

A quantum-enhanced search of axion dark matter

giovedì 30 maggio 2024 09:30 (20 minuti)

The QCD axion, both a dark matter candidate and a solution to the strong CP problem, is made difficult to detect by its weak coupling to ordinary matter. The axion haloscope, proposed and first realized more than three decades ago, is still the most promising detection platform to probe the coupling with the photon with the required sensitivity. However, even with best microwave cavity and superconducting magnets technologies, it requires many hundreds of years to scan just a mass decade. A technology that will permit more efficient searches is the single microwave photon detector (SMPD), that by circumventing the quantum limit on the system noise of the linear amplification (SQL) has the potential to improve the haloscope speed by a few orders or magnitude.

We will report the results of a prototype haloscope experiment, in which axions are searched as exclusive constituents of the Galactic dark matter halo by means of a 7.37 GHz cylindrical microwave cavity under a 2 T field and readout by a SMPD. Our results allow to exclude axion-photon couplings to within one order of magnitude from the QCD prediction, with a gain of about 500 compared to SQL.

Collaboration

Role of Submitter

I am the presenter

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Classifica Sessioni: Low Temperature, Quantum and Emerging Technologies - Oral session

Classificazione della track: T9 - Low Temperature, Quantum and Emerging Technologies