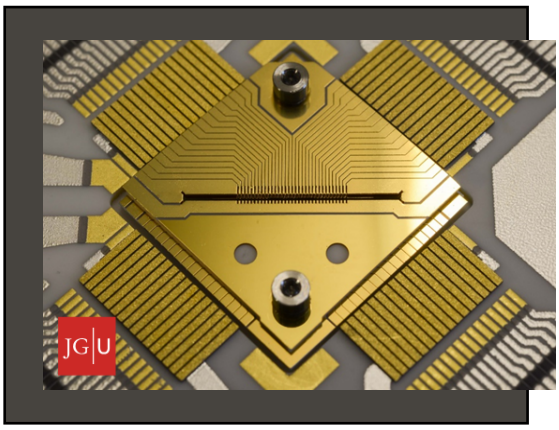

COLLOQUIUM DFA

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NOVEMBER , 26 - 3 PM
DEPARTMENT OF PHYSICS AND ASTRONOMY
Zoom meeting and YouTube streaming

Modern Quantum Technologies with trapped ions

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. This includes a discussion of different architectures, the required trap technologies and fabrication methods, control electronics for quantum register reconfigurations, and recent improvements of qubit coherence and gate performance. Using a segmented micro-ion trap for implementing a reconfigurable qubit register we have realized multi-qubit entanglement [2]. Topological quantum error correction [3] is a current aim, as well as an execution of quantum gates in few ns [4].

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 few nm [5]. 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 N2+ molecular ions to generate NV centers, rate-earth Presodym ions [6] in YAG samples and will start implanting P+ ions into ultrapure Silicium, with the vision to fabricate devices for quantum information processing.

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