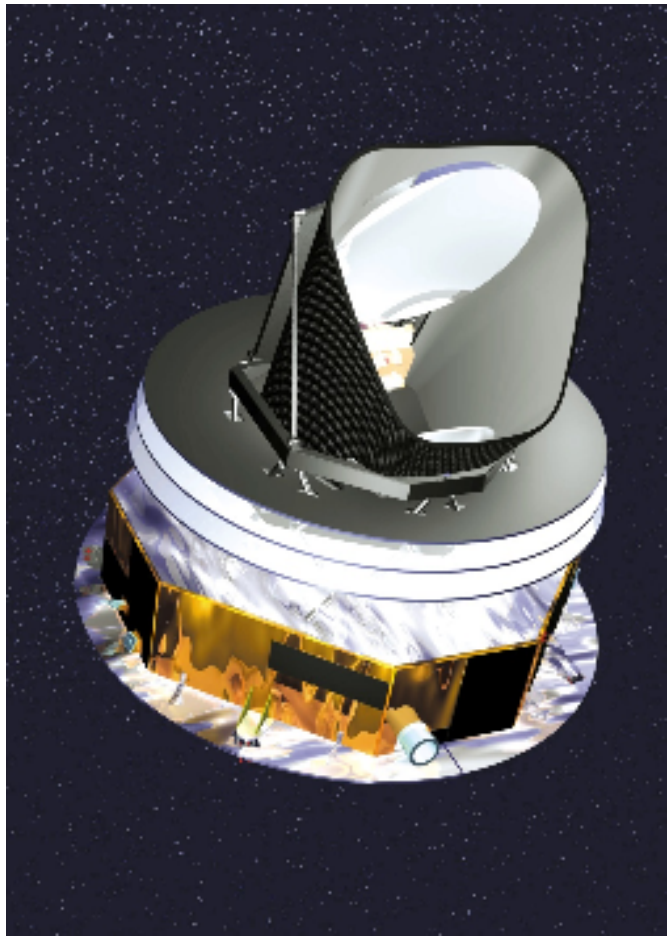
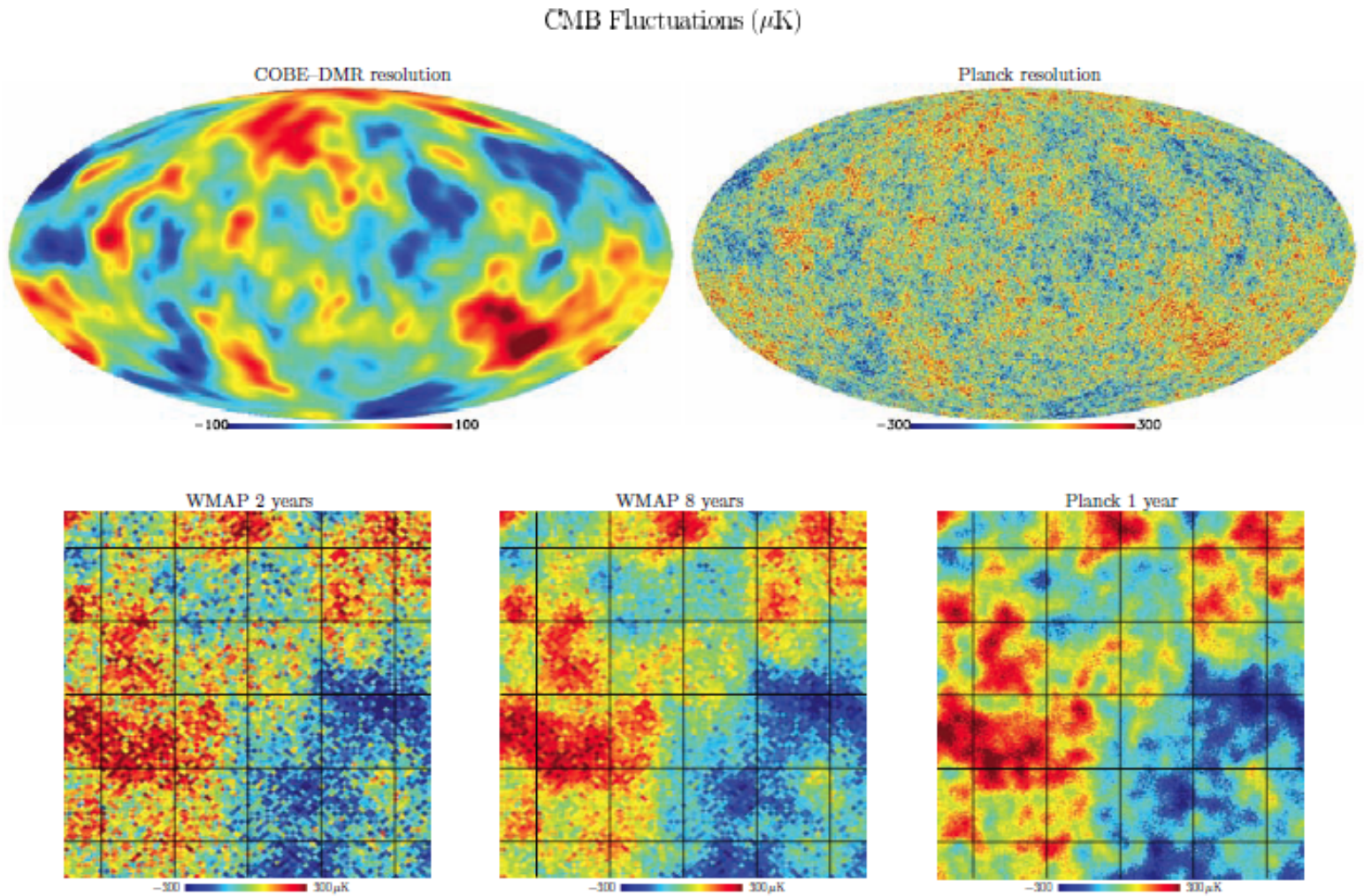
PLANCK



