

Implementation of Quantum Games by NMR

Anil Kumar

*Department of Physics and NMR Research Centre
Indian Institute of Science, Bangalore-560012, India
e-mail : anilnmr@physics.iisc.ernet.in*

This talk will describe two quantum games that we have experimentally implemented by NMR, using a 3-qubit system. The games are (i) the quantum version of Ulam's game and (ii) a 3-player 'Dilemma' game which is an extension of 2-player 'Prisoner's Dilemma' game.

The Ulam's game is a two player game in which one of the players tries to search in a minimum number of queries a number thought by the other player. Classically the problem scales polynomially with the size of the number. The quantum version of the game has a query complexity that is independent of the dimension of the search space. The experimental implementation of this game has been carried out in our laboratory by NMR, using a 3-qubit system. The experimental results will be described.

The three player 'Dilemma' game deals with a situation in which each player tries to take a decision independently to maximize their individual gains. The optimal strategy in the quantum version of the game has a higher 'pay-off' as compared to its classical counterpart. However, this advantage is lost if the initial qubits provided are from a 'noisy' source. We have experimentally implemented the three qubit 'Dilemma' game as described by Johnson [Phys. Rev. A, **63**, 020302(R), 2001] using nuclear magnetic resonance quantum information processor and have demonstrated that the theoretical prediction of the quantum game being at an advantage, till the corruption in the source qubits are below a threshold value, holds.