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A Search for Axion Dark Matter with the HAYSTAC Experiment

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The Haloscope At Yale Sensitive to Axion CDM (HAYSTAC) is a tunable microwave cavity experiment searching for axion dark matter in the galactic halo through the inverse Primakoff interaction, in which axions in a strong magnetic field are resonantly converted to microwave photons. In 2017, HAYSTAC excluded axion-photon couplings above $\sim 2 \times 10^{-14} \text{ GeV}^{-1}$ for the axion mass range $23.15 < m_a < 24.0 \text{ } \mu\text{eV}$, and probed new parameter space of interest to both particle physics and cosmology. HAYSTAC is now entering its second phase of operation, incorporating the improvements from the 2017 run with a new squeezed-state receiver and significant upgrades to the cryogenics system. We discuss our recent results, upgrades, the current status of HAYSTAC, and expectations for Phase II.

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