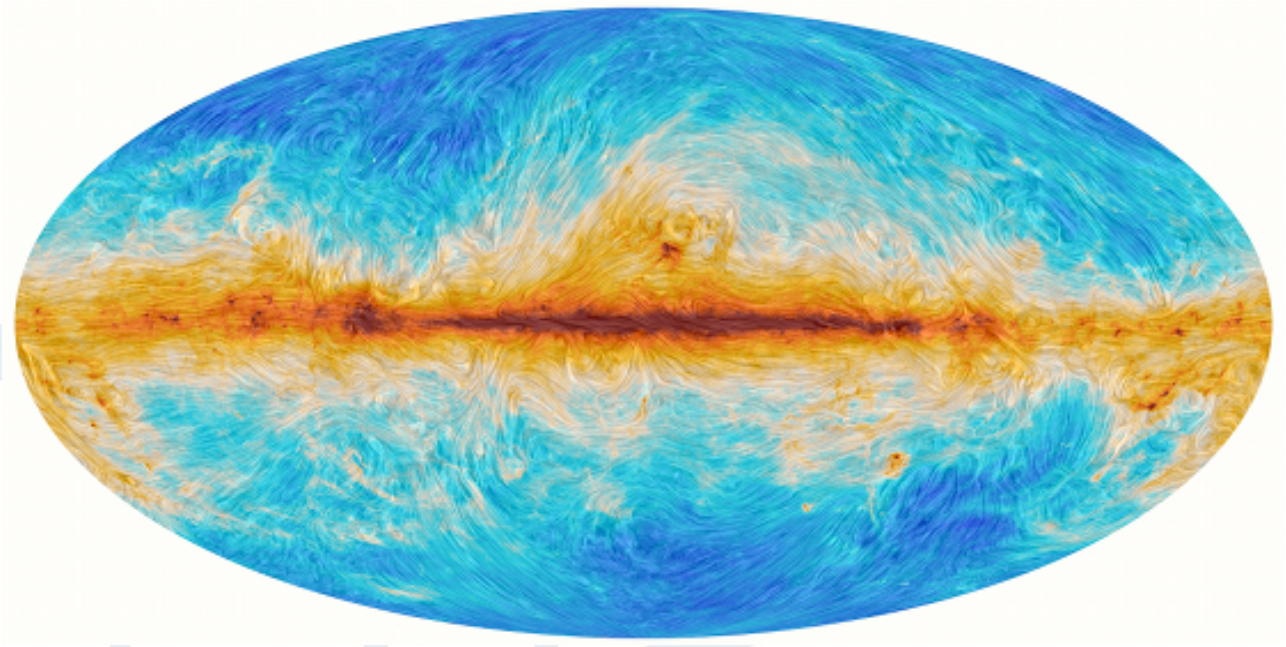
SISSA to "clean" gravitational waves in CMB



EU grant for studying cosmic radiation "Contaminants"

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SISSA has received a 3-year grant of roughly 200 thousand euros for a team of researchers to study gravitational waves in cosmic microwave background radiation (CMB). The work is part of a broader project, RadioForegrounds, within the Horizon 2020 framework of the European Commission with other European institutions (Institute of Astrophysics-- Canary Islands, The University of Cantabria, Cambridge University, the University of Manchester and CNRS in France as well as the private company, Trilogic). SISSA will focus on ridding cosmic signals of contaminants. Leading the SISSA group is cosmologist Francesca Perrotta.

The RadioForegrounds project will study gravitational waves of polarized radiation in the cosmic background leftover from the Big Bang (known as " B-modes"), one of the most elusive and important cosmological phenomena in terms of our knowledge of the Universe. The project was recently approved by the European Commission under the umbrella of the Horizon 2020 framework. Partners of the project include SISSA, which will receive a substantial contribution that will go towards clearing the cosmic signal of contaminants.

"Space is full of dust, gas and other sources that can confuse the signal emitted by the gravitational waves we are looking for in the spectrum of microwaves," explains SISSA cosmologist Francesca Perrotta, coordinator of the group. "It's like looking through a fogged-up window: before we can see through it clearly, we need to wipe it off." To do this, scientists at SISSA (including SISSA Professor Charles Baccigalupi, former Head of Planck and POLARBEAR projects in B-modes cosmology, SISSA and INAF-OAPD Professor Gianfranco De Zotti, SISSA Researcher Andrea Lapi, and post-docs Giulio Fabbian, Pawel Bielewicz, and Soumen Basak) will measure the "pollutant" signals and create mathematical models, the "sponges" that eliminate contaminants. Other SISSA experiments, especially POLARBEAR, will benefit from the RadioForegrounds research on synthesizing the Big Bang signal through the elimination of galactic contaminants.

The measurements will be recorded by the Quijote Tenerife telescope, which observes the cosmos at a frequency of between 10 and 20 GHz, and will complement information previously obtained by SISSA scientists using the Planck satellite, which opened the door to this new and important phase of research, but is not precise enough to remove contaminants from the polarized radiation of the Big Bang.

Gravitational Waves

What are gravitational waves, and why are they so important? "As a phenomenon they were predicted by the theory of General Gravity but not the Newtonian theory of gravitation, which has never been observed directly," says Charles Baccigalupi. "This is why scientists all over the world are increasing their efforts to obtain direct evidence of their existence, and in particular their production a few moments after the Big Bang."

There is only indirect evidence of what is described as ripples in the curve of space and time speading out like waves from a source. Just last year the team of BICEP2, the instrument placed at the South Pole, confirmed it had obtained the first direct measurement of B-modes, but it was most likely a "mistake" due to the same contaminants the team at SISSA are now responsible for cleaning up. "Already last year our Planck collaboration team collaborated with BICEP2 to verify their observation. Data from Planck established that the contamination effect, which was initially dismissed by their team, was in fact probable." The challenge within this newly-funded project is to eliminate galactic B-mode contaminants and to see if gravitational waves exist or not in what remains. The answer will be a momentous discovery in Physics.

IMAGES:

- **The galactic magnetic field measured by Planck in 2015 (crediti: ESA/planck collaboration)**
- **The Quijote telescope (credits ESA): https://goo.gl/1CR7Ch, https://goo.gl/JbfsCF**

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