

First results of the DOSUE-RR experiment - search for dark photon CDM in the mass range

$$74 - 110 \mu\text{eV}/c^2$$

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Dark photon cold dark matter (CDM) is one of the WISPs. Dark-matter Observing System for Un-Explored Radio-Range (DOSUE-RR) is a series of experiments to search for the dark photon CDM using millimeter-wave spectroscopy. The dark photons convert to ordinary photons at the boundary of electromagnetic fields such as a metal surface. The frequency of the conversion photon corresponds to the mass of the dark photon CDM owing to the energy conservation, i.e., $h\nu \simeq mc^2$. We aim to detect the signal in the frequency spectrum.

For the first experiment, we developed a cryogenic millimeter-wave receiver in a frequency range 18 – 26.5 GHz, which corresponds to a dark photon mass range 74 – 110 $\mu\text{eV}/c^2$. Our first search was performed for two weeks in 2021. We found no signal of the dark photon CDM, and set an upper limit on the coupling constant between dark photons and ordinary photons: $\chi < (0.3 - 2.0) \times 10^{-10}$ at 95% confidence level. This is the most stringent constraint to date, and tighter than indirect constraints from cosmological observations. In this workshop, we will present our first results and future prospects.

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