# THE PHYSICS COLLOQUIUM

Thursday 1 February 2024, 4:00 p.m.
Nijenborgh 4, Lecture Hall 5111.0080

# Cosmic Microwave Background measurements with mm-telescopes


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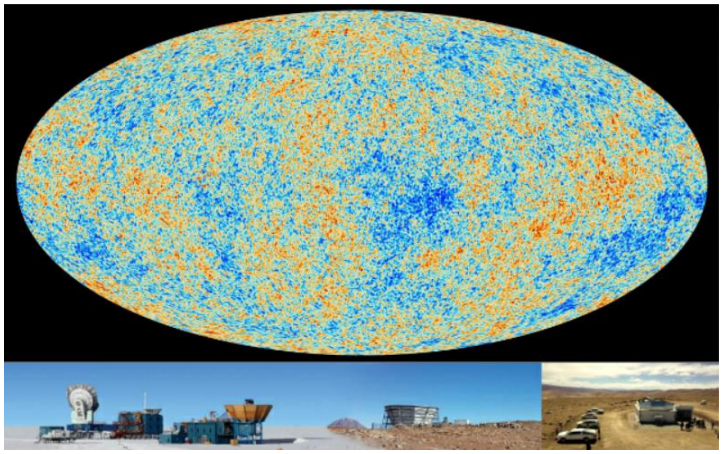

One of the major challenges of modern cosmology is the detection of primordial B-mode polarization anisotropies in the CMB, a smoking gun for inflation. The B-modes is the most promising direct observational signature of the inflationary phase that is thought to have taken place in the early Universe, generating primordial perturbations, producing Standard Model elementary particles and giving its generic features to our Universe (flatness, homogeneity. . .). Science aims at testing models of inflation by measuring or putting upper limits on r, the ratio of tensor fluctuations to scalar fluctuations. A detection of tensor modes would yield the first evidence of quantum gravity and point to inflationary physics near the energy scale associated with grand unified theories, probing energy scales far beyond the reach of the LHC or any conceivable collider experiment, and providing additional evidence in favour of the idea of the unification of forces.

Results from Planck, BICEP and other previous and current experiments have shown how challenging is the search for primordial B-mode polarization because of many difficulties: weakness of the expected signal, instrumental systematics that could possibly induce polarization leakage from the large E signal into B, polarized foregrounds (dust) larger than anticipated…

A review of results and projects will be given, with emphasis on two experiments:

- CMB-Stage 4 is the next generation project, aiming to reach a precision on r of 5x10-4, (5σ discovery of r>3x10-3 or an upper limit of 10-3 at 95% C.L.), allowing the detection of r for the favoured models of inflation. CMB-S4 will comprise telescopes in two locations: a large telescope and nine smaller ones in Antarctica, and two large telescopes in the mountains of Chile. It will target additional rich science goals including the measurement of the number of light relic species with an error of 0.03, corresponding to a freeze-out temperature TF>1GeV, and of the sum of the masses of neutrinos.

- QUBIC, now with the technical demonstrator installed in Argentina and starting commissioning observations of the sky, is designed to address the foreground subtraction with a novel kind of instrument, a Bolometric Interferometer, with spectral imaging, allowing to better disentangle primordial B-polarization from complex, decorrelated foregrounds.

*Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.*

*For more information contact the host: Manuela Vecchi (m.vecchi@rug.nl)*
*Website: http://www.rug.nl/research/vsi/colloquia/*