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J/ψ production in Cu+Cu and Au+Au collisions at RHIC-PHENIX

S.X. Oda[a], for the PHENIX collaboration

[a] Center for Nuclear Study, Graduate School of Science, University of Tokyo
7-3-1 Hongo, Bunkyo, Tokyo 113-0033, Japan, *oda@cns.s.u-tokyo.ac.jp*

Heavy quarkonia (J/ψ, ψ', χ_c, Υ etc.) are considered to be among the most important probes for the deconfined quark gluon plasma (QGP) created by relativistic heavy ion collisions. The yields of heavy quarkonia are expected to be suppressed in the QGP due to Debye screening of the color charge. The J/ψ is especially promising because of its large production cross section and di-lepton decay channels, which make it easily detected. The PHENIX experiment at RHIC is able to detect J/ψ at mid rapidity ($|y| < 0.35$) via e^+e^- decays and at forward rapidity ($1.2 < |y| < 2.2$) via $\mu^+\mu^-$ decays. Models of J/ψ production in heavy ion collisions at RHIC energy contain a number of important competing effects, including reduction of J/ψ yields by cold nuclear matter effects, destruction of J/ψ due to interactions with thermal gluons in the QGP, reduced feed down from excited charmonium states that melt just above the QGP transition temperature, and enhancement of the yields due to coalescence of uncorrelated charm pairs. The recent PHENIX Au+Au data which were collected in 2004 at $\sqrt{s_{NN}} = 200$ GeV showed that the J/ψ suppression at forward rapidity is larger than that at mid rapidity and the suppression at mid rapidity is similar to that observed by NA50 at SPS in $\sqrt{s_{NN}} = 17.3$ GeV Pb+Pb collisions. However, these results are not well understood theoretically. Systematic study of J/ψ production in heavy ion collisions across the entire range of N_{part} is needed to disentangle the competing effects. In 2005, PHENIX recorded Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV to obtain precise data in the range $N_{part} \leq 126$, where Au+Au data is limited by statistics and systematic uncertainty. The final results of J/ψ in Cu+Cu collisions will be discussed and compared with PHENIX p+p, d+Au and Au+Au measurements and various theoretical models to understand in-medium effects on J/ψ production.