Dileptons from the deconfinement phase transition

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Photons and dileptons are excellent probes of the hot and dense matter formed in high energy collisions of heavy nuclei. Due to their large mean free path thermal radiation from both quark gluon plasma and the hot hadronic gas are accessible to experiment. Their spectra and other properties not always match expectations, indicating that we do not yet fully understand the emission processes. E.g. the yield of dileptons at RHIC with masses below the ρ meson is larger than expected in most calculations. We have embarked on a project to identify additional sources of electromagnetic radiation that have not been taken into account in previous theoretical calculations. In particular, we have calculated rates of radiation that is emitted during hadronization processes. This includes photons associated with recombination, $q+\bar{q} \to \gamma + \pi$, and $q+\bar{q} \to \gamma + \rho$ (where γ could be either a real or virtual photon, the latter decaying into dileptons), as well as recombination and direct decay, $q+\bar{q} \to \rho \to$ dileptons.

We find that the rates of these processes are competitive with both quark gluon plasma and hot hadronic gas emission. We have plugged the rates into a hydrodynamic fireball simulation tuned to RHIC energies, and find that photon yields from hadonization are suppressed compared to other thermal emission because of the short duration of the emission process (just above the critical temperature). However we find that they make a sizable contribution to dileptons with masses below the ρ peak.