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【711】 Search for Axion-Like Dark Matter and Exotic Yukawa-Like Interaction

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Despite the undoubted success of the Standard Model of particle physics, it fails to answer many longstanding questions. These include the observed dark matter and the baryon asymmetry in our universe. Many theoretical models that try to answer those questions require new particles and gauge bosons, which must be verified or excluded experimentally.

In this talk, I will present the search for two such candidates. The first candidates are ultralight pseudo-scalar particles called axion-like particles (ALPs). We searched for them using a Ramsey-type apparatus for cold neutrons. A hypothetical coupling of ALPs to gluons would manifest in a neutron electric dipole moment signal oscillating in time. Twenty-four hours of data have been analyzed in a frequency range from 23 μHz to 1 kHz, and no significant oscillating signal has been found. Present dark-matter models allow for constraining the coupling of ALPs to gluons. The second candidate is an axial-vector gauge boson that could mediate a Yukawa-like interaction in the millimeter range between Standard Model fermions. We built a tabletop experiment that applies Ramsey's technique to the proton spins of hydrogen in water. We performed a proof-of-principle search for this exotic interaction and measured radio-frequency effects like the Bloch-Siegert shift and dressed spin states.

Theoretical Work

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