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A new search for dark matter axions using quantum technologies

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The toolkit of quantum technologies developed in atomic, molecular and optical physics are ideally suited to enhance the search for dark matter axions with masses above ˜40 μeV. I will present an overview of a new experimental effort at Imperial College, developing technologies to initially target an axion mass range 120-250 μeV. We will use a large mode area Fabry-Perot cavity to efficiently convert axions into microwave photons. Compared to other geometries, the Fabry-Perot cavity can have a large volume factor, high Q and can be easily tuned. To detect the microwaves, we plan to use an electron in a Penning trap as a single photon counter. Individual microwave absorption events will change the cyclotron state of the electron, causing measurable shifts in the trapped particle's oscillation frequencies. This versatile device will also open up other possible detection routes for alternative dark matter candidates.

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