Best Sensitivity to Wavelike Dark Photon Dark Matter with SRF Cavities

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Searching for dark matter with Microwave Cavities

- Makes up 85% of all the matter in the Universe, but what is it? Is it wavelike?
- Axions and dark photons are two candidates that can convert to photons.

Dark Photons

Microwave cavities can detect wavelike DM. Axions and dark photons can enter the cavity and convert to photon. Cavity resonantly enhances DM signal.

Need a magnetic field for detecting axions, but not for detecting dark photons.





Lots of unexplored parameter space.





to

We can search deeper and faster with SRF cavities.



Credit: N. Du

 $Q_L \approx 8 \times 10^4$

Compare









DP signal would be a narrow power excess over the noise floor.



Future Work

Tunable SRF cavities to search through more parameter space.

Transmon qubit photon counting to subvert SQL noise.

SRF cavities resistant to magnetic fields



+++++ * * * Credit: S. Kazakov 4.3-7 GHz





 $B_0 = 6T$ arxiv.org/abs/2201.10733v2

searches.

Acknowledgments

This material is based upon work supported by the U.S. Department of Energy, Office of Science, National Quantum Information Science Research Centers, Superconducting Quantum Materials and Systems Center (SQMS) under contract number DE-AC02-07CH11359





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