e+e- pairs: a clock and a thermometer of relativistic heavy ion collisions

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Relativistic heavy ion collisions are powerful experimental tools to study the nuclear medium under extreme conditions of density and temperature. Recently, we have growing evidences that a new state of matter is formed in $\sqrt{s_{NN}}$ = 200 GeV Au+Au collisions at RHIC: a strongly coupled Quark Gluon Plasma of partonic degrees of freedom which develops a collective motion. As not affected by strong interaction, dilepton spectra can probe the whole time evolution and dynamics of any stage of the collision, which may experience an onset of deconfinement and/or chiral symmetry restoration, as well as the production of thermal photons, emitted as a blackbody radiation from the plasma.

The excess yield measured at SPS in the low mass dilepton continuum invokes in-medium modifications of hadron properties, and may allow disentangling the emission time of different sources. Recent data collected at RHIC extend these measurements into a new energy regime. Central Au+Au collisions show an enhanced yield which increases faster with centrality than the number of participating nucleons, suggesting emission from scattering processes in the medium.

While the mass dependence is important for an understanding of in-medium changes of light vector mesons and is insensitive to collective expansion, the p_T dependence arises from an interplay between emission temperature and collective transverse flow; since each phase develops a specific p_T dependence by hydro dynamical expansion, this effectively results in a kinematical constrain of the phase diagram.