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Effective Approximation of Electromagnetism for Axion Haloscope Searches YOUNGGEUN KIM, DONG-OK KIM, JUNU JEONG, KAIST , CAPP/IBS, YUN CHANG SHIN, CAPP/IBS, YANNIS SEMERTZIDIS, KAIST , CAPP/IBS — Most of successful experiments searching for axion dark matter are based on an anomalous coupling of axion to the electromagnetic field. This requires a modification of the classical Maxwell equations to include the anomalous interaction. However, due to the axion anomaly, this set of modified Maxwell equations doesn't naturally satisfy certain boundary conditions such as one for axion haloscope searches. We introduce an effective approximation of Maxwell equations to resolve this issue and shows that they naturally satisfy the boundary conditions for haloscope searches. The electric stored energy and magnetic stored energy are also estimated from the electromagnetic fields, which are different in this approximation. A very small difference arises between the electric and magnetic stored energies due to the anomalous interaction. The difference can be interpreted as oscillating electric dipole moments (EDM) induced by axions.

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