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Anisotropy of thermal dileptons

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It is shown that the interaction of quarks with the collective color field confining them results in an intensive radiation of the magnetic bremsstrahlung type (synchrotron radiation). An existence of the boundary bremsstrahlung is based on three quite realistic assumptions: (i) the presence of relativistic light quarks (u and d quarks) in the hot medium; (ii) the semiclassical nature of their motion; (iii) confinement. The intensity of such a radiation for the hot medium of size 1–10 fm that is expected in ultrarelativistic collisions of heavy ions is comparable with that of the volume mechanism of photon and dilepton production in the temperature range of $T = 200{-}500\,\text{MeV}$. Quantitavelly a relative effect is regulated by the three basic parameters: the characteristic medium (QGP) size R, the QGP temperature T, and the confining force σ, which are firmly fixed. Possible uncertainties come mainly from the simple modeling of confinement and simplification of the QGP geometry what allow us to obtain estimates in transparent analytical form.

The most striking feature of magnetic bremsstrahlung is the high degree ($\sim 20\,\%$) of polarization of both real and "massive" (virtual) photons that is mainly determined by the medium (QGP) geometry. The virtual photons develop the noticeable specific anisotropy in the angle distribution of leptons with respect to the three-momentum of pair. The origin of this anisotropy is rooted in the existence of a characteristic direction in the field where the quarks are moving. Besides the synchrotron radiation will be nonisotropic for the noncentral collisions because the photons are dominantly emitted around the direction fixed by a surface normal. As result, the coefficient of elliptic anisotropy for dilepton pairs will be also proportional to the eccentricity of QGP system as it takes place for the bremsstrahlung real photons and can be experimentally measured.

Indeed, in order to draw a more definite conclusion, further investigations are necessary including, in particularly, a proper comparison with other sources of photons and dileptons.

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