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THE NONLINEAR TERAHERTZ RESPONSE OF GRAPHENE

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Abstract: Over the past decade or more, there has been a great deal of interest in the mechanical, electronic and optical properties of graphene. The interest in the optical properties of graphene stems largely from two key features of the electronic band structure: it is gapless and the dispersion is linear near the Dirac points where the two bands touch. Both of these features can be uniquely accessed using terahertz radiation, because, under the right conditions, it can strongly drive both interband and intraband transitions. In this talk, I will describe the formalism and computational results of our density-matrix approach to modelling the nonlinear terahertz response of graphene, including various scattering mechanisms. As I will show, in undoped graphene, a very large nonlinearity can arise due to the interplay between the intraband and interband transitions. I will finish by showing how a parallel-plate waveguide configuration containing graphene could be used to generate the third harmonic of a 2 terahertz incident field with a power conversion efficiency of up to 20%. If time allows, I will also discuss our recent results on the effects of impurities and strain on third harmonic generation in graphene.