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Status of the HAYSTAC Experiment

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Dark matter axions may be detected by their resonant conversion to photons in a tunable microwave cavity permeated by a strong magnetic field. This talk will give an overview of the design and operational experience of HAYSTAC (Haloscope At Yale Sensitive to Axion CDM), which incorporates a dilution refrigerator and Josephson parametric amplifier and has thus achieved a system equivalent noise temperature of only twice the Standard Quantum Limit. First results will be presented, which exclude axion models a factor of ~2.3 above the benchmark KSVZ model over the mass range 23.55-24.0 μeV. These are the first limits within the axion model band in the 10-100 μeV mass decade. Finally, I will discuss our R&D oriented to significantly increase the detector sensitivity through application of a squeezed-vacuum state receiver, higher Q cavities, distributed Bragg reflectors, and photonic band-gap resonators. This work was supported by NSF Grants PHY-1306729 and PHY-1362305, Heising-Simons Foundation Grant 2014-182, and U.S. DOE Contract DE-AC52-07NA27344. M. Simanovskaia is supported by the NSF Graduate Research Fellowship Grant DGE-1106400 and the Berkeley Fellowship.

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