Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

The Virial Theorem in Graphene and other Dirac Materials JAMES STOKES, Boston College, BNL, HARI DAHAL, PRB, ALEXANDER BALATSKY, LANL, NORDITA, KEVIN BEDELL, Boston College — The virial theorem is applied to graphene and other Dirac Materials for systems close to the Dirac points where the dispersion relation is linear. From this, we find the exact form for the total energy given by $E = \mathcal{B}/r_s$ where $r_s a_0$ is the mean radius of the d-dimensional sphere containing one particle, with a_0 the Bohr radius, and $\mathcal{B}$ is a constant independent of r_s. This result implies that, given a linear dispersion and a Coulombic interaction, there is no Wigner crystalization and that calculating $\mathcal{B}$ or measuring at any value of r_s determines the energy and compressibility for all r_s. In addition to the total energy we calculate the exact forms of the chemical potential, pressure and inverse compressibility in arbitrary dimension.

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Date submitted: 09 Nov 2012 Electronic form version 1.4