

Unresolved issues in hard-scattering at RHIC.

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One of the major, arguably *the* major, discovery at RHIC is the suppression of π^0 with $p_T \geq 3$ GeV/c by a factor ~ 5 in Au+Au central collisions at $\sqrt{s_{NN}} = 200$ GeV, where in p-p collisions the production in this p_T range is due to hard-scattering of the constituents of the nucleon as described by QCD. The suppression had been predicted in advance to be the result of Landau-Pomeranchuk-Migdal coherent (gluon) bremsstrahlung by the outgoing hard-scattered partons traversing the medium produced in Au+Au collisions, which is sensitive to the properties of the medium. Further evidence that the suppression was indeed due to the medium was given by the non-suppression (with respect to the point-like scaling of hard-scattering) of direct photons which do not interact with the medium. However, as more detailed measurements in Au+Au collisions became available, the clarity of the previous explanation became obscured. Prompt $e^\pm$ production from the decay of mesons containing the heavy quarks, charm and beauty, exhibited the same suppression as π^0 (which are produced by light quarks and gluons), naively arguing against the bremsstrahlung explanation. Measurements of π^0 suppression as a function of the reaction plane and centrality revealed a ~ 2 fm spatial or temporal region where no suppression occurs. Recombination models of the other exciting effect in the range $2 \leq p_T \leq 4.5$ GeV/c, the large $\bar{p}/\pi$ ratio ~ 1 , a factor of 3-5 larger than exhibited by known jet fragmentation in p-p collisions, failed to explain the jet like structure associated to the $\bar{p}$, which is essentially the same as that for mesons in both the near and far hemispheres. Preliminary results of direct photon production for $p_T \approx 20$ GeV/c appeared to indicate a suppression approaching that of π^0 . These new results raised a host of questions that remain to be answered. For instance: since no measurements exist, are structure functions in nuclei as a function of centrality really understood? Do partons lose energy continuously or discretely in the medium? Do a significant number of partons exit the medium without losing energy? Are there really monojets in d+Au collisions? etc. These and other questions will be discussed together with the measurements that give rise to them. Hopefully, during the course of the meeting many of these questions will be answered or methods proposed to resolve them.