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Sommario/riassunto	This thesis offers a comprehensive introduction to surface acoustic waves in the quantum regime. It addresses two of the most significant technological challenges in developing a scalable quantum information processor based on spins in quantum dots: (i) decoherence of the electronic spin qubit due to the surrounding nuclear spin bath, and (ii) long-range spin-spin coupling between remote qubits. Electron spins

confined in quantum dots (QDs) are among the leading contenders for implementing quantum information processing. To this end, the author pursues novel strategies that turn the unavoidable coupling to the solid-state environment (in particular, nuclear spins and phonons) into a valuable asset rather than a liability.