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## **Cosmic Microwave Background (CMB) as a window to particle physics.**

Since the 1970s the Italian CMB community has played a leading role in several groundbreaking CMB experiments, including the very successful BOOMERanG and Planck projects, that have contributed significantly to the present-day era of precision cosmology, where models and theories can be tested and cross-checked with data from other fields, in particular high-energy physics. During the last ten years, this community has organized itself in the COSMOS network, supporting current and future observations of CMB polarization anisotropy and spectral distortions.

The present document summarizes the deep connection between CMB observables and fundamental physics. In Section 2, we recall in particular how the evolution of our Universe, from the very early stages (Inflation) up to the late stages (Dark Energy take-over) is driven by the nature of the particles and fields that fill it in the different eras, and how cosmic evolution leaves distinct imprints both on CMB anisotropies (polarized and unpolarized) and its frequency spectrum. In the same Section, we recall that CMB can be seen as a backlight that travels through the Large Scale Structure, thus opening the possibility of a rich cross-correlation science with Euclid and other experiments targeting different LSS tracers. Section 3 provides a landscape of ongoing and future experiments planned worldwide, with an emphasis on the Italian contribution. This broad scientific return is enabled by a substantial technological development, mostly related to cryogenic ultra-low noise detection and microwave/millimeter wave techniques, which is described in Section 4.

Overall, the present document represents a summary of the connections between CMB and collider physics with a view on current and future projects, highlighting the areas of common interest and possible synergistic developments.

**Authors:** TARTARI, Andrea; BACCIGALUPI, Carlo (SISSA); PIACENTINI, Francesco (INFN - National Institute for Nuclear Physics); SIGNORELLI, Giovanni (Universita & INFN Pisa (IT)); PAGANO, Luca (INFN Ferrara); MIGLIACCIO, Marina (University of Rome "Tor Vergata"); GERBINO, Martina; Prof. BARTOLO, Nicola; NATOLI, Paolo (Università di Ferrara)