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ADAMOS: Axion Daily Modulation Searches for Dark Matter at 20 GHz

We present ADAMOS, a new microwave haloscope experiment under development at the University of Hamburg, aimed at searching for dark matter axions in the 20 GHz frequency range. The experiment centers on a novel “thin-shell” annular cavity resonator designed to maintain a large detection volume at high frequencies—an approach that addresses longstanding challenges in haloscope scaling. A proof-of-principle prototype of the cavity is currently under construction, following extensive eigenfrequency and frequency-domain simulations to validate and optimize the design.

The resonator will be installed in an existing 14 T superconducting magnet and coupled to a highly sensitive, continuously calibrated RF readout chain. This system incorporates real-time in-situ calibration to suppress temperature-dependent gain drifts—an improvement inspired by the CAST-CAPP campaign. ADAMOS will simultaneously search for three distinct classes of axion signals: (1) conventional cold dark matter (CDM) axions, (2) relativistic axions from Axion Quark Nugget (AQN) annihilations, which are expected to exhibit daily modulation, and (3) transient enhancements from streaming dark matter.

By targeting this unexplored frequency regime with a robust and versatile detection strategy, ADAMOS aims to open new discovery channels and position the University of Hamburg as a leading center for axion and dark matter research

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