Giuseppe Iannaccone
University of Pisa

Engineering transistors atom by atom with heterostructures of 2D materials

How close are we to the possibility of engineering next generation transistors atom by atom, as materials science and device engineering converge?

Recently, the so-called "materials-on-demand paradigm" has been proposed, thanks to the possibility of forming a "three-dimensional (3D) material" with tailored characteristics by combining layers of two-dimensional (2D) materials, such as graphene and other single-layer semiconductors, insulators, and metals.

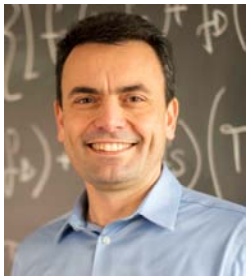
In many ways, this paradigm is a modern and challenging evolution of what in the 1980s was called "band-gap engineering" or "band-structure engineering", *i.e.*, the artificial modification of band edge profiles using heterostructures made possible by epitaxial growth of III-V and II-VI material systems.

Lateral and vertical heterostructures of 2D materials could represent a revolutionary and enabling technology to device engineering providing the possibility to engineer a transistor at the atomistic scale.

In this talk I discuss the challenges, opportunities, and the potential of atomistic engineering of electron devices exploiting the fundamental properties of 2D material heterostructures.

From the point of view of physical understanding, I will also highlight some peculiarities of the off-plane transport in heterostructures of 2D materials, that are not observed in the heterostructures based on III-V and II-VI materials systems.

Bio



Giuseppe Iannaccone is Professor of electronics at the University of Pisa, Italy, Fellow of the Institute of Electrical and Electronics Engineers, and Fellow of the American Physical Society. His interests include the fundamentals of transport and noise in nanoelectronic and mesoscopic devices, the development of device modeling and TCAD tools, and the design of extremely low-power circuits and systems for RFID and ambient intelligence scenarios. He has published more than 180 papers in peer-reviewed journals and more than 130 papers in proceedings of international conferences. Giuseppe Iannaccone has coordinated a few European and National Projects involving multiple partners and has acted as the Principal Investigator in several research projects funded by European and National public agencies and by private organizations.