Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

High resolution transmission electron microscope Imaging and first-principles simulations of atomic-scale features in graphene membrane WEI WANG, SAGAR BHANDARI, WEI YI, DAVID BELL, ROBERT WESTERVELT, EFTHIMIOS KAXIRAS, Harvard University, KAXIRAS TEAM, WESTERVELT TEAM — Ultra-thin membranes such as graphene[1] are of great importance for basic science and technology applications. Graphene sets the ultimate limit of thinness, demonstrating that a free-standing single atomic layer not only exists but can be extremely stable and strong [2–4]. However, both theory [5, 6] and experiments [3, 7] suggest that the existence of graphene relies on intrinsic ripples that suppress the long-wavelength thermal fluctuations which otherwise spontaneously destroy long range order in a two dimensional system. Here we show direct imaging of the atomic features in graphene including the ripples resolved using monochromatic aberration-corrected transmission electron microscopy (TEM). We compare the images observed in TEM with simulated images based on an accurate first-principles total potential. We show that these atomic scale features can be mapped through accurate first-principles simulations into high resolution TEM contrast. [1] Geim, A. K. & Novoselov, K. S. *Nat. Mater.* **6**, 183-191, (2007). [2] Novoselov, K. S.*et al. Science* **306**, 666-669, (2004). [3] Meyer, J. C. *et al. Nature* **446**, 60-63, (2007). [4] Lee, C., Wei, X. D., Kysar, J. W. & Hone, J. *Science* **321**, 385-388, (2008). [5] Nelson, D. R. & Peliti, L. *J Phys-Paris* **48**, 1085-1092, (1987). [6] Fasolino, A., Los, J. H. & Katsnelson, M. I. *Nat. Mater.* **6**, 858-861, (2007). [7] Meyer, J. C. *et al. Solid State Commun.* **143**, 101-109, (2007).

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Date submitted: 14 Nov 2011 Electronic form version 1.4