Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

**Electromechanical coupling in atomically thin $MoS_2$ and graphene** SAJEDEH MANZELI, MUHAMMED MALIK BENAMEUR, ADRIEN ALLAIN, AMIRHOSSEIN GHADIMI, MAHMUT TOSUN, ANDRAS KIS, Electrical Engineering Institute, Ecole Polytechnique Federale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland, FERNANDO GARGIULO, GABRIEL AUTS, OLEG V. YAZYEV, Institute of Theoretical Physics, Ecole Polytechnique Federale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland — Nanoelectromechanical systems (NEMS) based on novel materials such as graphene and $MoS_2$ allow studying their electromechanical characteristics. Here, we incorporate single and bilayer $MoS_2$ and graphene into NEMS and investigated their electromechanical behavior. We observe a Strain-induced bandgap modulation in atomically thin $MoS_2$ membranes with a thickness dependent modulation rate. Finite element modeling is used to extract the piezoresistive gauge factor for $MoS_2$. In the case of graphene, deflection of monolayer graphene nanoribbons results in a linear increase in their electrical resistance where an upper limit is estimated for the gauge factor. Surprisingly, we observe oscillations in the electromechanical response of bilayer graphene. Our numerical simulations indicate that these oscillations arise from quantum mechanical interference in the transition region induced by sliding of individual graphene layers with respect to each other. Our results reveal that atomically thin $MoS_2$ membranes show strong piezoresistive effect, comparable to the state-of-the-art silicon sensors. Moreover, bilayer graphene conceals unexpectedly novel physics allowing the rare observation of room temperature electronic interference phenomena.

Sajedeh M
Electrical Engineering Institute, Ecole Polytechnique Federale de Lausanne (EPFL), CH-1015 Lausanne, Switz

Date submitted: 06 Nov 2015 Electronic form version 1.4