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Constraints on primordial non-Gaussianity using Planck simulated data: First Results

After the successful porting of the point source detection code and the SZ clusters detection code to the EGEE GRID, we have ported and tested a new application. This application is composed of two codes, one that produces simulations of Planck and another one that looks for non-Gaussianity signatures in these maps using spherical wavelets. These applications are part of an ongoing project being carried out by the Observational Cosmology and Instrumentation Group at the Instituto de Física de Cantabria (CSIC-UC) on different analyses of the Cosmic Microwave Background (CMB).

Conclusions and Future Work

References

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Detailed analysis

This application consists of: 1) 11.000 Gaussian CMB maps are simulated and processed through the Planck simulation pipeline for 4 frequency bands, 70, 100, 143 and 217 GHz, producing four maps per simulation. 2) these maps are combined and convolved in harmonic space with the spherical mexican hat wavelet, a tool used in the past to do several Gaussianity analyses of CMB maps (see for example 1,2,3,4). The convolved map, the wavelet coefficients map, will contain information about those structures of the initial map with a characteristic size of R and will be used to compute third order statistics in a similar way as the bispectrum (see 5). We will repeat this process for several angular scales R between 2.9 arc min - 170 degrees. This process is going to take approximately 70K CPU hours and 550 GB of disk. Finally these statistics are used to constrain the levels of non-Gaussianity of the local type (see 6,7,8) which could be present in Planck data. In particular, we have focused on the uncertainties of a parameter known as the non-linear coupling parameter, fnl. The constraints have been obtained using both analytical and numerical methods. We will present the first results.

Impact

The uncertainties on fnl, sigma_fnl, depend on the cosmological model, the instrumental properties and the available fraction of the sky to be analyzed. For instance, a better estimation on fnl can be achieved with a low instrumental noise and a high sky coverage. The Planck mission will provide CMB maps with unprecedented resolution and quality at several frequencies. Therefore, we expect to obtain very competitive constraints on the primordial non-Gaussianity with this experiment. The study of this kind of non-Gaussianity has become

a question of considerable interest as it can be used to discriminate different possible scenarios of the early Universe and also to study other sources of non-Gaussianity non-intrinsic to the CMB.

Keywords

Application Porting, Planck, Non-Gaussianity

URL for further information

http://max.ifca.unican.es/webcmb/research/research.html

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Track Classification: Scientific results obtained using distributed computing technologies