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Benjamin Huard: Quantum trajectories and feedback based on the measurement of decoherence channels in a qubit

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Decoherence can be understood as the result of unread measurements of the system by its environment. For a superconducting qubit, the two main corresponding jump operators are the lowering operator and the Hamiltonian operator. While the former is associated with the detection of an emitted photon by fluorescence, the latter can be associated with the detection of a frequency shift of a coupled resonant mode. We will discuss a series of experiment that were designed so that a large part of the information carried by the decoherence channels is accessible and retrieved by quantum limited amplifiers. The experiments offer a textbook example of quantum trajectory monitoring in various cases including QND and destructive continuous measurements, simultaneous incompatible measurements, Zeno effect and jump dynamics, post-selection and the associated past quantum states and also measurement based feedback.