

Massachusetts Institute of Technology  
Department of Physics

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Condensed Matter Theory Seminar

"Photoexcitation Cascade and Quantum-Relativistic Jets in Graphene"

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**Abstract:** Interactions between 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 how jets can be formed upon photoexcitation in graphene, which due to its linear dispersion provides an appealing platform for exploring quantum-relativistic phenomena. We will study the cascade generated by carrier-carrier collisions in photon absorption, where a single photon creates an electron-hole (e-h) excitation that decays producing multiple near-collinear secondary e-h pairs. We will argue that such a cascade can occur through an off-shell mechanism, which relieves the bottleneck that arises in an on-shell process due to energy and momentum conservation. The off-shell mechanism stands in contrast to a more conventional description of a photoexcitation cascade, where all participating carriers at all times and all stages of the cascade satisfy the energy-momentum relation. Photogenerated jets provide an interesting setting to investigate the carrier-carrier collision processes in graphene and other Dirac materials.

**12:00pm noon**  
**Tuesday, May 15, 2018**  
**Duboc Room (4-331)**

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Host: Itamar Kimchi