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The POLARBEAR experiment probing the cosmic microwave background polarization

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The B-mode polarization of the cosmic microwave background (CMB) is a unique window on fundamental questions in physics. The mass of the neutrinos and the properties of the dark energy affect the structure formation, the gravitational lensing exerted by these structures on CMB results in a B-mode signal at small scales. The large scales of the B-mode spectrum convey fundamental information on the primordial universe, such as the energy scale and other properties of inflation.

As the sensitivity of the instruments has approached the level of the B-modes signal, its measurements have become of major interest in cosmology. At the forefront in this quest, POLABEAR is a ground based telescope located in the Atacama desert (Chile), at nearly 5200 m of altitude. With a 3.5 arcmin resolution and a 1274 polarization sensitive bolometers, POLABEAR has been observing three 10 $\deg^2$ CMB patch at 150 GHz since 2012.

Using the data of the first observational campaign, which ended in may 2013 POLABEAR provided indirect measurements of B-modes either via cross-correlation of its maps with the Herschel cosmic infrared background maps (on 4 σ level), or from an analysis of 4-point moments of the polarization maps only (4.2 σ). A direct measurement of the B-mode power was also delivered finding an evidence (97.5 % c.l.) for non-zero sky power consistent with the predicted lensing B-mode signal. Furthermore, POLABEAR recently set new constraints on the cosmic birefringence and primordial magnetic fields.

In this talk I will describe these results in detail as well as present the plans for the future of the POLABEAR experiment. POLABEAR 2 and the Simons Array will increase the sensitivity and have multiple frequency bands for a better rejection of the foreground signals.

Author: POLETTI, Davide

Presenter: POLETTI, Davide

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