Dilepton Rates (II)

hadronic current: $(N_f = 3)$

$$J^V_\mu(x) = \bar{q}(x)\gamma_\mu(\lambda^a/2)q(x)$$

hadron tensor: (medium)

$$\Pi^V_{\mu\nu}(\omega,\vec{q}) = \sum_k \int d^4x e^{-iqx} \langle k|J^V_\mu(x) J^{V\,\dagger}_\nu(0))|k\rangle \rho_k$$

$$\rho_k = \frac{e^{-(E_k-\mu N_k)/T}}{\mathcal{Z}} \qquad \text{density matrix}$$

tensor structure: (Lorentz invariance broken)

$$\Pi^V_{\mu\nu}(\omega,\vec{q}) = \Pi^V_L(\omega,\vec{q})P^L_{\mu\nu} + \Pi^V_T(\omega,\vec{q})P^T_{\mu\nu}$$

longitudinal transverse

$P^{L,T}_{\mu\nu}$: long (trans) projectors