Tata Institute of Fundamental Research
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Colloquium

Quantum Computation and Quantum Information Processing by NMR: Introduction and Recent Developments

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Till recently, the most successful of the various experimental techniques for the demonstration and verification of various QIP protocols and quantum algorithms has been that of Nuclear Magnetic Resonance (NMR). Our research group, which started experimental work in this field in late 90's, has performed several experiments which include; (i) preparation of pseudo-pure states, (ii) implementation of logic gates using one and two-dimensional NMR, (iii) implementation of Deutsch-Josza (DJ) and Grover's search algorithms, (iv) use of quadrupolar and dipolar coupled nuclei oriented in liquid crystal media for quantum information processing, (v) entanglement and entanglement transfer, (vi) observation of non-adiabatic geometric phase in NMR and its use in NMR QIP, (vii) implementation of some quantum games and (viii) implementation of adiabatic quantum algorithms by NMR. As part of "Introduction" some of these works will be highlighted.

Later developments include, (i) Experimental proof of Quantum No-Hiding theorem (ii) Use of Nearest Neighbor (NN) Heisenberg XY interaction for creation of entanglement in a linear chain of 3-qubits (iii) Multi-Partite Quantum Correlations Revel Frustration in a Quantum Ising Spin System and (iv) use of Genetic Algorithm in NMR QC. We have also by NMR, non-destructively distinguished Bell states and more generalized orthogonal states. Some of these experiments have been repeated, with higher fidelity, by using the IBM's 5 qubit "Quantum experience". These will also be described.

Friday, Apr 26th 2019

11:30 AM (Tea/Coffee at 11:00 AM)

Auditorium, TIFR-H