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Photoexcitation cascade and quantum-relativistic jet formation in graphene[1] CYPRIAN LEWANDOWSKI, LEONID LEVITOV, Massachusetts Inst of Tech-MIT — Interactions between ultra-relativistic particles can lead to striking behavior in which a high-energy particle creates showers of softer particles characterized by a collimated angular distribution aligned with the particle velocity. These showers, known as jets, are a generic phenomenon relevant for all quantum cascades of linearly dispersing particles. This talk will discuss jets formed upon photoexcitation in graphene, which due to its linear dispersion provides an appealing medium for exploring quantum-relativistic phenomena. We will study the cascade generated by carrier-carrier collisions in photon absorption, wherein a single photon creates an electron-hole (e-h) excitation that decays producing multiple near-collinear secondary e-h excitations. We will argue that the cascade can occur through an off-shell mechanism such that all the particles and holes involved reside outside the energy-momentum dispersion manifold, relieving the bottleneck arising in the on-shell process due to energy and momentum conservation. The characteristics of the jets such as the angular and energy distribution of the particles will be discussed. Photogenerated jets provide an interesting setting to investigate the carrier-carrier collision processes in graphene and other Dirac materials.

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Cyprian Lewandowski
Massachusetts Inst of Tech-MIT

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