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Status of the QUAX experiment

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The QUest for Axion (QUAX) is a direct-detection CDM axion search which reaches the sensitivity necessary for the detection of galactic QCD-axion in the range of frequency 8.5-11 GHz. The QUAX collaboration is operating two haloscopes, located at LNL- and LNF-INFN laboratories in Italy, that work in synergy and operate in different mass ranges. In this talk we will report about the LNL haloscope, currently talking data at 10.3 GHz with a dielectric resonator cooled at less than 100mK inside a dilution refrigerator equipped with a 8 T magnet. In addition, the system noise is minimised in the wide frequency range where the cavity can be tuned by means of a new generation traveling wave parametric amplifier (TWPA) developed by the group of N. Roch (Grenoble), with measured noise temperature of 2 K or better. We will describe the results of preliminary runs, where a narrow range tuning system (1 MHz) was employed. Data sets were acquired with significantly different antenna couplings, to investigate the experimental requirements that are needed for running the experiment with a cavity exceeding the axion quality factor.
We will also report about R&D activity aimed at increasing the scanning speed with application of single microwave photon detectors (SMPDs) for cavity readout, in collaboration with E. Flurin (Quantronics, Saclay). The prototype haloscope is based on a cylindrical copper cavity sputtered with NbTi, with a quality factor of 5 10^5 at 5 K and the experiments will be conducted at 7 GHz frequency in a dilution refrigerator where a moderate magnetic field (3T) can be applied. Systematic studies of the SMPD dark count and efficiency will be described.

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