

## CONDENSED MATTER SCIENCES SEMINAR

# Professor Matteo Mitrano



Harvard University

### HOST

Dr Hitesh Changlani

### TITLE

Light-induced condensation of a quantum spin liquid

Friday, October 9<sup>th</sup>, 2026

1<sup>st</sup> Floor – B101

15:00-16:00

### ABSTRACT

Optical driving can trigger emergent symmetry breaking and offers a route to superconducting-like states far from equilibrium. In correlated quantum materials, superconductivity often emerges from strongly fluctuating regimes proximate to Mott insulating and quantum spin liquid phases. Yet it remains unclear whether light can trigger the condensation of fractionalized charges in a quantum spin liquid. Here, we use light to coherently drive the organic quantum spin-liquid candidate  $\kappa$ -(BEDT-TTF)<sub>2</sub>Cu<sub>2</sub>(CN)<sub>3</sub>. Starting from an insulating, fractionalized ground state, intense mid-infrared pulses induce a transient divergent imaginary conductivity, which we identify as a signature of the condensation of its bosonic charge excitations. This response is short-lived, consistent with Floquet dressing, and coexists with a weak two-fluid response of incoherent holon-doublons. Our results establish the observation of charge condensation in a quantum spin liquid and provide a key step toward understanding driven superconductivity and other nonequilibrium phases in correlated materials

### BIO

Matteo Mitrano is an experimental condensed matter physicist. He received his PhD in 2015 from the Max Planck Institute for the Structure and Dynamics of Matter in Hamburg (Germany) and was subsequently a Feodor Lynen postdoctoral fellow of the Alexander von Humboldt Foundation at the University of Illinois at Urbana-Champaign (USA). Since 2020, he leads an experimental group at Harvard University (USA), where he is Associate Professor of Physics.

His research investigates quantum materials and their nonequilibrium properties, aiming to understand and control strongly correlated quantum states. His group combines ultrafast optical and terahertz spectroscopy with advanced X-ray scattering at large-scale facilities to probe light-induced states of matter.

His work has been recognized with the LCLS Young Investigator Award (2019), the PRISM Prize of the Italian National Research Council (2021), the U.S. Department of Energy Early Career Award (2022), the IUPAP Early Career Award for Structural Dynamics (2024), a Mercator Fellowship of the German Physical Society (2025), and the Alfred P. Sloan Research Fellowship in Physics (2026).