

Tatiana A. Webb

Assistant Professor, Department of Physics and Astronomy, Barnard College, New York, NY, USA



Title: Cavity-altered superconductivity

Abstract: Is it feasible to alter the ground-state of a material by engineering its electromagnetic environment? Amidst a variety of tantalizing predictions, experimental realizations of such cavity-controlled properties without optical excitation are beginning to emerge. In this work [1], we implement a new platform to realize cavity-altered quantum materials. Thin hyperbolic van der Waals crystals act as a resonant electromagnetic environment with enhanced density of photonic states and prominent mode confinement. We place hexagonal boron nitride (hBN) on the surface of organic superconductor κ -(BEDT-TTF)₂Cu[N(CN)₂]Br (ET). Nano-optical measurements demonstrate resonant coupling of the hBN hyperbolic modes with the C=C stretch phonon of ET. Using the Meissner force to probe superconductivity, we find a strong reduction of superfluid density near this resonant interface. These observations suggest that hBN/ET realizes a cavity-altered superconducting ground state and highlight the potential of dark cavities—devoid of external photons—for engineering quantum electronic ground states.

[1] Nature **650**, 864 (2026).