launched on
14 May, 2009

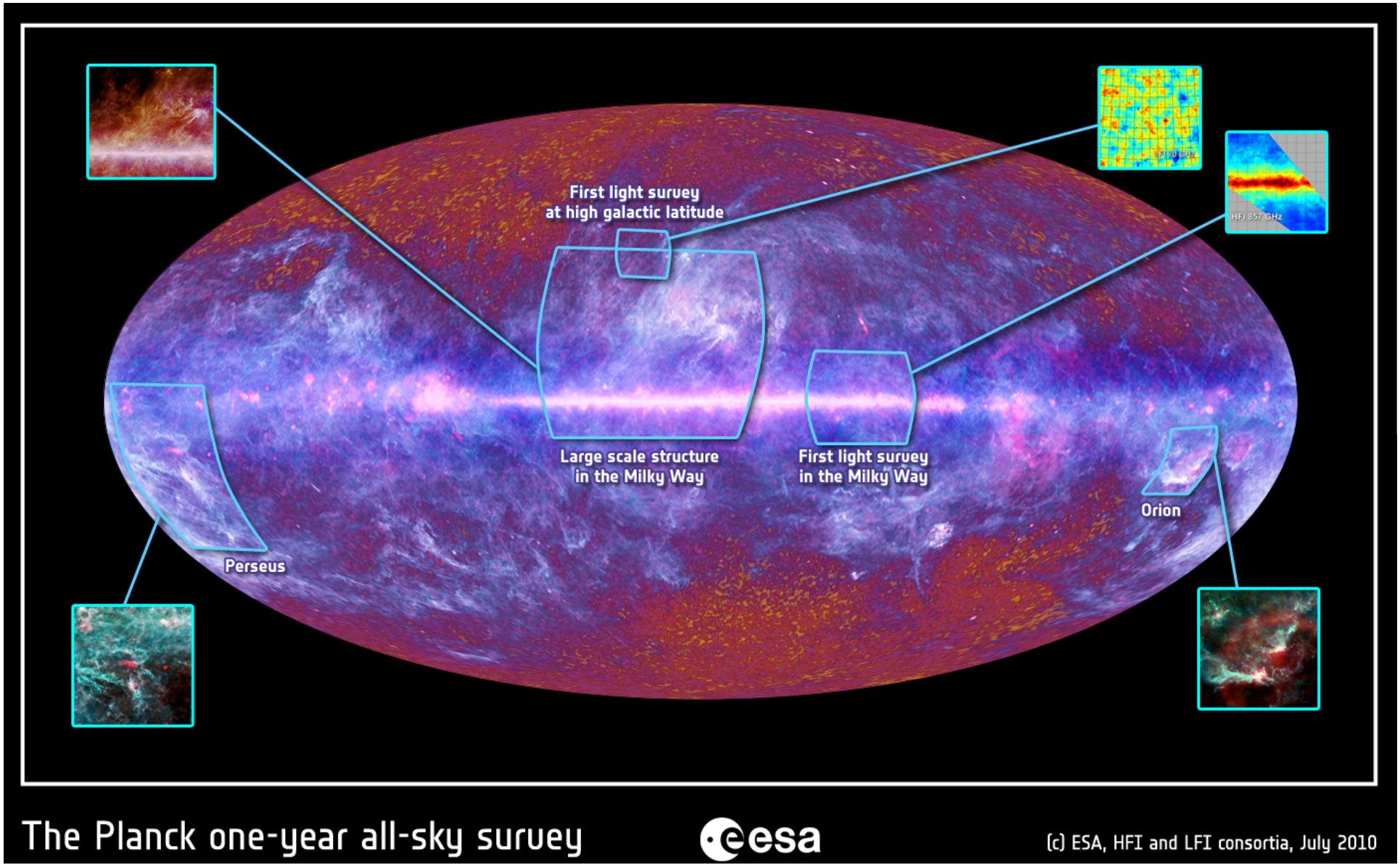
full-sky survey started on 27 Aug, 2009

Angular resolution

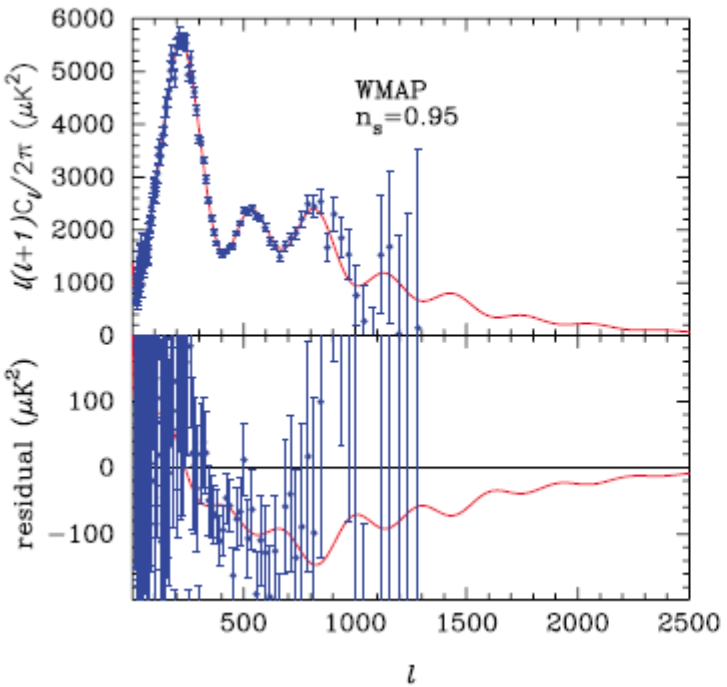


WMAP 2years WMAP 8years Planck 1year

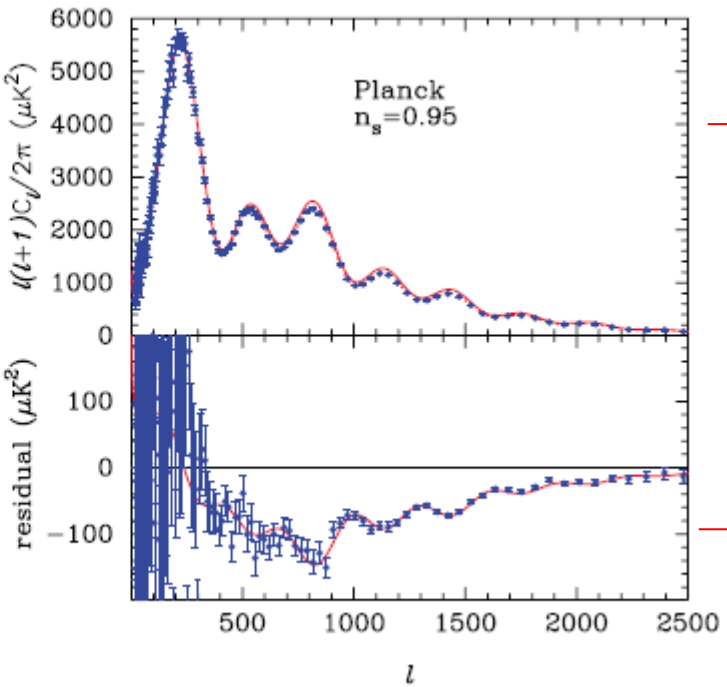
Planck 1yr Map



Scalar spectral index: $P_R(k) \propto k^{n_s}$



WMAP 4 years



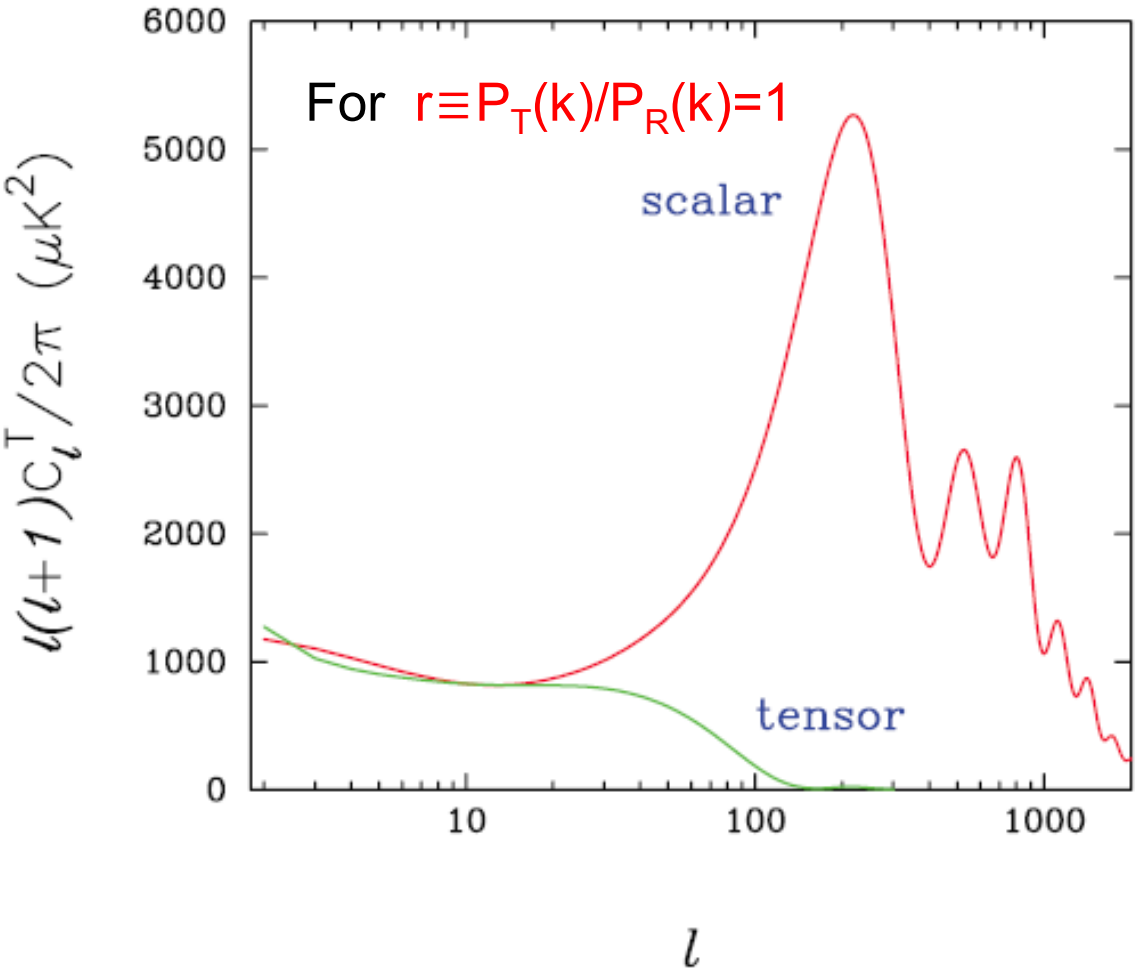
PLANCK 1 year

n_s=1

