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Single Photon Nonlinear Optics in Graphene MICHAEL GULLANS, Harvard University, DARRICK CHANG, FRANK KOPPENS, ICFO-Institut de Ciències Fotoniques, F. JAVIER GARCÍA DE ABAJO, Instituto de Optica-CSIC, MIKHAIL LUKIN, Harvard University — Achieving strong interactions between photons is a central goal in quantum information science and classical nonlinear optics. We show that one can realize significant nonlinear interactions at the few photon level in bulk graphene by taking advantage of the electric field enhancement associated with the strong confinement of graphene plasmons. We also show that one can achieve significantly out-coupling to free space by using a nonlinear grating. We discuss applications of this system that emerge due to the unique fabrication opportunities and electrical control of graphene.

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