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A high Quality factor dielectric Fabry-Perot cavity for detecting dark matter axions

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The axion is a type of pseudoscalar (spin-0, odd parity) particle initially proposed as a solution to strong CP problem as well as being a theoretically well-motivated dark matter candidate. One part of the Quantum enhanced Particle Astrophysics (QuEPA) project at Imperial College focuses on developing a Fabry-Perot cavity as a dark matter haloscope to convert axions in the 125-250 μeV mass range into microwave photons. According to axion-modified electrodynamics [2], axions can be converted to microwave photons between 30-60 GHz when this cavity is placed in a strong, homogeneous magnetic field. Compared to other haloscope geometries operating at this frequency, the Fabry Perot cavity is relatively compact, it has a large effective mode volume, it can be easily tuned, with the right choice of materials it can reach Q > 100,000, and its performance should not be degraded when placed in a strong magnetic field.

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