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Implantation of single phosphor ions for solid quantum computer development

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Abstract. Several solid state quantum computer schemes are using single phosphor ions in silicon as qubits [1–4]. To use the electron or nucleon spin of the phosphorus atom as a qubit, one must be able to control the position of single atoms and to control the spin of the donor atom [5, 6].

In this paper we discuss our approach to build such a device. Following mainly the original Kane scheme and more recent variations. There are many challenging problems in realizing a quantum computer in silicon. We will focus on the following subjects: setup for single ion implantation using highly charged ions, annealing conditions and electrical properties of the implanted phosphor ions and integration of the implanted single ions with gates and read-out structures.

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