UNIVERSITÀ DI PARMA

Dipartimento di Scienze Matematiche, Fisiche ed Informatiche - DSMFI

SEMINARIO DI DIPARTIMENTO

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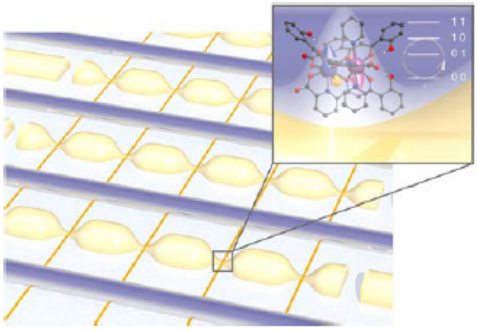
Scaling-up quantum computing with molecular spins

Abstract:The development of large-scale quantum computing and simulation calls for the integration of a vast number of qubits in a device. A natural option to address this scaling challenge is to use microscopic qubits in a hybrid approach. In this talk, I discuss the application to this field of artificial magnetic molecules. A molecule represents the smallest “nano-object” that, while truly microscopic, remains “tuneable”: its relevant properties can be set, with exquisite precision and reproducibility, by chemical methods. In the past few years, it has been shown that simple molecules can perform as spin qubits with sufficiently long coherence times. Besides, they provide model systems to explore fundamental aspects related with, e.g. the energy cost of (quantum) computation. Their design flexibility can also be used as an extra tool for scaling up computational resources: realizations of two- and three-qubit gates have been achieved in molecules with multiple inequivalent spin centers and/or profiting from the internal (nuclear or electronic) spin degrees of freedom of these centers. Even more challenging is how to create a scalable architecture for quantum computation and simulation, as it necessarily implies “wiring-up” many of such molecular units. A promising scheme is based on circuit QED, that is, on linking molecular spins via microwave photons trapped in superconducting on-chip resonators. The technical challenges, limitations and future potential of this scheme will be discussed.



Giovedì 4 ottobre – ore 16:30
Aula Newton – Plesso Fisico