

## Measurement of system size and energy dependence of $J/\psi$ production with the STAR experiment

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In relativistic heavy-ion collisions, the production of  $J/\psi$  serves as an important probe for studying the properties of quark-gluon plasma (QGP). However, interpreting the modification of  $J/\psi$  yields is challenging due to the interplay of hot, such as dissociation and regeneration, and cold nuclear matter effects. Measuring  $J/\psi$  production across various collision systems and energies is therefore essential for gaining deeper insights into QGP properties.

In this talk, we will present the nuclear modification factor ( $R_{AA}$ ) of  $J/\psi$  as a function of centrality and transverse momentum in O+O collisions at  $\sqrt{s_{NN}} = 200$  GeV, as well as in Au+Au collisions at  $\sqrt{s_{NN}} = 14.6, 17.3, 19.6,$  and  $27$  GeV. In particular, the O+O results can be used to explore small-system dynamics and provide a baseline for comparisons with larger systems, such as Au+Au or Pb+Pb collisions, thereby enriching our understanding of nuclear matter behavior across different scales. Furthermore, we examine the energy dependence of  $J/\psi$   $R_{AA}$  in central heavy-ion collisions, spanning RHIC to LHC energies, and compare the results with theoretical model predictions.

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