Highlights

Superconducting and correlated low dimensional materials and devices for quantum electronics and spintronic - 2019

Towards oxide electronics: a roadmap

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At the end of a rush lasting over half a century, in which CMOS technology has been experiencing a constant and breathtaking increase of device speed and density, Moore's law is approaching the insurmountable barrier given by the ultimate atomic nature of matter. A major challenge for 21st century scientists is finding novel strategies, concepts and materials for replacing silicon-based CMOS semiconductor technologies and guaranteeing a continued and steady technological progress in next decades. Among the materials classes candidate to contribute to this momentous challenge, oxide films and heterostructures are a particularly appealing hunting ground. The vastity, intended in pure chemical terms, of this class of compounds, the complexity of their correlated behaviour, and the wealth of functional properties they display, has already made these systems the subject of choice, worldwide, of a strongly networked, dynamic and interdisciplinary research community. In this review and perspective paper, the opportunities of oxides as future electronic materials for ICT and Energy are discussed.

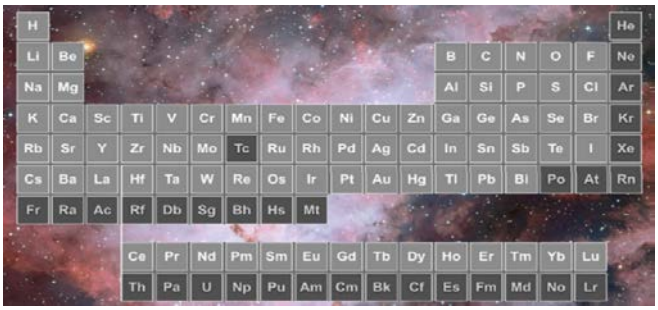

Fig. 1: .Exploring the periodic table to discover and synthesize materials for electronic devices is a one-off research adventure: we have only one periodic table of the elements in our universe! In this rendition, we have highlighted those elements that in our view are practical building blocks for films and heterostructures to be used at room-temperature.

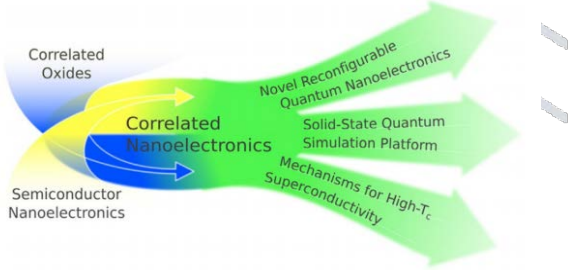

Fig. 2: Concept of correlated nanoelectronics. It combines the core functionalities of correlated oxides and semiconductor nanoelectronics. This combination, bridged by STO based electron systems, may lead to future applications of quantum technologies.