Quantum systems and dissipation

Mazyar MIRRAHIMI, Equipe QUANTIC, INRIA Paris-Rocquencourt

Stabilizing a quantum system in a desired state has important implications in quantum information science. In control engineering, stabilization is usually achieved by the use of feedback. The closed-loop control paradigm consists of measuring the system in a nondestructive manner, analyzing in real-time the measurement output to estimate the dynamical state and finally, calculating a feedback law to stabilize the desired state. However, the rather short dynamical time-scales of most quantum systems impose important limitations on the complexity of real-time output signal analysis and retroaction. An alternative control approach for quantum state stabilization, bypassing a real-time analysis of output signal, is called reservoir (dissipation) engineering. While dissipation, leading to what is known as decoherence for quantum systems, is generally considered as an obstacle to manipulate such systems in a controlled manner, here we will illustrate how it could be instead used as a resource to robustly stabilize them around a particular quantum state or a manifold of quantum states.

Mazyar MIRRAHIMI, Equipe QUANTIC, INRIA Paris-Rocquencourt, Domaine de Voluceau, BP 105, 78153 Le Chesnay, France
mazyar.mirrahimi@inria.fr