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Hot carrier cooling with Landau levels in graphene XINGHAN CAI, SANFENG WU, Department of Physics, University of Washington, Seattle, WA 98195, USA, YOU LAI, National High Magnetic Field Laboratory, Tallahassee, FL 32310, USA, DAVID COBDEN, Department of Physics, University of Washington, Seattle, WA 98195, USA, ZHIQIANG LI, National High Magnetic Field Laboratory, Tallahassee, FL 32310, USA, XIAODONG XU, Department of Physics, University of Washington, Seattle, WA 98195, USA — Photo-excited hot carriers in homogeneous graphene can give rise to photocurrent under perpendicular magnetic field. In turn, this so-called photo-Nernst effect can be used to probe hot-carrier dynamics as modified by the formation of Landau levels. We have carried out an ultrafast optical pump-probe photocurrent study of hexagonal boron nitride encapsulated graphene devices in the quantum Hall regime. Photocurrent, which exhibits quantum oscillations, is observed when the laser spot is near the free edges of the graphene. The relaxation time of the photo-Nernst current shows a drastic change when the graphene's Fermi energy is tuned across a Landau level. Our observation points to a new means of probing and control of non-equilibrium carrier dynamics in the quantum regime.

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