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Detection of compact objects in maps of the Cosmic Microwave Background Radiation with Planck

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The detection of compact objects, extragalactic point sources and Sunyaev-Zel'dovich clusters, in maps of the Cosmic Microwave Background Radiation (CMB), is a very important problem. These objects contaminate the underlying CMB signal and their detection and characterization allows to produce cleaner maps of the CMB, that will be used to extract cosmological parameters and to look for signatures of non-gaussianity. In addition, these catalogues can be used to study their physical properties.

Impact

In the last year we have ported two applications to the GRID. One to detect point sources and the other to detect SZ clusters. Even though this is preparatory work for Planck, we have tested these techniques with realistic simulations for Planck and real data from NASA's WMAP satellite. Regarding the detection of point sources, we have used the GRID to test and fine tune the algorithm. Then we have used it to detect point sources in WMAP 5yr data, publishing the results. Also, we have tested the algorithm in the framework of the Planck Early Release Compact Source Catalog algorithm comparison exercise, where we have obtained very good results that will be published soon. With respect to the SZ cluster detection algorithm, this is a very demanding software in terms of CPU and only using the GRID one can do a full sky analysis in a reasonable time. So far we have successfully tested it in realistic Planck simulations and the results will be published as well. This is an ongoing work.

URL for further information

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

Conclusions and Future Work

In one year we have been able to port 2 astrophysical applications to the GRID. We have tested them using realistic simulations and real data, and the results of these analysis will be published. This is preparatory work for Planck and further work needs to be done to the algorithms to tackle with increasing complexity of the simulations and the data analysis pipelines. In the future we will continue to test these applications in the GRID using even more realistic simulations as well real data.

Keywords

Astronomy, Cosmology, CMB, Linear Filters, Detection of Compact Sources

Detailed analysis

In 2009, ESA will launch Planck, a satellite that will map the Cosmic Microwave Background Radiation (CMB) with unprecedented resolution. Planck will observe the microwave sky at nine frequencies between 30 and 857 GHz. The maps produced by Planck at these frequencies will be used to produce a clean image of the CMB that will be used to infer important information about the universe we live in. In order to produce this map, a complex process of component separation must be carried out. At these frequencies several diffuse and

compact emissions contribute to the observed signal. Most of the compact emission comes from extragalactic point sources (EPS) and Sunyaev-Zel'dovich clusters (SZ). The detection and characterization of the EPS and SZ is very important and for this purpose we have developed several techniques based on linear filters, mainly wavelet and matched filter. These techniques demand lots of storage and CPU resources and we have successfully ported them to the GRID.

Author: Dr LÓPEZ-CANIEGO, Marcos (IFCA-CSIC)

Co-authors: Dr HERRANZ, Diego (IFCA-CSIC); Prof. MARTÍNEZ-GONZÁLEZ, Enrique (IFCA-CSIC); Dr CAMPOS, Isabel (IFCA-CSIC); Prof. MARCO, Jesús (IFCA-CSIC); Dr VIELVA, Patricio (IFCA-CSIC); Dr BARREIRO, Rita Belen (IFCA-CSIC)

Presenter: Dr LÓPEZ-CANIEGO, Marcos (IFCA-CSIC)

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