2D atomic crystals and their heterostructures

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Probably the most important "property" of graphene is that it has opened a floodgate of experiments on many other 2D atomic crystals: $NbSe_2$, TaS_2, MoS_2, etc. One can use similar strategies to those applied to graphene and obtain new materials by mechanical or liquid phase exfoliation of layered materials or CVD growth. An alternative strategy to create new 2D crystals is to start with an existing one (like graphene) and use it as an atomic scaffolding to modify it by chemical means (graphane and fluorographene are good examples). The resulting pool of 2D crystals is huge, and they cover a massive range of properties: from the most insulating to the most conductive, from the strongest to the softest.

If 2D materials provide a large range of different properties, sandwich structures made up of 2, 3, 4 … different layers of such materials can offer even greater scope. Since these 2D-based heterostructures can be tailored with atomic precision and individual layers of very different character can be combined together, - the properties of these structures can be tuned to study novel physical phenomena (Coulomb drag, Hostadter butterfly, metal-insulator transition, etc) or to fit an enormous range of possible applications, with the functionality of heterostructure stacks is "embedded" in their design (tunnelling or hot-electron transistors, photovoltaic devices).