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P32 - Writing and Imaging Nanostructures of Single Defects in Diamond

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In the last years quantum information processing developed very fast and progressive. One promising way to realize a solid state quantum computer is doping solids with single atoms. Among the variety of doping possibilities one prominent candidate is the Nitrogen Vacancy (NV) centre in diamond.

This long-known defect (present in most of natural diamonds) can easily be created by nitrogen implantation followed by thermal annealing. It posesses strong optical absorption and flourescence which enabels the optical imaging of single NV centres.
The NV centre exists in three different charge states: neutral (NV0), negatively (NV-) and positively charged (NV+). The electron spin associated to the negative NV- can be polarized and read out optically. Moreover, the coherence time of the electron spin can reach ms at room temperature in ultrapure diamond samples. Therefore, the NV centre can be used as a qubit. The entanglement of NV-qubits has already been demonstrated at room temperature [1, 2].

In order to create scalable structures based on coupled NV centres one needs to place single NV centres within distances of a few tens of nanometers. To realize the addressing of single NVs within this resolution, we developed a unique technique to implant single ions with an accuracy of below 10 nanometers in all three dimensions.

The nano implanter is a combination of an atomic force microscope (AFM) with a pierced hollow tip and a low energy ion source (keV range). This results in a very small collimated ion beam about a few nanometers in diameter. An ion gun with a gas source provides a broad range of ion types and an integrated electron multiplier allows the detection of single ions. This contribution gives the actual status and discusses the advantages and limitations of the system.

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