

Electromagnetic responses of the axions in a high magnetic field with high-frequency modulations

It is believed that axion is one of the natural candidates of the cold dark matters and will play the key role to solve the strong CP problem in standard model. However, the existence of the axion has not been verified, until now, although a series of experiments have been developed to probe its possible response. Focusing on the possible electromagnetic response of the axion in a laboratory high stationary magnetic field, basing on the Sikivie effect [1], here we propose an approach to amplify such a response by introducing a high-frequency modulated magnetic field. For the simplicity, we first consider here a toy model [2], i.e., the electromagnetic responses of the axions passing vertically through a one-dimensional high stationary magnetic field superposed by an alternating magnetic field along the same direction, and show that the intensity of the resonant electromagnetic response of the axions could be amplified by at least 2 orders of magnitude, compared with that in the usual stationary high magnetic field. Additionally, the non-resonant response signals could also be generated. The possibility of such a toy model being applied to the experimentally demonstrated three-dimensional cavity setups with only the high stationary magnetic field [3] is also discussed.

[1] P. Sikivie, Experimental Tests of the “Invisible” Axion, Phys. Rev. Lett. 51, 1415 (1983)

[2] Hao Zhang, et al., Electromagnetic responses of the axions in a high magnetic field with high-frequency modulation, to be published.

[3] T. Braine et al. (ADMX Collaboration), Extended Search for the Invisible Axion with the Axion Dark Matter Experiment, Phys. Rev. Lett. 124, 101303.

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