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Second-order nonlinear optical effects in multilayer graphene

Optical properties of graphene are being intensively studied nowadays due to a high interest in both the fundamental properties and possible applications of this unique material. Second-order nonlinear optical effects in graphene are studied much less, mostly due to a high symmetry of its crystallographic structure, which results in small values of the second-order susceptibility. At the same time, such effects as optical second harmonic generation (SHG) are known as a sensitive technique for the characterization of structural, electronic, transport etc. properties of centrosymmetric media, which is the case of graphene. In this talk I will focus on recent experimental studies of second-order nonlinear optical effects in graphene, with the main emphasis on the underlying mechanisms and symmetry considerations. The experiments on optical second harmonic generation and hyper-Rayleigh scattering, dc current induced SHG, as well as photogalvanic effects will be revealed.