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Supercollision cooling in undoped graphene SUNG HO JHANG, ANDREAS BETZ, EMILIANO PALLECCHI, ROBSON FERREIRA, GWENDAL FEVE, JEAN-MARC BERROIR, BERNARD PLACAIS, Ecole normale superieure - Paris, ECOLE NORMALE SUPERIEURE - PARIS TEAM, LABORATOIRE DE PHOTONIQUE ET NANOSTRUCTURES COLLABORATION — We have investigated the electron-lattice cooling rate in graphene by means of GHz Johnson noise thermometry. For phonon temperatures (T_{ph}) larger than Bloch-Grüneisen temperature ($T_{\rm BG}$), we find the energy relaxation rate J obeys a cubic law as a function of electron temperature T_e. In this regime, the small Fermi surface of graphene drastically restricts the allowed phonon energy in ordinary electron-phonon scattering, and disorder-assisted supercollisions dominate over the conventional electron-phonon collisions. In the low-temperature regime, for $T_{ph} < T_{\rm BG}$, we regain $J \propto T_e^4$ dependence, which is the signature of standard electron-phonon interaction in the 2D graphene. Beside its implication for electron-phonon physics, our observations are of direct relevance for the performance of graphene bolometers and photo-detectors.

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