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Measurement of Quarkonium Production and Polarization in Heavy-Ion Collisions

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Quarkonium production provides a powerful probe of the deconfinement of strongly interacting matter in high-energy heavy-ion collisions. Because the binding potential of heavy quark–antiquark pairs is screened in the quark–gluon plasma (QGP), measurements of quarkonium yields and polarization can reveal the onset and properties of this deconfined medium. For the J/ψ meson, a bound state of a charm quark and antiquark, (re-)generation during the QGP evolution is established as the dominant production mechanism at low transverse momentum (p_{T}) and in central Pb–Pb collisions at LHC energies. This regeneration process serves as a direct probe of charm-quark deconfinement and the degree of thermalization in the QGP.

In this talk, we present comprehensive measurements of the J/ψ nuclear modification factor R_{AA} in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$~TeV. Furthermore, new results on J/ψ polarization in heavy-ion collisions will be discussed, providing an additional handle on the quarkonium production mechanism and possible modifications of spin alignment in the QGP. All results are compared with state-of-the-art theoretical model calculations to constrain quarkonium production dynamics and to characterize the properties of the deconfined medium.

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