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Particle production and vacuum structure in QED

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The decay of electric fields into electron-positron pairs and conversion of classical field energy into matter remains one of the most exciting unverified predictions of relativistic quantum theory [1,2]. Advances in high intensity lasers bring the phenomenon tantalizingly close to experimental realization but also demand more sophisticated calculations and understanding of signals to identify the uniquely strong-field particle production events [3]. Some such signals point to the need for deeper understanding of the relation between the perturbative vacuum, particle states and classical fields, thus connecting to fundamental questions about quantum theory and spacetime structure [4].

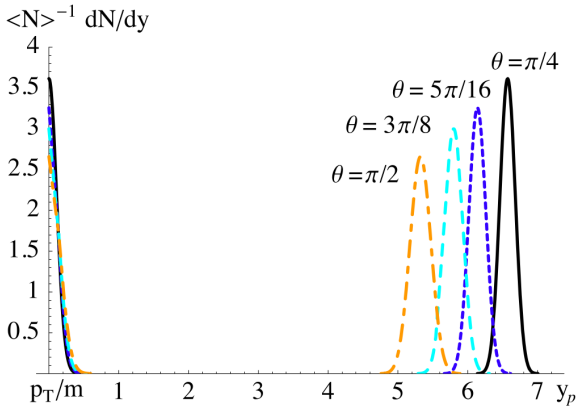

Fig 1. Transverse momentum and rapidity distributions of electron-positron pairs produced from two laser fields colliding at an angle θ. From [5].

References
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