# Experimental Setup and Initial Trapping Results of $^9Be^+$ Ions

Radhika Goyal,[1,*] Celeste Torkzaban,[1] Sascha Agne,[1] Ludwig Krinner,[1] David Stuhrmann,[1] Tobias Pootz,[1] Najwa Sophie Al-Zaki,[1] Erik Dunkel,[1] Kevin Rempel,[1] Giorgio Zarantonello,[1] Lukas Kilzer,[1] and Christian Ospelkaus[1]

[1] *Institute of Quantum Optics, Leibniz University Hannover, Callinstr. 36, Germany*

We report on the design, implementation, and initial performance of an experimental apparatus for trapping and manipulating beryllium ions. The setup is based on a surface-electrode Paul trap optimized for stable confinement of 9Be+ ions, combined with a laser system tailored for photoionization, Doppler cooling, and state detection. Particular emphasis is placed on the optical layout, much of which was designed and built in-house. Neutral beryllium atoms are generated via laser ablation and subsequently ionized using a resonant two-step photoionization scheme. Trapped ions are cooled close to the Doppler limit, and fluorescence is detected using a high-numerical-aperture imaging system. We present initial trapping results, demonstrating stable confinement of single and few-ion crystals for several hours, and we characterize fluorescence signals under various operating conditions. These results confirm the robustness of the setup and provide a foundation for future experiments involving coherent control and precision spectroscopy. This work establishes a versatile platform for further studies in quantum optics and trapped-ion physics, with applications in quantum information processing.

* goyal@iqo.uni-hannover.de; https://www.iqo.uni-hannover.de/en/research-groups/trapped-ion-quantum-engineering