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2D Electronics: what can we really expect?

One of the technological solutions under investigation in order to continue to come after Moore's Law [1] is to reduce channel thinness so to improve electrostatic control of the overlaying gate on the channel potential, as well as to decrease power consumption [2]. Due to their ultimate thinness, two-dimensional materials (2DMs) are exceptional candidates for ultra-scaled devices, but many questions remain open, and the real potential to be expected are still to be proven [3].

With respect to this, device simulations can provide relevant information, while assessing the performance against Industry requirements.

In this talk, we will provide an overview of the main requirements a new technology aiming at becoming the mainstream technology for Electronic applications has to satisfy, focusing on digital as well as on Radio Frequency applications (Fig. 1) [4].

One of the most limiting factors of ultra-scaled devices is related to the contact resistance between the metals and the 2DMs, which will be investigated through a multi-scale approach, ranging from ab-initio, to atomistic simulations.

Optoelectronic applications will be addressed, too, especially regarding solar cell applications, while exploiting 2DMs as possible substitute to Indium Tin Oxide, as transparent electrode in flexible bulk heterojunction solar cells.

References

[1] G.E. Moore, Electronic Magazine, 1, (1965) 4.
[2] ITRS, available at http://itrs.net
[3] G. Fiori et al., Nature Nanotechnology, 9 (2014) 768.
[4] G. Fiori et al., IEEE TED, 61 (2014) 729.

Figures

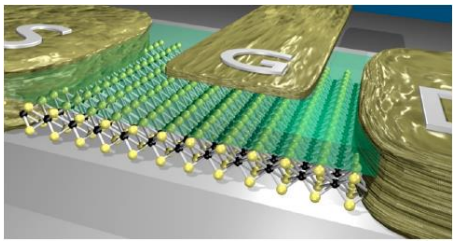

Figure 1: Sketch of a 2DM-based Field Effect Transistor.