Characterization of the Microwave Strip Antenna in the Experiment of Optically Detected Magnetic Resonance

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Optically Detected Magnetic Resonance (ODMR) is a powerful technique that allows for local and selective sampling of magnetic properties. The intensity of the measured ODMR signal crucially depends on how effectively microwave radiation is provided to the sample.

Typically, the magnetic resonance signal, e.g., in Electron Paramagnetic Resonance (EPR), is measured with a single specific frequency of the RF field. The single-frequency restriction is imposed by the resonant cavity employed to amplify the strength of the RF field. In order to perform measurements in a wide range of frequencies, a totally different approach is needed. Our research aimed to characterize a new type of broadband microwave antenna and its role as an element of the experimental system.

The microwave antenna is designed to act as a long line: a transmission line, which length is comparable to the wavelength of the propagating microwaves. The transmission lines are the metalized tracks on the dielectric support plates that encircle the sample. The antenna's construction allows it to work in low temperatures, such as 1.5 K, and with a wide range of microwave frequencies. The actual antenna is shown in the picture below.

In this research, the signal was measured on the reference sample – a quantum well (Cd, Mn)Te with manganese content of 0.3%. The characterization was made based on measurements of various microwave radiation power and various environmental conditions, such as the temperature and pressure of helium surrounding the sample, affecting its dielectric constant. Obtained results are compared with the results of numerical simulations.

[1] Bogucki A., et al., *Phys. Rev. B* **105**, 075412 (2022).
[2] Łopion A., et al., *Phys. Rev. B* **106**, 165309 (2022).
[3] Goryca M. i Bogucki A., Sample Holder for Measurements of Optically Detected Magnetic Resonance, "Sample holder patent WO2021064687A1" (2021).