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Formation of integrated single atom arrays

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Several solid state quantum computer schemes are based on the manipulation of electron and/or nuclear spins of single ^{31}P atoms in a semiconductor matrix [1]. The fabrication of qubit arrays requires the placement of individual atoms with nanometer precision and high efficiency. We are developing a single ion implantation scheme for $^{31}\text{P}^{q+}$ ions, integrated with processing of control and readout structures [2]. Single ion implantation is achieved through detection of secondary electron bursts from the impact of highly charged dopant ions such as P^{12+} . We will present results on implant alignment, single dopant atom activation and damage repair and SET formation for fabrication of integrated qubit arrays.

[1] B. E. Kane, Nature 393, 133 (1998); R. Vrijen et al., Phys. Rev. A 62, 12306 (2000)

[2] T. Schenkel et al., SPIE V 4656, 10 (2002), J. Vac. Sci. Technol. B in press (2002)

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