Graphene cold-electron bolometer

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Graphene, the atomic monolayer of carbon, has gotten a lot of interest since it was experimentally realized in 2004, an achievement acknowledged with the Nobel prize in physics 2010 [1,2]. Graphene may be bring contributions to fundamental research, electronic devices, sensors, biological imaging, photonics and several other fields.

We fabricate high quality graphene using the so called "scotch-tape-method", where flakes of graphite are peeled with tape and deposited on a substrate. The electronic quality of the graphene is verified using quantum Hall- and field effect measurements. This shows that it is in fact high quality single-layer graphene.

Many of the most promising applications rely on sensor devices based on graphene. In this work we investigate a cold-electron bolometer with a graphene absorber. The cold-electron bolometer is one type of cryogenic bolometers for high sensitivity THz radiation detection [3]. It consists of a normal metal absorber connected to superconducting antenna leads through superconducting-insulator-normal metal (SIN) junctions. One of the main factors limiting the performance of such device is the absorber volume. The use of graphene as the normal metal absorber presents a possible route to drastically reduce the volume, being only one atom thick. At 277 mK we measure the temperature responsivity of 0.4 μV/mK and a clear optical response to microwaves at frequency 110 GHz.

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