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High-Q 3D Photonic Bandgap Cavities for Axion Detection

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Axion dark matter haloscope requires high magnetic field to convert dark matter into microwave photons and high-Q cavities to store these photons for measurement. Copper cavities with Q ~ 10^4 must be used since the high magnetic field makes it challenging to utilize superconducting cavities. Photonic Bandgap (PBG) cavities made out of high contrast, low-loss dielectric material can operate in high field and achieve a Q-values of 10^8. I will discuss the design and simulation results of a 3D FCC-type lattice constructed using alternating layers of Rutile and Sapphire which shows a large bandgap of ~ 31% centered around the desired cavity frequency.

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