Contribution ID : **33** Type : **not specified**

Glueball Dark Matter

Friday, 26 September 2025 10:30 (30)

We explore a generic class of composite dark matter candidates arising from confining dark sectors, where phase transitions—especially deconfinement-confinement and chiral symmetry breaking—can generate stochastic gravitational waves. Using a combination of lattice results and effective field theory approaches such as the Polyakov Loop and PNJL models, we analyze the dynamics of these phase transitions and demonstrate that the resulting gravitational wave signals are highly sensitive to the fermionic content and representation in the dark sector. These signals are significantly enhanced near conformal symmetry and may be detectable by upcoming experiments such as DECIGO and the Big Bang Observer.
As a concrete realization, we focus on glueball dark matter arising from a pure Yang-Mills sector, where glueballs develop axion-like couplings to photons through radiative effects induced by heavy fermion portals. These glueball ALPs (GALPs) feature a coupling-mass relation determined by two fundamental scales: the dark fermion mass and the confinement scale. Without requiring fine-tuning or large mass assumptions, GALPs naturally populate previously unexplored ALP parameter space with suppressed electromagnetic interactions. Importantly, our framework yields a robust prediction for the GALP relic abundance—an order of magnitude below previous estimates—providing a new benchmark for both cosmological modeling and future detection strategies.

Primary author(s) : WANG □, ZHIWEI □□ (□□□□□□)

Presenter(s) : WANG □, ZHIWEI □□ (□□□□□□)

Session Classification : Plenary