Graphene Membranes for Cryogenic Nano-Electro-Mechanical Resonators

Z. Han, A. Allain, and V. Bouchiat

Neel Institute, CNRS, 25 rue des Martyrs, 38042 Grenoble, France

Graphene is a very promising material for implemeting nano-electromechanical resonators as it combines extremely low mass, very high young modulus (1 TPa) and tunable charge density with excellent carrier mobilities [1]. We present experimental study of graphene membrane resonators obtained by the controlled under-etching of Graphene transistors. Graphene menbranes have been fabricated by chemical vapor deposition [2], and subsequently patterned into an array of back-gated resonators by optical lithography. Actuation is realized by RF irradiation on the gate while measurement of the mechanical resonance is obtained by heterodyne frequency mixing [3], followed by lock-in detection. Resonances and quality factors for micron-scale doubly clamped membranes are studied at both room temperature and low temperature. The dispersion curves measured at different temperatures show that stress within the membrane determine the resonance properties. Perspective to use these devices in the superconducting state (or even at tens of mK) after controlled doping [4] and realizing suspended Josephson junctions will be presented.

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