IACS Colloquium from School of Physical Sciences by Prof. Diptiman Sen, IISc Bangalore

Speaker: Prof. Diptiman Sen, IISc Bangalore

Date & time: 1st, March, 2024 from 4.00 pm to 5.00 pm

Venue: MLS hall, IACS

Title: Quantum Games

Abstract:
We will discuss some examples of two-person games where quantum strategies can give better payoffs than purely classical strategies (even if the latter are probabilistic). The examples are as follows.

(i) a coin flipping game where two people, Q and C, play in the order Q, C, Q. It turns out that Q has a quantum strategy which always wins regardless of the classical strategy followed by C.
This game can be thought of as the simplest version of a quantum error correction code.

(ii) a game with two questions with yes/no answers and some payoffs for the four possible answers. The best classical strategy has a success rate of 3/4 in the long run, but there is a quantum strategy which has a higher success rate of about 0.854.
This game is related to the Clauser-Horne-Shimony-Holt (CHSH) and Bell inequalities.

(iii) the prisoner's dilemma: this is a famous game in which one strategy is at a Nash equilibrium while the other three strategies are Pareto optimal. A quantum version of this game has a Nash equilibrium which coincides with one of the Pareto optimal strategies and has a better payoff for both players compared to the Nash equilibrium of the classical game.

This talk will be at an elementary level. I will assume only a basic knowledge of two-state systems in quantum mechanics, and no knowledge of game theory.

References:

1. Meyer, Phys. Rev. Lett. 82, 1052 (1999)

2. Eisert, Wilkens, and Lewenstein, Phys. Rev. Lett. 83, 3077 (1999)

3. Cleve, Hoyer, Toner, and Watrous, arXiv:quant-ph/0404076

4. Landsburg, Notices of the AMS 51, 394 (2004); available at http://www.ams.org/notices/200404/fea-landsburg.pdf (this is a simple introduction to quantum game theory written by an economist)