Contribution ID: **24** Type: **Oral**

Heavy Quarkonium Dissociation Using Deep Learning–Driven Medium Parameters

Sunday, 26 October 2025 15:25 (20 minutes)

We present a machine learning–based framework for modeling temperature-dependent non-perturbative quantities in the quark-gluon plasma (QGP), aimed at improving predictions for heavy quarkonia suppression in high-energy nuclear collisions. Deep neural networks are trained on lattice data to extract temperature profiles of the Debye screening mass $m_D(T)$ and the QCD running coupling $\alpha_s(T)$. These learned profiles are incorporated into a potential model to compute quarkonium thermal widths and binding energies by numerically solving the Schrödinger equation with a complex, medium-modified heavy-quark potential.

To determine dissociation temperatures T_d, we employ two complementary criteria: the upper bound criterion $2E_B = \Gamma_{\text{th}}$, [1], and the lower bound criterion $E_B = 3T$, [2]. This unified ML-based approach enables a data-driven estimation of quarkonia dissociation across a broad temperature range, providing improved consistency with lattice QCD results and experimental suppression patterns observed in relativistic heavy-ion collisions. The framework offers a robust extension beyond perturbative techniques and can be adapted to model in-medium evolution in both isotropic and anisotropic backgrounds.

References:
1: A. Mocsy and P. Petreczky, Phys. Rev. Lett. 99, 211602 (2007)
2: S. Digal, P.Petreczky and H.~Satz, Phys. Lett. B 514, 57-62 (2001)

Primary authors: Dr JAMAL, MOHAMMAD YOUSUF (Central China Normal University Wuhan); Dr LI, Fu-Peng (Central China Normal University); 庞, 龙刚 (C); QIN, Guang-You (Central China Normal University)

Presenter: Dr JAMAL, MOHAMMAD YOUSUF (Central China Normal University Wuhan)

Session Classification: Parallel II

Track Classification: 重味与奇异粒子 (heavy flavor and strangeness)