

Abstract Submitted
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Colossal Corrugations in Freestanding Graphene Observed with STM¹ P.M. THIBADO, P. XU, Y. YANG, S.D. BARBER, M.L. ACKERMAN, J.K. SCHOELZ, SALVADOR BARRAZA-LOPEZ, L. BELLAICHE, Department of Physics, University of Arkansas, IGOR A. KORNEV, Propriétés et Modélisation des Solides, France — The discovery of graphene, a unique two-dimensional electron system with extraordinary physical properties, has ignited tremendous research activity in both science and technology. Graphene interactions with a substrate, such as SiO₂/Si, are known to significantly degrade the electrical performance of graphene devices. Alternatively, suspending a graphene device eliminates the substrate interaction, thereby yielding a 10-fold increase in mobility. However, a detailed investigation on the microscopic scale explaining the origin of these improvements has yet to be completed. In this talk, we present for the first time atomic-resolution STM images of a freestanding graphene membrane. Samples were prepared by direct CVD growth and by large graphene sheet transfer, both onto a 2000-mesh copper grid. Atomic-scale corrugation amplitudes were observed in perfect registry with, yet 50 times larger than the expected electronic corrugations. Density functional theory revealed that charge localization occurs directly beneath the STM tip due to bond angles rotating away from sp² hybridization as graphene flexes in response to the electrostatic attraction. A detailed model of the 3-way interaction which accounts for the observed behavior will be discussed.

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