

Title : Constraints on primordial non-Gaussianity using Planck simulated data

Primary Authors : A. Curto, M. López-Caniego, E. Martínez-González

Co-Authors :

Presenters : M. López-Caniego

Track Classification : EGEE

Keywords: Application Porting, Planck, Non-Gaussianity

Abstract:

Introduction

After the successful porting of the point source detection code and the SZ clusters detection code to the EGEE GRID, we are in the process of porting and testing a new application. This application is composed of two additional codes, one to produce Gaussian simulations of Planck and another to look for non-Gaussianity signatures in these maps using 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).

The analysis

This application consists of two parts. First, thousand's of Gaussian CMB maps are simulated and processed through the Planck instrument simulation pipeline for three frequency bands, 100, 143 and 217 GHz, producing three maps per simulation. Then, these maps are combined into a single map. Second, for each simulation, the combined map is convolved in harmonic space with a spherical wavelet, in this case the spherical Mexican hat wavelet (SMHW) will be used, a wavelet that has been used in the past to do several Gaussianity analyses of CMB maps (see for example 1,2,3 and 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 minutes and about 170 degrees.

Finally these statistics will be used to constrain the levels of non-Gaussianity of the local type (see 5,6,7) which are expected to be present in Planck data. In particular, we will focus on the uncertainties of a parameter known as the non-linear coupling parameter, f_{nl} . The constraints will be obtained using two methods: simulations and analytical equations.

Discussion

The uncertainties on f_{nl} , $\sigma(f_{nl})$, depend on the cosmological model, the instrumental properties and the available fraction of the sky to be analyzed, e.g., a better estimation on f_{nl} 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 the 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.

References

1. Martínez-González E., Gallegos J. E., Argüeso F., Cayón L., Sanz J. L., 2002, MNRAS, 336, 22
2. Vielva P., Martínez-González E., Barreiro R. B., Sanz J. L., Cayón L., 2004, ApJ, 609, 22 3.
3. Cruz M., Turok N., Vielva P., Martínez-González E., Hobson M., 2007, Science, 318, 1612
4. Curto, A., Martínez-González, E., Mukherjee, P., Barreiro, R. B., Hansen, F. K., Liguori, M., & Matarrese, S. 2008, MNRAS, 393, 615
5. Komatsu E., Spergel D. N., 2001, Phys. Rev. D, 63, 063002
6. Liguori M., Matarrese S., Moscardini L., 2003, ApJ, 597, 57
7. Liguori M., Yadav A., Hansen F. K., Komatsu E., Matarrese S., Wandelt B., 2007, Phys. Rev. D, 76, 105016

Important Notes

Abstract Preparation

People are kindly requested to use the abstract template in the previous page to prepare their abstracts.

General Topics

Proposed abstracts for oral contributions should focus at least one of these topics:

1. Scientific results obtained using Grid technology
2. Planned or on-going scientific work using the Grid
3. Experiences from application porting and deployment activities
4. Grid Services exploiting and extending gLite middleware (job management, data management, monitoring, workflows etc)
5. Programming environments
6. End-user environments and portal technologies
7. Emerging Technologies within the EGEE infrastructure (cloud, virtualization, etc)

Abstract Submission

You are not requested to directly submit your abstract in Indico. The A&A session Chair (Claudio Vuerli) will do that for you. You are simply requested to send your abstract at the following e-mail address: vuerli@oats.inaf.it.

Abstract Submission Deadline

Abstracts must be sent to the session Chair by Saturday 15 August 2009.

Abstracts sent after this deadline will NOT be accepted.

Acceptance Notification

A Board of Reviewers will evaluate the submitted abstracts. The Board of Reviewers is the Editorial Board of the A&A SSC proposal for EGI. Acceptance notification will be given to the Presenters by Tuesday 25 August 2009.

Please note that Reviewers will do a check to verify that all people indicated as Presenters are registered to the Conference. Presenters not yet registered will be requested to do that before the acceptance notification date, otherwise the abstract will not be accepted.

Time Allocation

There will be 15 minutes available for each presentation. Therefore it will be possible to accept up to 8 presentations for the A&A applications session.

The session agenda will be set up just after the acceptance notification sent to all Presenters.