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High frequency nanomechanical resonators in ultraclean suspended graphene pn junctions MINKYUNG JUNG, PETER RICKHAUS, SIMON ZIHMANN, PETER MAKK, Department of Physics, University of Basel, ALEXANDER EICHLER, Department of Physics, ETH Zurich, MARKUS WEISS, CHRISTIAN SCHÖNENBERGER, Department of Physics, University of Basel, DEPARTMENT OF PHYSICS, UNIVERSITY OF BASEL TEAM, DEPARTMENT OF PHYSICS, ETH ZURICH TEAM — Here, we demonstrate high frequency nanomechanical resonators in ultraclean suspended graphene pn junctions. The suspended graphene resonators are fabricated on two bottom gates (left and right) covered with lift-off resist (LOR) by using a mechanical transfer technique. After current annealing, the device exhibits a clear charge neutrality point around zero gate voltage. Depending on the left and right bottom gate voltages, the device shows four different conductance regimes: pp, nn, np and pn corresponding to two different carrier types in the two sides of the sample. At pn and np regimes, the clear Fabry-Perot interference pattern is observed, indicating ballistic transport behavior over 1μm-long channel. Then, the mechanical resonance is measured in the same device with a frequency modulation (FM) mixing technique at 4.2 K in the vacuum chamber. The resonance frequency is about 405 MHz. By fitting resonance frequency, we deduce both the mass density and the built-in tension in the graphene sheet. In a similar device structure with different strain environment, we observe a resonance frequency as high as 1.17 GHz for the fundamental mode.

Minkyung Jung
Department of Physics, University of Basel

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