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Search for Axion Dark Matter

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The axion, a pseudoscalar particle originally introduced to solve the "strong CP problem", is a well motivated dark-matter candidate with a mass lying in a broad range from peV to few meV. Axions clustered inside our galaxy may be observed by means of detectors called "haloscopes"consisting in a resonant cavity immersed in a static magnetic field that triggers the axion conversion to microwave photons. While conventional haloscopes are already taking data, several new experiments have been proposed to improve the sensitivity, widen the search bandwith or probe different axion couplings. Among these, there are haloscopes of new concept such as multimode, ferromagnetic, NMR, dielectric, dish antenna up to the most recent plasma haloscopes.
A major challenge for cosmological-axion discovery is the detection of the faint signal expected in detectors with power as low as a fraction of yoctowatt corresponding to a single microwave photon per minute. In the attempt of reducing the noise temperature superconductive devices are the prefererred choice. Microstrip SQUID Amplifiers allows SQUIDs to operate at frequencies of a few GHz with a noise temperature reaching the standard quantum limit. Josephson Parametric amplifiers are now broadly employed to extend the search to higher frequency while broadband Traveling Wave Parametric Amplifiers are now under study. The ultimate sensitivity, beyond the quantum limit, is however expected from single microwave-photon detectors. The talk will review the status of galactic-axion searches, the prospects of future experiments and the efforts both in materials and devices taken to improve the experimental sensitivity.

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