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# Integrated ion traps for quantum metrology and information

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Chip-based ion traps are a versatile platform for quantum technologies. Our established ion traps for optical clocks enable controlling systematic frequency uncertainties at the 10ˆ-19 level [1, 2]. Currently, we are developing ion traps with integrated optics. Integrated optics improve the robustness against vibrations, make the traps scalable to large numbers of ions, and help to compactify the setup for portable optical clocks. With photonic design beam profiles can be generated that, combined with improved pointing stability, enable the excitation of forbidden transitions in trapped ions [3]. Together with our partners from Cornell University and ETH Zurich, we are working on ion traps with integrated waveguides for quantum metrology.
In our projects with partners from German industry, we are developing chip-based traps with integrated micro-optics, as well as traps with integrated waveguides for quantum information processing. To reach optimal performance in metrology, we pay attention to heat management and rf properties. Our aim is to employ the traps in portable optical clocks for geodetic measurements on earth and in space [4].

[1] J. Keller et al., Phys. Rev. A, 99, 013405 (2019)
[2] T. Nordmann et al., Rev. Sci. Instr., 91, 111301 (2020)
[3] A. A. Peshkov et al. ANNALEN DER PHYSIK 2300204 (2023)
[4]T. E. Mehlstäubler et al., Rep. Prog. Phys., 81, 064401 (2018)

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