Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Towards Quantum Strain Engineering in Ultra-short Ballistic Graphene Devices ANDREW MCRAE, VAHID TAYARI, SIMEON HANKS, ALEXANDRE CHAMPAGNE, Concordia University — We report our progress towards combining ultra-short and clean suspended graphene transistors [1] with mechanical breakjunction (MCBJ) instrumentation to create a widely tunable quantum strain engineering platform for graphene electronics. We first present data from our electromigrated ultra-short ($\sim$ 10 to 50 nm) suspended graphene transistors, which show ballistic transport [1], and demonstrate that we can tailor the length and shape of the suspended graphene by adjusting the electromigration parameters. We observe Fabry-Pérot interferences, which correspond to coherent transport not only in the suspended graphene channel, but also in the suspended graphene contacts connecting to the channel. We then describe the MCBJ assembly we use to bend the substrate in-situ at low temperature. Using long suspended cantilever contacts, this instrumentation allows strains up to $\sim$ 10% for device lengths $\sim$ 10 nm. The assembly is hosted in a cryostat operating down to 0.3 K and in magnetic fields up to 9 T. We finally report on our progress towards the application of large uniaxial strain for graphene strain transistors, and graphene NEMS with tunable frequencies approaching the THz range. [1] V. Tayari *et al.*, Nano. Lett. **15**, 1 (2015)

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Date submitted: 06 Nov 2015 Electronic form version 1.4