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Phase transitions of monolayers on graphene JOSHUA KAHN, BORIS DZYUBENKO, OSCAR VILCHES, DAVID COBDEN, Department of Physics, University of Washington — We have studied physisorbed layers of monatomic and diatomic gases on graphene. We used devices in which few-layer graphene, ranging from monolayer to trilayer, is suspended across a trench between two platinum contacts and are cleaned by thermal and current annealing. We found that the density of adsorbates is revealed by the conductance, similar to the case with nanotubes. The conductance change for a monolayer can be large. On trilayer graphene the adsorbed gases can be seen to exhibit transitions between two-dimensional phases identical to those on bulk graphite, including incommensurate and commensurate solid, fluid and vapor and multiple layers. New features appear in the conductance at the boundaries of the commensurate phase of Kr. We are able to measure single-particle binding energies very accurately and see how it depends on thickness; investigate the effects of changing disorder by gradually current annealing; and search for new phases in the case of monolayer graphene where atoms adsorbed on both sides can interact. We can map out the 2d phase diagrams very quickly by ohmic heating, which gives nearly instantaneous control of the temperature.

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