



Department of Physics, Tsinghua University

清华大学 物理系

PARTICLE & COSMOLOGY THEORY SEMINAR

Searching for Dark Particles with Light (and Quantum Technologies)

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Fermilab

ABSTRACT Many puzzles of fundamental physics indicate the existence of new particles that interact feebly with ordinary matter, which makes them appear “dark” to us. Quantum sensors, given their low noise level, are promising devices to look for such new particles that feebly interact with photons. A well-known example is the axion (or axion-like-particle), which arises generically in the extensions of the Standard Model that involve the breaking of new global symmetries. We propose to use two superconducting radio-frequency cavities with resonant frequencies in the GHz range to look for axions. The search strategy is a broadband search using a light-shining-through-wall setup. Superconducting radio-frequency cavities have an exceptionally high quality factor, which both boost the number of photons stored in the emitter cavity, and enhance the signal power in the receiver cavity, and hence are ideal to search for light axion with mass below 10 micro eV. In the future, other quantum devices, such as thin-film lithium niobate optical cavities can search for axions at optical frequency.

10:00 AM, 2022/03/03

腾讯会议 353-4463-2887