Microwave driven quantum logic gates in $^{43}Ca^{+}$

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We present a novel qubit in the ground state of $^{43}Ca^{+}$ at intermediate magnetic field (146 G). This qubit is magnetic field insensitive to first order and has a coherence time of tens of seconds. Using robust optical pumping and microwave techniques we demonstrate preparation, single qubit gates and readout at fidelities well above those previously demonstrated for a hyperfine qubit.

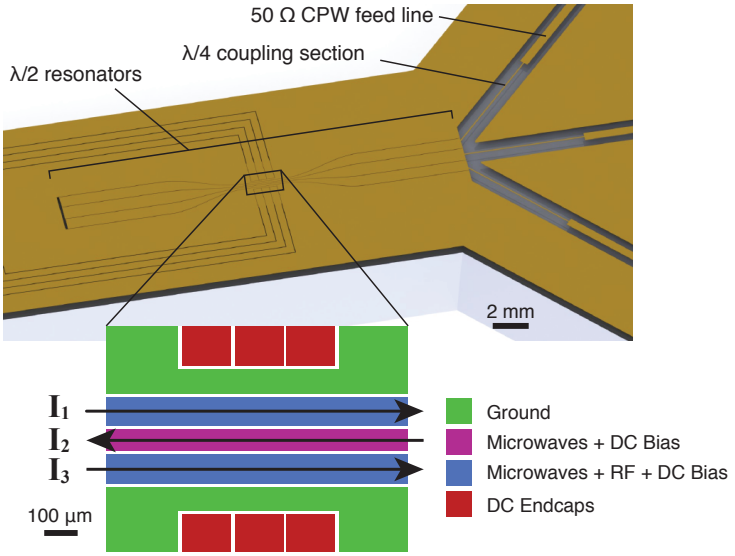

Figure 1: Surface-electrode ion trap with integrated microwave resonators and coupling elements.

This work was carried out in an ion trap which incorporates three half-wave microwave resonators (see fig. 1). These resonators are optimised to give high microwave field gradients at the ion in order to produce state dependent forces. The next goal is to carry out microwave-driven two qubit gates [1] in this trap and the latest progress towards this will be reported.

[1] C Ospelkaus et al. Nature **476**, 181 (2011)