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D. Esteve - Superconducting Quantum Bits and Hybrid Spin Superconducting Circuits for Quantum Technologies

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In the domain of electrical circuits, superconducting quantum bits based on Josephson junctions are presently the most advanced qubits. I will describe the single Cooper pair box circuit, its transmon version used nowadays, and the operation of an elementary quantum processor. I will explain the scalability challenge required by quantum error correction, and the alternative routes for facing it. We are developing such an alternative hybrid route based on spins with superior quantum coherence coupled to quantum superconducting circuits. I will present the progress achieved in the control of a small number of electronic spins for performing ultra-sensitive Electronic Spin Resonance, and the perspectives open for quantum information processing.