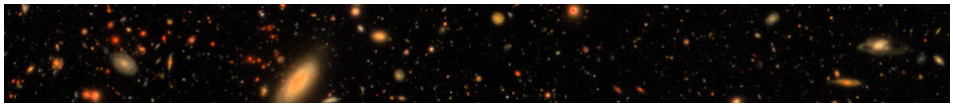

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Current status of sensitivity improvement of Dark matter Axion search with riNg Cavity Experiment (DANCE)

Wednesday 16 October 2024 14:40 (20 minutes)

Axion and Axion-Like Particles (ALPs) are one of the candidates of dark matter. Axion weakly interacts with photon, electron, proton and so on. Many experiments have been proposed by using the axion-photon conversion under magnetic fields. However, axion has not been observed yet. Our research group has proposed Dark matter Axion search with riNg Cavity Experiment (DANCE). DANCE aims to detect axion without using magnetic fields. The axion-photon interaction induces a rotation of linearly polarized light. We aim to detect the amplified rotation angle with a bow-tie optical ring cavity. In the prototype experiment with a bow-tie optical ring cavity with a round-trip of 1 m (DANCE Act-1), the reflection phase difference between s-polarization and p-polarization on the mirrors of the cavity was observed. This was due to oblique incidence on the mirrors, and we were not able to achieve simultaneous resonance, which is necessary to conduct a sensitive broadband axion search. Recently, we achieved simultaneous resonance by adding an auxiliary cavity to compensate for the reflection phase difference. However, the optical loss on the polarization beam splitter between a bow-tie optical ring cavity and an auxiliary cavity degrades the sensitivity to axion. Also, the measurement results of DANCE Act-1 revealed the time drift of the reflection phase difference between polarizations on the mirrors of the cavity. This makes it challenging to conduct an accurately sensitive axion search. An alternative approach to address these issues is to tune the reflection phase difference between polarizations by tuning laser wavelength. This approach achieves simultaneous resonance by canceling the reflection phase difference between polarizations when light is reflected on the mirrors. In this talk, I will report the detail of simultaneous resonance for DANCE.

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