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A fundamental test of the Higgs Yukawa coupling in Relativistic Heavy Ion Collisions MICHAEL TANNENBAUM, Brookhaven National Laboratory — Hard-scattering of point-like constituents (or partons) in p-p collisions was discovered in 1972 by experiments utilizing inclusive single or pairs of hadrons with large transverse momentum $p_T > 2-5$ GeV/c. Similar measurements in Au+Au collisions at RHIC revealed suppression by a factor of 5 relative to point-like scattering for nearly all measured identified hadrons such as π^0 and η with $p_T > 2-5$ GeV/c but no-suppression for direct-γ production. This indicated a strong medium effect on outgoing partons suggestive of the predicted LPM radiative energy loss in a QGP. Evidence for such energy loss was provided by the away side conditional yield of associated particles, with p_{T_a}, from a trigger π^0, with p_{T_t}, the $x_E \sim p_{T_a}/p_{T_t}$ distribution. The ratio of the x_E distributions for a given p_{T_t} in A+A to p-p collisions, $I_{AA}(x_E)$, shows an exponential drop at low x_E, indicating energy loss. However, observation that direct-electrons from the decay of heavy quarks are also suppressed by a factor of 5 for $p_{T_e} > 5$ GeV/c in Au+Au raised doubts about radiative energy loss and has attracted more exotic explanations. For instance if the Higgs mechanism gives mass to gauge bosons but not to fermions then a proposal that all 6 quarks are nearly massless in a QGP could explain the apparent equal suppression of light and heavy quarks. This proposal can be tested with future measurements of $b-\bar{b}$ correlations in Au+Au collisions.

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