A controlled quantum SWAP logic gate in a 4-center metal complex

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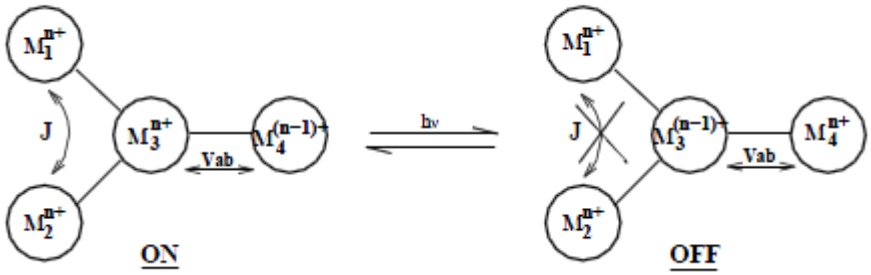
Abstract

A monomolecular four center low spin paramagnetic organometallic complex is proposed and theoretically studied to work as a controlled quantum swap molecule logic gate. The magnetic super-exchange interaction between the 2 intramolecular qubits depends on the oxydation state of a third intermediate center itself controlled by an intervalence electron transfer process. A model system is build up using entangled spin qubits in the framework of an Heisenberg-Dirac-Van Vleck like spin Hamiltonian demonstrating the effective swapping operation of this complex.

Figures



The model structure of a 4-center controlled swap organometallic complex. The magnetic interaction between the metal centers M_1 and M_2 can be switched ON or OFF depending on the oxidation state of M_3 which changes respectively from n to (n−1) under electron transfer between M_3 and M_4 induced by a specific light radiation. "OFF" is the initial ground state configuration and "ON" the swapping state of the molecule. Vab is the electronic through bond interaction between M_3 and M_4 in their respective oxidation states. J is the spin super-exchange interactions between M_1 and M_2 centers through M_3.