Imaging electric fields in the vicinity of cryogenic surfaces using Rydberg atoms

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The ability to characterize static and time-dependent electric fields in situ is an important prerequisite for quantum-optics experiments with atoms close to surfaces. Especially in experiments which aim at coupling Rydberg atoms to the near field of superconducting circuits, the identification and subsequent elimination of sources of stray fields are crucial. We present a technique that allows the determination of stray-electric-field distributions at distances of less than 2 mm from (cryogenic) surfaces using coherent Rydberg-Stark spectroscopy in a pulsed supersonic beam of metastable (1s)1(2s)1 1S0 helium atoms. We demonstrate the capabilities of this technique by characterizing the electric stray field emanating from a structured superconducting surface. Exploiting coherent population transfer with microwave radiation from a coplanar waveguide, the same technique allows the characterization of the microwave-field distribution above the surface.

- H2020 [3]
- RySQ [4]
- 18.30.+a Atoms close to surfaces/in laser fields or cavities [5]
- Result [6]
- 17.80.+h Hybrid systems [7]
- 15.10.Ry Rydberg atoms [8]

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