n_s=0.95

determination of spectral index to within 1 % accuracy

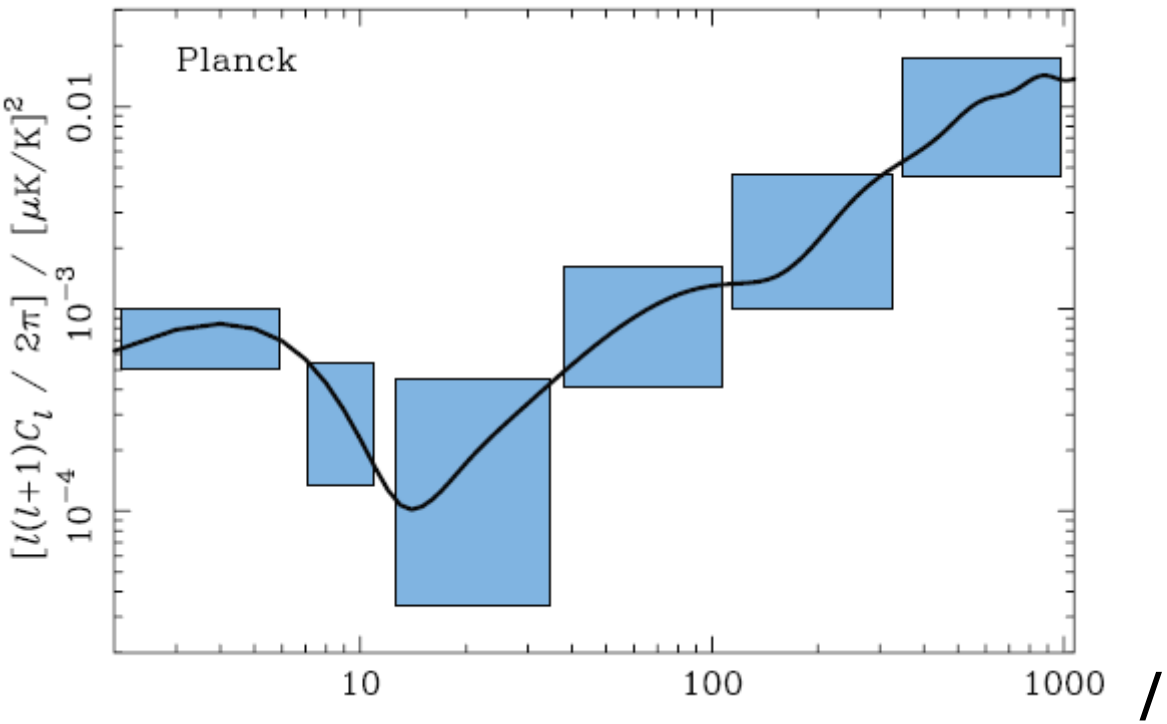
Tensor (gravitational wave) modes



In a “standard”(chaotic inflation) model, r~0.1

B-mode (odd parity) polarization

B-mode is a unique signature of tensor modes



——— $r=P_T(k)/P_S(k)=0.1$

Planck sensitivity: r > 0.05 may be rejected at >80% CL

Detection of r > 0.05 proves inflation at $V^{1/4} \approx 10^{16}$GeV

Non-Gaussianity

Curvature perturbation (gravitational potential):

$$\Phi = \Phi_G + f_{NL}\Phi_G^2$$

Gaussian perturbation: $\Phi_G \sim 10^{-5}$

current WMAP bound:

$$-10 < f_{NL} < 74 \quad (95\%\ \mathrm{CL})$$

Planck's sensitivity: $|f_{NL}| \gtrsim 5$

Standard single-field slow-roll inflation gives $|f_{NL}| \ll 1$

Detection of non-zero f_{NL} implies non-conventional inflation

Tests of Fundamental Theory

extra-dims, string landscape, ...

Cosmology in 21st Century

High Precision Cosmology

- gravitational waves from Inflation
- non-Gaussian perturbations
- extra dimensions / string cosmology
- origin of dark energy
- ...

fundamental laws of nature may be revealed.
(final theory?)

Cosmological perturbation theory
will play a major role