

DAMOP19-2019-000984

Abstract for an Invited Paper
for the DAMOP19 Meeting of
the American Physical Society

Quantum Advances in the Search for Dark Matter Axions

KARL VAN BIBBER, University of California, Berkeley

The most sensitive experiments searching for dark matter axions today exploit the conversion of axions to microwave photons in a strong magnetic field, resonantly enhanced in a high-quality microwave cavity. After three decades, these experiments have finally achieved the sensitivity to detect dark matter axions over a limited range of mass, whose signal may be no more than a yoctowatt. This achievement has been enabled by dramatic advances in ultralow noise receivers based on devices operating at the Standard Quantum Limit, such as SQUIDs and Josephson Parametric Amplifiers. Further improvements are sought, however, to both increase the sensitivity of these experiments and their scan rate in frequency (mass), and active research and development is ongoing on strategies to circumvent the quantum limit entirely, such as receivers based on squeezed states of vacuum, and qubit-based single photon detectors. Among others in the talk, the HAYSTAC experiment at Yale will be highlighted as an example, where a squeezed-state receiver is currently in commissioning.