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Recent results on charmonium production from nuclear and photonuclear interactions in Pb–Pb collisions with nuclear overlap in ALICE

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Charmonium is one of the most prominent probes used to investigate and quantify the properties of the quark-gluon plasma (QGP) created in ultra-relativistic heavy-ion collisions. Thanks to its larger size and weaker binding energy, the excited $\psi(2S)$ state is expected to be affected differently by the nuclear medium with respect to the J/ψ state, therefore the effects of nuclear medium on its production might be significantly different. The regeneration mechanism, within the QGP or at the phase boundary, is an important ingredient for describing the J/ψ production at LHC energies. $\psi(2S)$ production relative to J/ψ represents one possible discriminator between regeneration scenarios. Moreover, the determination of the non-prompt J/ψ production, originating from b-hadron decays, allows one to access the energy loss of b-quarks within the QGP, while prompt J/ψ measurements permit a direct comparison with models implementing regeneration. Furthermore, heavy ions accelerated at ultra-relativistic energies generate a strong electromagnetic field, leading to photonuclear interactions during the collision. The photoproduction of the J/ψ vector meson has been widely studied in ultra-peripheral collisions, where hadroproduction is negligible. In the last few years, this study was extended to heavy-ion collisions with nuclear overlap. The coherently photoproduced J/ψ are sensitive to nuclear gluon distributions at low Bjorken- x , and might be used in future to probe the formed and fast-expanding QGP.

In this contribution, latest ALICE results on inclusive, prompt and non-prompt J/ψ at midrapidity, on J/ψ and $\psi(2S)$ production at forward rapidity, and on coherent J/ψ photoproduction in both rapidity regions will be shown in Pb–Pb collisions with nuclear overlap at $\sqrt{s_{NN}} = 5.02$ TeV. The comparison with the available model calculations will be presented as well.

Submitted on behalf of a Collaboration?

Yes

Participate in poster competition?

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