

# Glueball Dark Matter: From Gravitational Waves to Direct Detection

*Tuesday, 23 June 2026 15:30 (20 minutes)*

This talk presents a unified view of glueball dark matter and related composite states in confining dark Yang–Mills sectors. I first review lattice-informed effective descriptions of dark confinement and chiral dynamics, and show how the resulting phase transitions can generate potentially observable gravitational-wave signals, especially in fermionic and near-conformal regimes. I then discuss the non-perturbative thermal evolution of the dark gluon–glueball system, which leads to a controlled prediction for the relic abundance of scalar glueball dark matter. Building on this framework, I introduce composite glueball axion-like particles generated by a  $\theta$  term and heavy fermion portals, yielding novel visible-sector couplings. Finally, I present recent progress on direct detection, where UV portal operators are matched to non-perturbative glueball amplitudes through a tensor-Pomeron-inspired EFT, opening a quantitative route to recoil searches and collider-consistent light-portal scenarios. Overall, this framework provides a coherent link between dark confinement, cosmological evolution, and experimental probes of strongly coupled dark sectors.

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