Plenary Talk PLV X Thu 14:00 HSZ 02

Single-electron-spin-resonance detection by microwave photon counting — •Patrice Bertet[1], Zhiren Wang[1], Leo Balembois[1], Eric Billaud[1], Milos Rancic[1], Marianne Le Dantec[1], Thierry Chaneliere[2], Alban Ferrier[3], Philippe Goldner[3], Sylvain Bertaina[4], Denis Vion[1], Daniel Esteve[1], and Emmanuel Flurin[1] — [1]Université Paris-Saclay, Gif-sur-Yvette, France — [2]Université Grenoble-Alpes, Grenoble, France — [3]Université PSL, Paris, France — [4]Université Aix-Marseille, Marseille, France

We report a new method for single-electron-spin-resonance spectroscopy at millikelvin temperatures. It consists in measuring the spin fluorescence signal at microwave frequencies using a microwave photon counter based on a superconducting transmon qubit. In our experiment, individual paramagnetic erbium ions in a scheelite crystal of CaWO4 are magnetically coupled to a small-mode-volume, high-quality factor superconducting microwave resonator to enhance their radiative decay rate. We detect the microwave photon spontaneously emitted by a spin following its excitation with a signal-to-noise ratio of 1.9 in one second integration time. Coherence times up to 3 ms are measured, limited by the spin radiative lifetime. The method applies to arbitrary paramagnetic species with long enough non-radiative relaxation time, and offers large detection volumes ($10\,\mu m^3$); as such, it may find applications in magnetic resonance and quantum computing.