

Search of dark-matter axions in the microwave frequency range with full-wave modal techniques

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Abstract

Axions, originally proposed to solve the strong Charge-Parity problem of Quantum Chromo-Dynamics theory, emerge now as leading candidates of dark matter. In fact, the search of dark-matter axions in the microwave frequency range has been developed by different research groups during the last twenty years. In this demanding scenario, several microwave passive components (haloscopes) have been designed and fabricated for such axions detection based on the use of cavities and multi-cavities. From an electromagnetic point of view, commercial software (ANSFT HFSS, CST MICROWAVE STUDIO, etc) has been employed for the design of different kind of haloscopes. In this work we propose to use the BI-RME 3D method (Boundary Integral – Resonant Mode Expansion) as an alternative to analyze the axion-photon coupling existing within an haloscope. This full-wave modal technique has provided interesting wide-band results for the design of new haloscopes.