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First results of DOSUE-RR experiment - the most stringent constraint for dark photon CDM at the mass range of 74–110 μeV

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Dark photon is one of the cold dark matter (CDM) candidates. It is predicted in the context of high-scale inflation models and a part of string theories. However, experimental constraints for its mass range at around $O(10\text{--}100) \mu\text{eV}/c^2$ have not been tight yet. The dark photon CDM is predicted to convert to a photon with a weak coupling constant (χ). The frequency of the conversion photon corresponds to the CDM mass because of the energy conservation ($h\nu \simeq mc^2$), e.g., a signal at 24.2 GHz corresponds to the mass of $100 \mu\text{eV}/c^2$. DOSUE-RR (Dark-matter Observing System for Un-Explored Radio-Range) is a series of experiments searching for the conversion photons based on technologies matured in observations of the cosmic microwave background. Hence, $O(10\text{--}100)$ GHz is our target frequency range of the conversion photon. We developed a cryogenically cooled setup for the 18–26.5 GHz observations, and we succeeded to improve the experimental sensitivity compared to previous studies.

We performed our first search for the dark photon CDM in the mass range of 74–110 $\mu\text{eV}/c^2$ with the world's best sensitivity. In this presentation, we will present our first results. Even assuming that there is no significant signal, our constraint for χ will be tighter than that is given by cosmological observations: $\chi < (4\text{--}10) \times 10^{-10}$.

In-person participation

Yes

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