

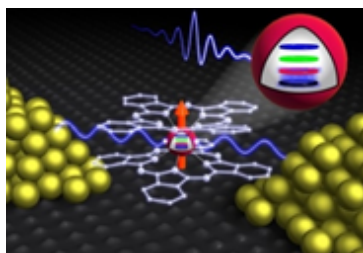
# Molecular Nuclear Spin Qubits for Implementing Quantum Gates and Quantum Algorithms

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Nuclear spin states in molecules will be proposed to act as quantum registers for Quantum Computing (QC). We report on the implementation of metal complexes into nanometre-sized spintronic/optoelectronic devices by a combination of bottom-up self-assembly and top-down lithography techniques. The controlled generation of magnetic molecular nanostructures will be shown and persistence of their magnetic properties under confinement Molecular Quantum Devices will be proven. The Hilbert space spanned by the nuclear spins will be engineered synthetically and addressed both electrically and optically, partially at the single molecule level [1-13]. Finally, Grover's quantum search algorithm will be implemented on the nuclear spin register of a TbPc<sub>2</sub> Qudit [10].



**Figure** Artistic representation of a Molecular Spin Transistor based on a TbPc<sub>2</sub> complex acting as a molecular Spin Qudit [8].

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