Searching for Wavelike Dark Matter with SRF Cavities

What is Dark Matter?

- Can it be wavelike?
- Axions
- WIMP-like Dark Photons
- Muon
- Neutralino
- Axion
- Dilaton
- WIMP
- Higgsino
- Wino

Sergey Kazakov, Alex Melnychuk, Yuriy Pischalnikov, Roman Pilipenko, Sam Posen, Alexander Romanenko

Fermi National Accelerator Laboratory

Can We Speed Up DM Searches with SRF Cavities?

- Benefits from longer coherence time.

State of the art: ADMX

$Q_L \approx 8 \times 10^4$

Dark Photon Dark Matter Search with SRF Cavity

$T_\alpha \approx 4.9$ K

G $\approx +37$ dB

Power Measured from Cavity

SRF Cavities

Just noise. No DP signal

DM coupling strength, mass unknown. Lots of unexplored parameter space.

Can SRF cavities increase instantaneous scan rate of haloscope experiments by a factor of 100,000?

SRF Cavities for Possible Axion Dark Matter Searches

If this worked in an 8 T magnetic field, would be sensitive to QCD axion with single cavity and HEMT.

Take-home message

We have demonstrated that SRF cavities have unprecedented sensitivity to dark photon dark matter and have achieved the smallest excluded kinetic mixing for wavelike dark photons.

SRF cavities may be able increase the scan rate of dark matter searches by a factor of 100,000.

SRF cavities that are resistant to magnetic fields are being developed for axion searches.

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