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Ultra-high Q cavity-based search for the Dark Photon: new exclusion limit from Dark SRF phase 1 and steps forward for phase 2

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We present here the first results of Dark SRF, a light-shining-through-wall (LSW) experiment that leverages ultra-high quality factor superconducting radio frequency (SRF) cavities to search for dark photons. The use of Nb SRF cavities combined with a strict calibration and measurement protocol increased sensitivity to dark photons by several orders of magnitude compared to other LSW experiments, as demonstrated by our new limit that excluded a broad range of previously unstudied dark photon mass and mixing angle.

In addition to the results of the search conducted in liquid helium using 1.3GHz SRF cavities, we also present the first steps of the second phase of the experiment, which will take place in a dilution refrigerator using 2.6GHz SRF cavities. These experiments are part of a wider effort of the Superconducting Quantum Materials and Systems (SQMS) Center to employ ultra-high Q SRF cavities to search for Beyond the SM particles and wavelike dark matter.

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