



center for nanophysics
and advanced materials

Condensed Matter Colloquium

Thursday, May 1, 2014

2 pm, Room 1201



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Soft phonon modes in strained monolayer materials

Two dimensional materials display a wealth of novel phenomena, including unique soft phonon modes. Here we show that monolayer materials possessing semimetallic, semiconducting, and insulating electronic ground states all exhibit a similar phonon instability under sufficient strain. More specifically, graphene, BN, graphane, and MoS₂ all exhibit a K-point phonon instability which leads to mechanical failure under strain. The transition is first-order in all cases except graphene. For BN, graphane, and MoS₂ the phase transitions are not associated with the opening of a band gap, which indicates that Fermi surface nesting is not the driving force. We perform an energy decomposition that demonstrates why the soft modes at the K-point are unique and how strain drives the phonon instability. The remainder of the talk is dedicated to TaS₂, where a phonon instability is shown to drive a Mott insulating state in the monolayer and a novel one dimensional metal in the bulk.

Refreshments at 1:30 pm in **Room 1305F**

HOST: **Nick Butch**

