

## **Title: Quantum-bit engineering and some novel quantum phenomena**

### **Abstract:**

Quantum physics can be used to process and transmit information, where the information is stored in a quantum system called qubit or quantum bit. Rapid progress has been made in the implementation of various solid-state qubit systems. Single qubit coherence (superposition) and multiqubit entanglement (superposition) are the basic resources of various quantum information transfer processes and quantum computation. The loss of quantum superposition due to unavoidable interactions of quantum systems with the surrounding environment is known as decoherence. It represents the main obstacle to quantum computing and quantum information processing but decoherence is also necessary for quantum measurements. We will discuss the basic ideas of environmental decoherence, open quantum system dynamics under a Markovian and non-Markovian environment using master equation, quantum coherence control, decoherence-free subspace, quantum Zeno control, entanglement dynamics under non-Markovian environment, and some measurement models for solid state qubits. I will also share our studies of some novel quantum phenomena using wave packet dynamics.