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The OLIMPO experiment : galaxy clusters in the backlight of the cosmic microwave background

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Cosmic microwave background (CMB) photons crossing galaxy clusters can be scattered by hot electrons in the ionized intracluster medium (ICM). This results in a small change of the spectrum of the CMB in the direction of clusters of galaxies. The spectrum of the effect is characteristic, with a brightness decrease at f < 217 GHz and an increase at f > 217 GHz, independent of the redshift of the cluster. This is the thermal Sunyaev-Zeldovich (SZ) effect. Thousands of clusters have been already detected by means of photometric measurements of the SZ effect at low frequencies. The motion of the scatterers produces an additional spectral distortions, with different shape (kinematic SZ effect).

OLIMPO is a 2.6m aperture mm-wave telescope, working from the stratosphere at around 150, 250, 350 and 460 GHz to dectect the SZ effects. At high frequencies, its angular resolution is comparable to the one of 6-10m aperture ground based telescopes working at low frequencies. The instrument operates in a pointed mode, so that very deep observations of specific nearby (z \sim 0.05) clusters can be obtained, allowing for detailed studies of the density and temperature distributions of the gas, and of its dynamic state.

The instrument features four arrays of lumped elements kinetic inductance detectors working at 0.3K, reaching photon-noise limited performance. For the mainden flight it was launched from the Arctic airport of Longyearbyen, in 2018. During this technical flight we succesfully validated for the first time in near space (40 km altitude) the operation of kinetic inductance detectors arrays, and the operation of a plug-in differential Fourier Transform Spectrometer (FTS) for spectral studies within the four wide observation bands.

In the talk I will review the science goals of OLIMPO, the measured performance, and the preparation of the payload for the scientific flight.

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