



Contribution ID: 53

Type: **Talk**

Search for axion quark nugget at CAPP

Wednesday, 18 September 2024 10:25 (20 minutes)

Axion quark nuggets are hypothetical particles composed of (anti-)quarks in a unique phase called the color superconducting state, surrounded by an axion domain wall. This model proposes an alternative candidate for cold dark matter compared to conventional halo-axions. Under the hypothesis that anti-matter axion quark nuggets could annihilate with Earth matter, releasing relativistic axions, we performed the first AQN experiment using a haloscope at the Center for Axion and Precision Physics Research (CAPP). This experiment employed a high-temperature superconducting microwave cavity that achieved a Q-factor exceeding one million in an 8-T magnetic field, alongside a quantum-noise-limited flux-driven Josephson parametric amplifier. Our investigation targeted the axion rest mass range between $4 \mu\text{eV}$ and $9 \mu\text{eV}$. Data analysis focused on detecting daily modulation in the signal as predicted by the model. This presentation provides a detailed account of the experiment and reports the results.

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Session Classification: Morning 3