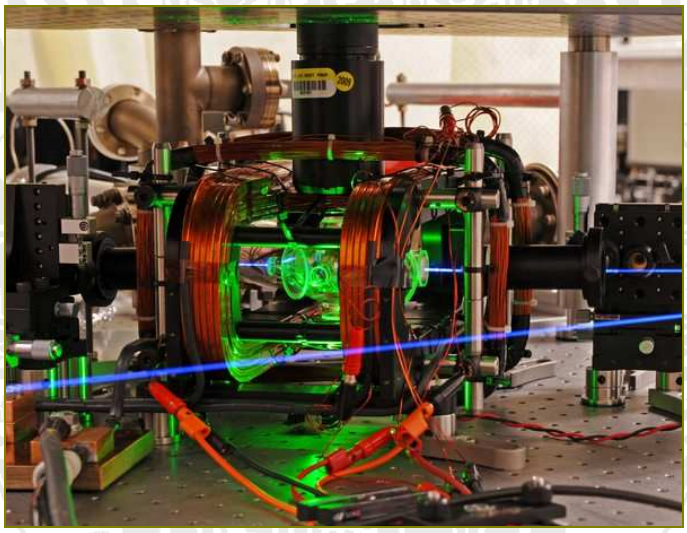
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg
Physikalisches Institut

# PHYSIKALISCHES KOLLOQUIUM

AM 24. JUNI 2013 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



## MICROWAVE NEAR-FIELD QUANTUM CONTROL OF TRAPPED IONS*

DR. ULRICH WARRING

*INSTITUTE OF PHYSICS, UNIVERSITY OF FREIBURG*

Quantum information research is pursued in many physical systems. Among them, trapped ions are promising for the implementation of quantum bits (qubits) and the required logic gates. Previous work has demonstrated elements of an ion trap array architecture and, by extension, these techniques may be sufficient to perform large-scale quantum computation. But experiments still require heavy experimental overhead. In most trapped-ion quantum information experiments coherent control is accomplished with lasers; in many cases implemented via Raman transitions addressing hyperfine qubits. Here, we discuss an alternative approach based on oscillating near fields. This method reduces the required laser overhead and may enable a higher level of control and integration than laser-based control. We demonstrate individual single-qubit and two-qubit logic gates, the requirements for a universal gate set in quantum information processing.

**Work performed at the NIST Ion Storage Group, Boulder, CO (USA) and supported by IARPA, ONR, DARPA, NSA, and the NIST Quantum Information Program*