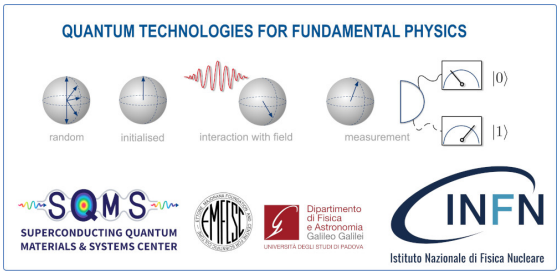

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Axion dark matter search with high-temperature superconducting cavities

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The pursuit of axion dark matter search has long been a daunting task, but recent advances in superconducting materials research have brought physicists closer than ever to unlocking the secrets of this elusive particle. At the forefront of this search is the Center for Axion and Precision Physics research (CAPP), which has established a state-of-the-art detector facility in Korea featuring multiple dilution refrigerator systems and a newly added 12 T big bore (32 cm) Nb3Sn magnet, along with quantum noise-limited amplifiers capable of collecting axion dark matter physics data with a DFSZ level sensitivity. With a total system noise temperature of around 200 mK, the facility is now able to scan more than 1 GHz per year. CAPP is currently engaged in critical R&D efforts aimed at improving the sensitivity of the haloscope detector system, including the development of superconducting cavities that can sustain a high Q-factor (more than 10 million) even at 12T. The utilization of the newly developed HTS cavities has resulted in promising and encouraging results, which augments our ability to search for axion dark matter with an enhanced scanning speed. Overall, our findings highlight the pivotal role of HTS cavities in revolutionizing axion haloscope experiments, accelerating the quest for understanding the elusive nature of dark matter, and unlocking new possibilities in the field of particle physics.

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