

Pion electromagnetic formfactor at finite temperature *

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In [1] we have proposed that a combined effect of an in medium modified pion dispersion relation together with a change of the pion formfactor due to chiral symmetry could provide a qualitative explanation for the enhancement of the dilepton production reported by the CERES collaboration [2]. As previous studies in the context of BEVALAC energy heavy ion collisions have shown [3,4], special care needs to be taken to ensure gauge invariance of the medium modified production amplitude. Using the soft pion limit, we explicitly could prove the gauge invariance of our result by showing that the relevant Ward-Takahashi identities are all satisfied.

An important result is that for back-to-back dilepton pairs the pion form factor in the time-like region does not have to go to one in the limit $k^2 \rightarrow 0$. Charge conservation constrains only the limit of the zero-component of the vertex-function

$$\Gamma_0(k_0 \rightarrow 0, \vec{k} = 0) = -\partial\Pi_\pi(p)/\partial p_0 \quad (1)$$

If, on the other hand, one approaches $k^2 \rightarrow 0$ from the space-like region the Ward-Takahashi identities constrain the spatial components of the vertex function

$$\Gamma_i(k_0 = 0, k_j = 0, j \neq i; k_i \rightarrow 0) = -\frac{\partial\Pi_\pi(p)}{\partial p_i}. \quad (2)$$

This of course is due to the fact that the heat bath breaks Lorentz invariance. In other words, there may very well be a discontinuity in either Γ_0 or Γ_i when going from space-like to time like photons. The actual pion formfactor we obtain is shown in figure 1.

As far as a quantitative comparison with the CERES data is concerned, we found [5] that the change in the pion form-factor around the mass of the ρ -meson, which is directly related with the onset of chiral restoration, can not be extracted from present data. To achieve that one needs to have good enough a mass resolution to identify the ω -meson.

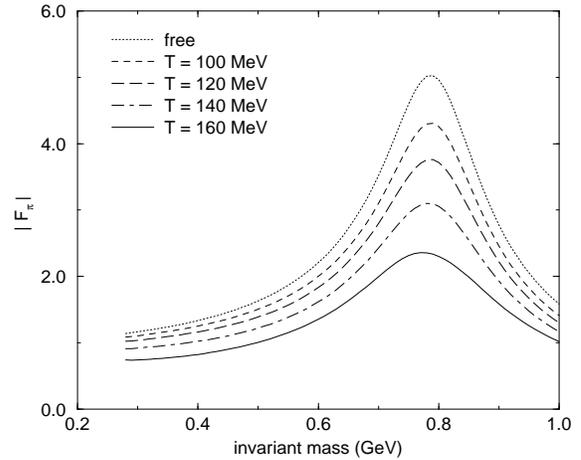


Figure 1: Pion form-factor at finite temperatures

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