



Contribution ID: 14

Type: **not specified**

New results of the DOSUE-RR experiment and future

Thursday, 6 July 2023 15:15 (20 minutes)

Dark photon dark matter (DP-DM) is one of the dark matter candidates. The DP-DM is theoretically predicted to have a weak coupling χ to ordinary photons. This results in the emission of the conversion photon at the electromagnetic boundary such as a metal surface when the DP-DM passes through.

The DOSUE-RR (Dark-photon dark-matter Observing System for Un-Explored Radio-Range) is a series of multiple experiments. We aim to detect the conversion photons from the DP-DM using millimeter-wave receivers. The frequency of the conversion photon corresponds to the mass of dark matter by energy conservation, and the intensity of the conversion photon corresponds to the square of the coupling χ . Since there is no obvious prediction for the dark matter mass, we should search in a wide frequency(=mass) range. A millimeter-wave receiver can cover a relatively wider frequency range rather than the haloscope experiments. The target frequency range of the DOSUE-RR is 10–300 GHz. To cover such a wide range, we are performing or planning multiple experiments.

We published our first results last year. We achieved the world's best exploration in the 18–26.5 GHz frequency range (74–110 μeV mass range) and set an upper limit ($\chi \sim < 10^{-10}$). We have been expanding our exploring range to both lower and higher frequency ranges. In this talk, we will present our latest results as well as the development status for the future.

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Session Classification: Thursday Session 3