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Quantum computation in a solid state diamond C^{12} with a chain of C^{13} atoms

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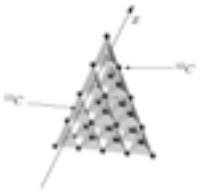
Quantum computation is one of latest hard goal in computer science and technology to perform algorithm that cannot be solved during our lifetime by a classical computer. The secret of this powerful machine is based on the exponential parallelism of calculations that it can make due to principle of superposition of the quantum mechanics, where the main elements which give us the information is called qubit (made up of the superposition of two states). However the difficulties found to have a workable quantum computer with significant number of qubits (say, 1000) are looked far away, due to decoherence and technological problems. We are proposing a new solid state quantum computer based on diamond estructure where one removes a C^{12} atom (spin zero) and replace it by a C^{13} atom (spin one half) forming a linear chain of C^{13} atoms. We show here that this in quantum sys- tem we can have an arbitrary single spin rotation of a qubit, a Controlled-Not (CNOT) quantum gate formed with two qubits, and a Controlled-Controlled-Not (CC- NOT) quantum gate with three qubits. This is enough to demonstrate that a full quantum computer can be constructed with this model. Parameters of the design are determined by the behavior of these quantum gates.



Biography

Gustavo Lopez Velazquez has completed his BS, MS, and PhD at the Universidad Nacional Autonoma de M´exico (UANM). He did a post-doc at Texas Accelerator Center, USA for about two years and went to Leon, Guanajuato, M´exico to help in the formation of the Instituto de F´ısica de la Universidad de Guanajuato (IFUG). Then, he went back to Texas, USA, to form part of the team who has spent six years trying to design and construct the Superconducting Super Collider Accelerator (SSC) in Waxahachie, Texas. After this, he went back to M´exico (Guadalajara, Jalisco) in 1994 to help a team of researchers in Physics, where he has collaboration with Los Alamos National Laboratory (LANL) in quantum computer research.

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