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Infrared observation of gate-tunable bandgap and a giant Fano electron-phonon resonance in bilayer graphene ALEXEY KUZMENKO, IRIS CRASSEE, DIRK VAN DER MAREL, University of Geneva, PETER BLAKE, KONSTANTIN NOVOSELOV, ANDRE GEIM, University of Manchester, LARA BENFATTO, EMMANUELE CAPPELLUTI, University "La Sapienza", Rome —
We studied infrared spectra of bottom gated bilayer graphene on SiO_2/Si substrate. The two major results of our study are: (i) a determination of the gate-voltage dependent bandgap, and (ii) an observation of a new giant phonon resonance at 0.2 eV. In addition, the Slonczewski-Weiss-McClure tight binding model parameters were extracted by a simultaneous fitting of infrared data at all gate voltages. The gate-voltage dependence of the bandgap supports the calculations, which take electrostatic self-screening effects into account. The phonon peak shows several remarkable anomalies: (i) a giant enhancement with the applied gate voltage, which we ascribe to the so-called "charged-phonon" effect and (ii) a pronounced Fano lineshape, which is a manifestation of a coupling of this phonon to a continuum of electron-hole excitations. The obtained results show an outstanding potential of bilayer graphene for applications in electronics and opto-electronics.

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