

# **CONTROL OF IMPURITY ORBITAL SUPERPOSITIONS IN SILICON.**

**K.L.Litvinenko<sup>1</sup>, B.Redlich<sup>2</sup>, B.N.Murdin<sup>1</sup>**

<sup>1</sup>*Advanced Technology Institute and SEPNet, University of Surrey, Guildford, GU2 7XH, UK*

<sup>2</sup>*Radboud University, Institute for Molecules and Materials, FELIX Laboratory, Nijmegen, Netherlands*  
*e-mail: k.litvinenko@surrey.ac.uk*

The ability to control dynamics of quantum states by optical interference, and subsequent electrical read-out, is crucial for solid state quantum technologies. Ramsey interference has been successfully observed for spins in silicon and nitrogen vacancy centres in diamond, and for orbital motion in InAs quantum dots. Here we demonstrate terahertz optical excitation, manipulation and destruction via Ramsey interference of orbital wavepackets in Si:P with electrical [1] and optical read-out [2]. The experiments open a route to exploitation of donors in silicon for atom trap physics, with concomitant potential for quantum computing schemes, which rely on orbital superpositions to, for example, gate the magnetic exchange interactions between impurities.

[1] K.L.Litvinenko et al, Nat. Commun. 6, 6549 (2015)

[2] K.L.Litvinenko et al, PRB 94, 235207 (2016)