講演会要旨

Because of the intrinsic difficulty in opening a sizable band gap in graphene with just its minute spin-orbit coupling, a gold rush has started with the search for other group IV analogs, which could be utilized in digital electronics and possibly work as two-dimensional (2D) topological insulators at room temperature.

The canonical epitaxial phase of silicene was first realized on a silver (111) template in 2012 [1]. Next, the synthesis of other column 14 siblings, i.e., germanene [2] and stanene [3,4], has been quickly achieved. These exotic artificial forms of Si, Ge and Sn may help prolong Moore's law, since these novel 2D materials appear directly compatible with the ubiquitous silicon-based technology [5]. They may further find promising applications in spintronics and quantum computing, since they are predicted to be robust topological insulators hosting the quantum spin Hall effect at accessible temperatures [6].

In my lecture, I will describe the growth and exciting properties of these atom-thin 2D allotropes, as well as those of their multi-layer stacks [7,8]. Moreover, upon reducing further the dimensionality, I will present benzenelike 0D, nanodot germs, which develop upon further Si deposition into a striking array of massively parallel, symmetry breaking, and highly perfect single or double strand 1D penta-silicenelike nanoribbons [9].