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Hard and Soft Physics with 2D Materials.

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With their remarkable structural, thermal, mechanical, optical, chemical, and electronic properties, 2D materials are truly special. For example, a graphene sheet can be made into a high-performance transistor, but it is also the ultimate realization of a thin mechanical sheet. Such sheets, first studied in detail by August Föppl over a hundred years ago, are notoriously complex, since they can bend, buckle, and crumple in a variety of ways. In this talk, I will discuss a number of experiments to probe these unusual materials, from the effects of ripples on the mechanical properties of a graphene sheet, to folding with atomically thin bimorphs, to the electronic properties of bilayer graphene solitons. Finally, I discuss how the Japanese paper art of kirigami (kiru = 'to cut', kami = 'paper') applied to 2D materials offers a route to mechanical metamaterials and the construction of nanoscale machines.