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Quantum Gates and Decoherence

In the lectures we will be concerned with some aspects of physical implementations of quantum gate operations which are necessary for quantum information processing. We will discuss two possible realizations. One of them is based on qubits being encoded in atomic degrees of freedom where the atoms are manipulated in optical lattices above atom chips. The other realization is based on photonic qubits and measurement-induced nonlinearities in linear optics. Both implementations have in common that their main decoherence mechanism is absorption in dielectric materials. The quantum theory of light in absorbing media and its implications to decoherence will form the last part of the lectures.