Molecular Spintronics Based on Single-Molecule Nanomagnet Devices

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Molecular spintronics is a rapidly emerging field of nanoelectronics that combines the concepts of spintronics, molecular electronics and quantum computing [1] with a strong potential impact for the realization of electronic devices with new functionalities and properties. The recent progress in the understanding of the electronic transport properties of individual molecules is driving electronics to its ultimate molecular-scale limit and opens the way to new spintronics devices, exploiting both the electron spin and its charge in electronic devices based on single molecules. Interestingly, single molecule magnets can bear large magnetic moments and new quantum properties such as quantum tunnelling of magnetization and quantum phase interference and are particularly attractive for challenging applications, e.g. molecular information storage or quantum computing.

This presentation will address the methods and strategies developed in order to read and manipulate the spin states of single molecule devices and to perform basic quantum operations. Various research groups are currently developing low-temperature scanning tunnelling microscopes to manipulate spins in single molecules, while others are working on molecular devices (such as molecular spin-transistors, spin valves and filters, and carbon-nanotube-based devices [1]). The talk will discuss this - still largely unexplored - field and present our first results [2-4].

References


