THE UNIVERSITY  **OF HONG KONG**

Department of Mathematics

Workshop on Quantum Information Science

Pre-workshop lectures

14:00 – 14:40 Professor Chi-Kwong Li (The College of William and Mary)

Why quantum properties can be used to do computing, and mathematical framework for quantum computing

14:40 – 15:20 Professor Mikio Nakahara (Kinki University)

Physical realizations of quantum computer

15:20 – 16:00 Dr. Chi-Hang Fred Fung (The University of Hong Kong)

Quantum cryptography, teleportation and quantum error correction

Wednesday, January 6, 2010

Room 210, Run Run Shaw Building
The University of Hong Kong

All interested are welcome

Abstracts

Why quantum properties can be used to do computing, and mathematical framework for quantum computing

Abstract We describe how quantum properties such as superposition, entanglement, no cloning can be used to do computing, and the mathematical framework of quantum mechanics of von Neumann.

Physical realizations of quantum computer

Abstract It has been shown in the previous talks that complex vectors or their matrix generalizations (density matrices) and unitary matrices can do some jobs more efficiently than classical digital computers. To build such a machinery, called a quantum computer, we need to realize density matrices and unitary matrices using physical systems. States in a microscopic world is described by complex vectors or density matrices and their time evolution by unitary matrices. I will explain how desired unitary matrices are obtained from the law of the microscopic world, called the Schrodinger equation. There are several candidates for a working quantum computer. I will explain some of the most promising candidates in my talk.

Quantum cryptography, teleportation and quantum error correction

Abstract I will explain how some of the properties of quantum mechanics are wisely exploited to perform cryptography. Also, I will introduce quantum error correction and talk about its properties and its relation with classical error correction. Teleportation and dense coding will be discussed and their use of quantum entanglement will be highlighted.