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Probing Mechanics of Rippled Two-Dimensional Materials RYAN NICHOLL, HIRAM CONELY, Vanderbilt University, NICKOLAY LAVRIK, IVAN VLASSIOUK, Oak Ridge National Laboratory, KIRILL BOLOTIN, Vanderbilt University — Two-dimensional materials such as graphene tend to ripple in the out of plane direction. These ripples arise both due to thermal fluctuations and uneven stress forces at the boundary. In this work, we study the effect of the rippling on the effective mechanical properties of graphene: Young's modulus and bending rigidity. To accomplish this, we developed a non-contact technique that allows probing mechanical properties of graphene at temperatures between 4K and 400K. We use a high voltage electrostatic force to pull on graphene and high-resolution optical interferometric profilometery to measure its mechanical response. We find that the effective Young's modulus of graphene is significantly softened and the bending rigidity is increased due to rippling.

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