RF Resonators for Strong Driving of Nuclear Spins

(No. T4-2431)

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Overview

An RF resonator designed for strong and fast driving of nuclear spins with applications in quantum sensing and microscopy. The resonator is a spiral structure composed of two metallic layers separated by an insulating material. It achieves high Rabi frequencies, constrained only by thermal dissipation, while maintaining compatibility with advanced technologies like quantum sensing, confocal fluorescence microscopy, atomic force microscopy, cryogenic temperatures, and ultra-high vacuum environments.

Applications

- Integration in quantum sensing toolboxes for addressing electron and nuclear spins
- Application with NV centers in diamonds for sensor-based information readouts
- Incorporation in circuits featuring transistors and other electronic components
- Enhancement of microscopy techniques requiring precise spin manipulation

Advantages

- Strong and efficient driving of nuclear spins (over 500 kHz) with low power consumption
- Compact design compatible with existing microscopy and sensing platforms
- Usability in extreme conditions such as cryogenic temperatures and ultra-high vacuums
- Adaptable to a variety of quantum sensors beyond NV centers in diamonds

Stage of Development

The invention is currently at the prototype stage, having been developed and tested successfully. Preliminary results have been validated and published in a peer-reviewed journal, demonstrating its functionality and compatibility with advanced quantum sensing techniques. A detailed publication in the New Journal of Physics on November 24, 2023, outlines its effectiveness and potential applications.

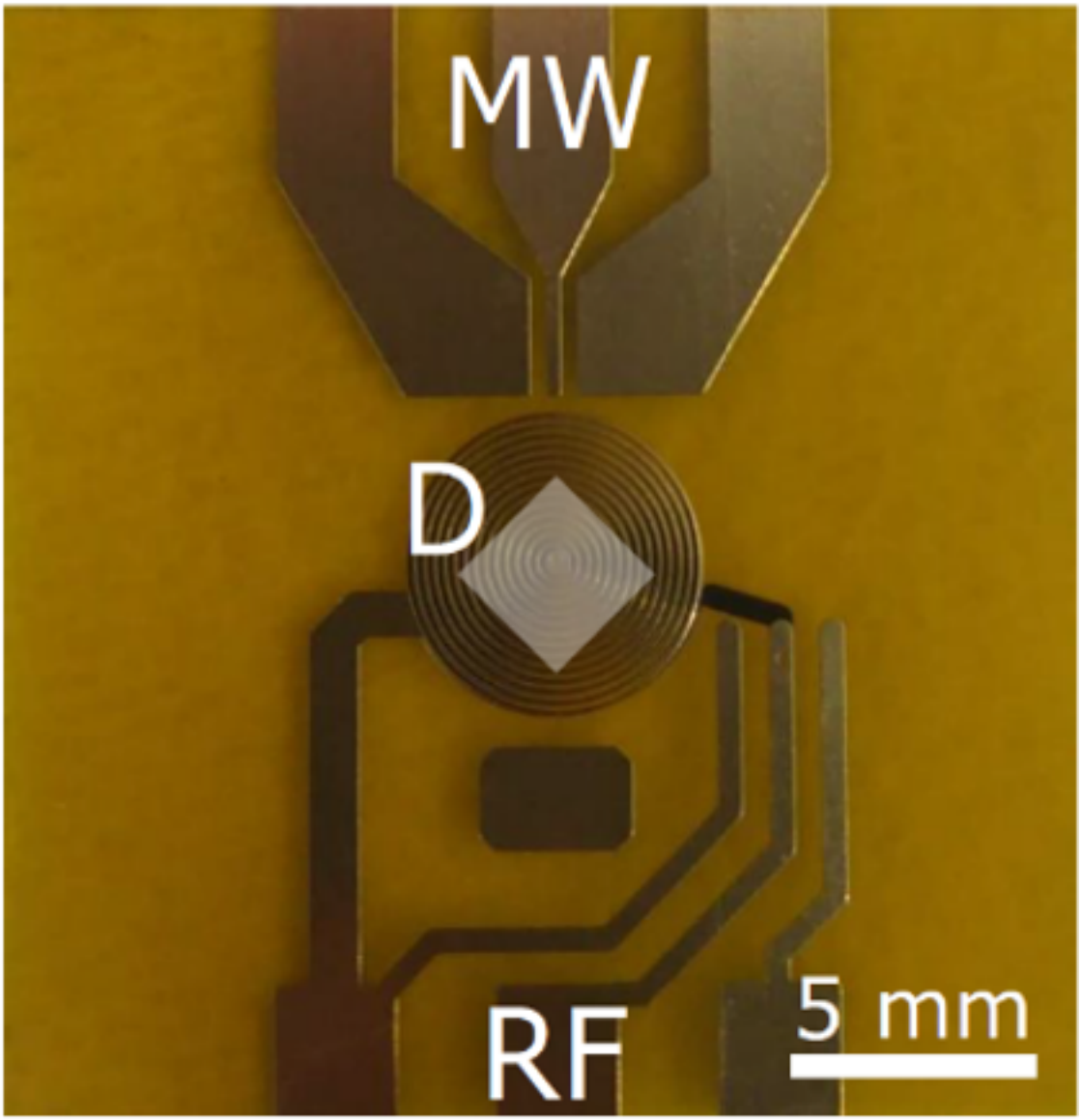

Photo of the antenna circuit. RF (MW) denotes the signal input connections.
The transparent white square schematically depicts the diamondâ€™s position.

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