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Quark Pair Production from Expanding Electromagnetic Flux Tube

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Just after a collision of ultra-relativistic heavy ions, there appear strong color electromagnetic flux tubes. It is commonly believed that the electromagnetic flux tubes decay into a huge number of particles to form the quark-gluon plasma, however, its physical mechanics is not well understood.

We discuss the quark production from an expanding electromagnetic flux tube based on the Schwinger mechanism. Emphasis is put on the effects of the expanding geometry and/or the existence of magnetic fields in addition to electric fields. In the first part of this presentation, we analytically compute the time evolution of the produced quarks by ignoring their backreaction to the electromagnetic flux tube, and show that (i) the quark distribution is consistent with the Schwinger formula for small transverse mass m_T , but it has a power-dependence m_T^{-4} for large transverse mass m_T ; (ii) the higher Landau level contributions are not exponentially suppressed. In the second part of this presentation, we take into account the backreaction effects by using numerical and/or model calculations, and discuss their phenomenological consequences in the formation of the quark-gluon plasma.

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