
INSTITUTO SABATO (CNEA-UNSAM) - ITEDA (CNEA/ CONICET/UNSAM)

Primordial Universal and Cosmology Data Analysis

Inscripción a la Materia: <http://goo.gl/forms/BkXEHNvov7ERq2GO2>

Consultas:

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Comienzo: 16 de Agosto

Finalización: 25 de Agosto

Duración: 2 semanas, 8 horas/semana

Horario: Martes 16, Jueves 18, Martes 23 y Jueves 25, 4 hs/día

10:00-12:00 y de 13:30-15:30 hs

Lugar: Instituto Sábado, CNEA, Av. de los Constituyentes y General Paz

Curso a dictarse en inglés.

Profesor Dr. Jean-Christophe HAMILTON

QUBIC Project Spokesperson

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First week: Anisotropy and Polarization of the CMBR, Primordial Universe, B-Modes and Bolometric Interferometry

Summary:

The CMB radiation is an amazing observable that nature offered to cosmologists throughout the Universe. Observed from here and now, its temperature and polarization anisotropies reveal the geometry of the Universe through which the radiation has travelled for 13.6 billion years and therefore allows to put tight constraints on cosmological parameters. Furthermore, specific features in the temperature and even more in the polarisation patterns are directly related to events that happened in the very primordial Universe. Specifically, polarization B-modes are predicted by the inflationary theory and their detection would not only strongly support inflation as the origin of the fluctuations in the Universe, but also allow to understand the physics of the inflation era.

In order to observe these B-modes a lot of experimental efforts are ongoing throughout the world. Among the many instruments dedicated to these quest, QUBIC (first module to be installed next year in the Puna region, Prov. Salta) is an original instrument using the novel technique of Bolometric Interferometry that offers high sensitivity, an unprecedented level of

control of instrumental systematics and the very promising ability to operate in a spectro-imaging mode allowing to distinguish between primordial features in the CMB and foreground emission thanks to their different colour.

Second Week: Data Analysis in Cosmology - Practical Works

Summary:

Data analysis has become a full specialization by itself in Observational Cosmology (as well as in other fields) as the data has become more and more complex, the models against which the data are compared more refined and the computers more powerful. The refined statistical techniques which are used become sometimes a bit opaque to the non-specialists making it difficult to appreciate how impressive is the agreement between data and model.

Examples of cosmology data analysis will be given based on supernovae and the cosmic microwave background radiation, introducing data analysis techniques. This practical work will require PhD students to code simple programs using the Anaconda release of python. No specific programming knowledge is required.

References

- **Equations-free overview of observational cosmology results:**
<http://arxiv.org/abs/1304.4446>
- **Nice technical review on CMB Polarization and inflation:**
<https://arxiv.org/abs/0811.3919>
- **QUBIC White Paper:** <https://arxiv.org/abs/1010.0645>
- **Anaconda python:** <https://www.continuum.io/downloads>