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| Soggetti | Quantum computers<br>Spintronics<br>Superconductivity<br>Superconductors<br>Quantum theory<br>Solid state physics<br>Quantum Information Technology, Spintronics<br>Strongly Correlated Systems, Superconductivity<br>Quantum Physics<br>Solid State Physics |
| Lingua di pubblicazione | Inglese |
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| Nota di bibliografia | Includes bibliographical references at the end of each chapters. |
| Nota di contenuto | Part 1: Physical Principles -- Conned Electromagnetic Waves -- Spins in the Cavity–Cavity QED -- Part II: Experimental Realization -- Experimental Implementation–Solid-State Hybrid Quantum System -- Part III: Main Results -- Collective Spin States Coupled to a Single Mode Cavity–Strong Coupling -- Spin Ensembles and Decoherence in the Strong-Coupling Regime–Cavity Protection -- Engineering of long-lived Collective Dark States–Spectral Hole Burning -- Amplitude Bistability with inhomogeneous Spin Broadening–Driven Tavis-Cummings -- Spin Echo Spectroscopy–Spin Refocusing -- Conclusion and Outlook. |
| Sommario/riassunto | This thesis combines quantum electrical engineering with electron spin resonance, with an emphasis on unraveling emerging collective spin phenomena. The presented experiments, with first demonstrations of |

the cavity protection effect, spectral hole burning and bistability in microwave photonics, cover new ground in the field of hybrid quantum systems. The thesis starts at a basic level, explaining the nature of collective effects in great detail. It develops the concept of Dicke states spin-by-spin, and introduces it to circuit quantum electrodynamics (QED), applying it to a strongly coupled hybrid quantum system studied in a broad regime of several different scenarios. It also provides experimental demonstrations including strong coupling, Rabi oscillations, nonlinear dynamics, the cavity protection effect, spectral hole burning, amplitude bistability and spin echo spectroscopy.