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Circuit QED: from microwave quantum optics to quantum computation

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In the last twenty years, circuit quantum electrodynamics (QED) has emerged as a leading architecture for quantum computation. Circuit QED is based on superconducting circuits resonating at microwave frequencies. Its enabling element is the Josephson junction, which endows these modes with a tunable nonlinearity without adding losses. This way one can define modes with tailored energy spectra ("artificial matter") and have them interact with microwave resonators and waveguides ("light"). The possibility to engineer these interactions with an unprecedented degree of control and tunability is key to circuit QED's success. In this first lecture I will give a general introduction to the field and to some of its applications, also beyond quantum computation.

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