

Dark Matter Search with Coherent Atoms (#3)

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“Axion and Dark Photon (DP) have been considered as well-motivated dark matter candidates. Axion was originally introduced as the solution to the Strong CP problem, while DP is a massive vector particle predicted by any extension of the Standard Model. Both particles should experience coupling or mixing with normal photons, this characteristic renders them viable for direct dark matter detection.

Here a new experimental approach is proposed to search both particles. This approach uses collective and coherent Cs atoms as a target, Axion/DP inducing resonant atomic transition along with signal photon emission to be detected. The key feature of this method is the “coherent amplification mechanism”. That is, when the process occurs coherently in an N-atom system, its transition amplitude interferes constructively, and the rate becomes proportional to N^2 instead of N.

In this regard, we focus on the coherence measurement experiment by investigating the cesium 8p-6p electric-dipole forbidden transition. We first determined the spontaneous emission rate of the forbidden transition, then generate coherence between the 8p and 6p states of cesium., the forbidden transition is expected to be amplified by the established coherence, and the amplification factor of the forbidden transition serves as a quantitative indicator of the achieved level of coherence.

In this talk, we explain the Cs coherence measurement experiment along with the dark matter detection principle.”

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