



CRC 1227
Designed Quantum States of Matter



GUEST LECTURE

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Albert-Einstein-Building, Room 201
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"Quantum computing with ion crystals and single ion implantation for novel quantum technologies"

Quantum technologies allow for fully novel schemes of computing, simulation and sensing. For quantum computing, we employ trapped ions in modern segmented ion traps as scalable and freely reconfigurable qubit register [1]. I will give an overview of the recent progress, where gate fidelities of 99.995% (single bit) and 99.6% (two bit) are reached. Now it is time for assessing trapped-ion processors towards fault-tolerant quantum computation [2]. Alternative, platforms for quantum computers in solid state technology would largely benefit from deterministic schemes to fabricate qubit registers with nm-accuracy. I describe our deterministic ion source, which allows for delivering Ca^+ ions on demand and focus it into a spot of a 6nm [3]. The source can be operated with any other doping ion, which is co-trapped and sympathetically cooled together with a single Ca^+ ion, eventually extracted and implanted. We have started structuring solid state samples such as diamond with N_2^+ molecular ions to generate NV centers, rare-earth Praseodym or Cer ions [4] in YAG samples and will start implanting P^+ ions into ultrapure Silicon [5], with the vision to fabricate devices for quantum information processing.

- [1] Kaufmann et al, Phys. Rev. Lett. 119, 150503 (2017)
- [2] Bermudez et al, arxiv 1705.02771, PRX (2018)
- [3] Jacob et al, Phys. Rev. Lett. 117, 043001 (2016)
- [4] Kornher et al, Appl. Phys. Lett. 108, 053108 (2016)
- [5] van Donkelaar et al, J. Phys.: Condens. Matter 27, 154204 (2015)

**All DQ-mat members and all interested
are cordially invited to attend.**