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The $X(3872)$ to $\psi(2S)$ yield ratio in heavy-ion collisions

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In this work we show how to evaluate the $X(3872)$ to $\psi(2S)$ yield ratio ($NX/N\psi(2S)$) in $PbPb$ collisions, taking into account the interactions of the $\psi(2S)$ and $X(3872)$ states with light mesons in the hadron gas formed at the late stages of these collisions. We employ an effective Lagrangian approach to estimate the thermally-averaged cross sections for the production and absorption of the $\psi(2S)$ and use them in the rate equation to determine the time evolution of $N\psi(2S)$. The multiplicity of these states at the end of mixed phase is obtained from the coalescence model. The multiplicity of $X(3872)$, treated as a bound state of ($D\bar{D}^* + c.c.$) and also as a compact tetraquark, was already calculated in previous works. Knowing these yields, we derive predictions for the ratio $NX/N\psi(2S)$ as a function of the centrality, of the center-of-mass energy and of the charged hadron multiplicity measured at mid-rapidity [$dN_{ch}/d\eta(\eta < 0.5)$]. Finally, we make predictions for this ratio in $PbPb$ collisions at $\sqrt{s_{NN}} = 5.02$ TeV to be measured by the ALICE Collaboration in the Run 3. This contribution is based on the paper arXiv:2401.11320 and contains more discussion on the results.

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