Description for the general public

Technological progress that occurred in the last years made controllable manipulations on single quantum objects possible. This resulted in emergence and intensive development of a new branch of science placed on the borders of mathematics, informatics, and quantum physics – quantum information theory. Playing of a game is connected with a transfer of information between players and, possibly, an arbiter. If a carrier of this information is a quantum object, we deal with so called quantum games, the theory of which has been intensively developed during the last seventeen years. Classical game theory is one of the youngest branches of mathematics and within it there still appear new ideas and trends, the emergence of which is usually connected with attempts to produce still more precise models of real conflict situations. One of the latest ideas is an idea of a game with unawareness, born right now, in the XXI century. The reason for defining games with unawareness was observation that in real situations players usually make their decisions not on the basis of complete knowledge about a game, possible strategies of their opponents, etc., but on the basis of their views of a game, their views how other players view the game, how other players view how other players view the game, etc. Game with unawareness is therefore defined as a family of games in traditional sense that fulfills some consistency conditions, in which each game represents a view on a game of a group of players. The aim of the project is to consider the idea of games with unawareness within the theory of quantum games, which was not done yet. The incentive for such research was an observation that already in the first paper by D. A. Meyer (Quantum strategies, Phys. Rev. Lett. 82 (1999) 1052) that has given rise to the whole theory of quantum games, a game considered there was actually a game with unawareness. Indeed, one of the players had an access to quantum strategies, what the second player was unaware of, and he thought that the game was played with the use of classical objects only. The author of this paper did not notice that the game considered by him is a game with unawareness (actually, he could not notice this, since theory of classical games with unawareness did not exist yet at that time), and he obtained results that in the light of our preliminary investigations do not describe the real course of the game. Apart from applying an idea of a game with unawareness to Meyer's Quantum Penny Flip game, we want to apply this idea to some other problems that are significant in quantum game theory. Among them there will be a problem of existence of pure Nash equilibria in static quantum games played with the use of the most popular in quantum game theory Eisert-Wilkens- Lewenstein scheme, and the problem of equilibria in quantum models of Bertrand and Cournot duopoly. We do hope that structure of games with unawareness, which is much more rich than structure of traditional games, will allow to get new, more easily acceptable, results.