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Thermoelectric transport in graphene with tunable mobility[1]

XINFEI LIU, Physics Deaprtment, UC Riverside, DEQI WANG, JING SHI, Physics Department, UC Riverside — Thermoelectric transport properties of single layer graphene have recently been studied both experimentally and theoretically. The unique band structure of graphene leads to unusual thermoelectric properties which are very sensitive to the carrier mobility. However, all previous experiments were carried out in graphene devices with different mobility values and comparisons were drawn among different devices. Recently, we have shown that by controlling the charge state of the ligand-bound nanoparticles on graphene it is possible to tune the mobility of the same graphene device over a wide range, e.g. 5000-19000cm^2/Vs. In this work, we adopted this method and successfully tuned the mobility of graphene while systematically studied the Seebeck and Nernst effects in a magnetic field up to 14 Tesla for each fixed mobility value. Our results show that at zero magnetic field, the width of the transition region near the Dirac point decreases sharply and the diverging behavior in the Seebeck coefficient becomes more pronounced as the mobility is tuned from low to high. At high magnetic fields, the Seebeck coefficient in the high mobility state clearly reveals additional features that are related to the splitting of the zeroth Landau level near the Dirac point. Moreover, we demonstrate that the Nernst peak height at the Dirac point depends linearly on the carrier mobility in graphene.

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