

Microfabrication of surface ion traps for operation with Strontium Rydberg ions

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Recently, using Rydberg-states for gate operation in trapped ions has been shown to greatly reduce two qubit gate times down to 700ns [1]. Those experiments were performed in a macroscopic Paul trap at room temperature. We propose to perform similar experiments but in a cryogenic environment as well as on a surface ion trap chip that is industrially microfabricated at Infineon Technologies [2,3]. This will prove further scalability of this gate scheme. We will give details of the planned experimental setup and show its current status.

As UV-Lasers are needed for the Rydberg gate operation, we discuss material and design choices for making our ion trap resilient against radiation down to a wavelength of around 240nm and show successful microfabrication of an ion trap on a sapphire substrate. We show first results from surface characterization methods like the measurement of photocurrent when illuminating trap surfaces with UV-light. This will be used to further improve the quality of our trap metallization.

[1] Chi Zhang et al., Nature 580, 345-349 (2020)

[2] Ph. Holz et al., Adv. Quantum Technol. 3, 2000031 (2020)

[3] S. Auchter et al., Quantum Sci. Technol. 7, 035015 (2022)

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