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

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Abstract

Quantum computation is one of latest hard goal in computer science and technology to perform algorithm that can not 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) is 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 system 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 (CCNOT) quantum gate with three qubits. This is enought 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.

Image

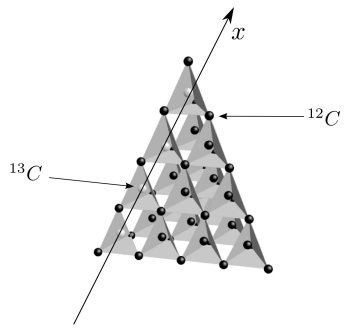


Fig. 1 Chain of spin one half C^{13} atoms.

Recent-Publications:

1. G. V. López (2016), *Force approach to radiation reaction*, Annals of Physics, **365**, pages: 1-6.

2. G.P. Berman, A.I. Nesterov, G.V. López, and R.T. Sayre, (2015), *Superrradiance Transition and Nonphotochemical Quenching in Photosynthetic Complexes*, J. Phys. Chem. C, **119**, pages: 22289-22296.

3. G. V. López and G. C. Montes, (2015), *Study of Decoherence of Entangled States Made up of Two Basics States in a Linear Chain of Three Qubits*, J. Mod. Phys., (2015), **6**, pages: 1701-1710.

4. G.V. López, G.C. Montes, and J.G.T. Zanudo, (2015), *One dimensional Relativistic Free Particle in a Quadratic Dissipative Medium*, J. Mod. Phys., **6**, pages: 121-125.

5. G.V. López, (2014), *Diamond as a Solid State Quantum Computer with a Linear Chain of Nuclear Spins Systems*, J. Mod. Phys., **5**, pages: 55-60.

Bibliography

Gustavo López Velázquez made his BS, MS, and Ph. D. at the Universidad Nacional Autónoma de México (UANM). He did a postdoc at Texas Accelerator Center, USA for about two years and went to Leon, Guanajuato, México to help in the formation of the Instituto de Física de la Universidad de Guanajuato (IFUG) during three years. Then, he went back to Texas, USA, to form part of the team who spend six years trying to design and construct the Superconducting Super Collider Accelerator (SSC) in Waxahachie, Texas. After this, he went back to México (Guadalajara, Jalisco) in 1994 to help a team of researchers in Physics, and he has been there since now, where he has have collaboration with Los Alamos National Laboratory (LANL) in quantum computer research.