Arkady Fedorov - Quantum Measurement

In this lecture, I will refresh the Stern-Gerlach experiment as a paradigmatic example of quantum measurement and introduce the corresponding postulates of quantum mechanics related to quantum measurement. I will then consider in detail the dispersive measurement of a superconducting qubit in circuit QED platform. I will show the basic principle of this scheme and will describe what happens to both the qubit and the cavity after the measurement and how the postulated wave-function collapse happens for this specific system. I will then generalize the dispersive readout to a qutrit and show how one can protect the qutrit subspace from the measurement collapse. I will show experimental results and discuss the implication of this measurement to the test of quantum contextuality.

In the second half of the lecture, I will introduce continuous measurement on the example of a continuously measured driven superconducting qubit. I will discuss different regimes of continuous measurement and present relevant experimental results. In particular, I will show that a strongly driven qubit can be protected from measurement backaction on demand which is useful for measurement multiplexing. I will then present the results of the measurement of quantum trajectories for a strongly and weakly measured qubit and will show how the quantum measurement induces additional constraints on time-keeping.