

Photon induced production of J/ψ and dilepton pairs in semi-central nucleus-nucleus collisions

Friday, 1 March 2019 10:00 (25 minutes)

We calculate total and differential cross sections for J/ψ photoproduction in ultrarelativistic lead-lead collisions at the LHC energy $\sqrt{s_{NN}}=2.76$ TeV. In the present approach we use a simple model based on vector dominance picture and multiple scattering of the hadronic ($c\bar{c}$) state in a cold nucleus as an example. In our analysis we use both the classical mechanics and quantum (Glauber) formulae for calculating $\sigma_{tot, J/\psi Pb}$ which is a building block of our model. We compare our UPC results with ALICE and CMS data. For semi-central collisions ($b < R_A+R_B$) a modification of the photon flux is necessary. We discuss different motivated by physics approximations. We try to estimate the cross sections for different centrality bins and for J/ψ mesons emitted in forward rapidity range ($2.5 < y < 4$) corresponding to recent ALICE experimental results. Reasonable results are obtained and open questions are discussed.

We study the invariant-mass distributions of dileptons produced in ultrarelativistic heavy-ion collisions at very low pair transverse momenta, $P_T \leq 0.15$ GeV. Specifically, we investigate the interplay of thermal radiation with initial photon annihilation processes, $\gamma\gamma \rightarrow l^+l^-$, triggered by the coherent electromagnetic fields of the incoming nuclei. For the thermal radiation, we employ the emission from the QGP and hadronic phases with in-medium vector spectral functions which describes the inclusive excess radiation observed over a wide range of collision energies. For the coherent photon fusion processes, whose spectrum is much softer than for thermal radiation, we employ initial fluxes from the Fourier transform of charge distributions of the colliding nuclei in the equivalent-photon approximation. We first verify that the combination of photon fusion, thermal radiation and final-state hadron decays gives a fair description of the low- P_T invariant-mass as well as P_T spectra as recently measured by the STAR collaboration in $\sqrt{s_{NN}}=200$ GeV Au+Au collisions for different centrality classes, including experimental acceptance cuts. The coherent contribution dominates in peripheral collisions, while thermal radiation shows a markedly stronger increase with centrality. We extend the calculations to lower collision energies ($\sqrt{s_{NN}}=17.3$ GeV) and compare to the acceptance-corrected dimuon excess spectra measured by the NA60 experiment at the CERN SPS; the contribution from photoproduction turns out to be subleading. We also provide predictions for the ALICE experiment at the LHC. The resulting excitation function from SPS to LHC energies reveals a nontrivial interplay of photoproduction and thermal radiation.

Presenter: SZCZUREK, Antoni (IFJ Krakow)