

Seminarium Zakładu Fizyki Teoretycznej

Departament Badań Podstawowych
Narodowego Centrum Badań Jądrowych

13 listopada 2019 r. (środa), godz.12:15
NCBJ, sala 404, Pasteura 7

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“Adiabatic electron transfer between two quantum dots in presence of $1/f$ noise”

ABSTRACT:

Single electron transfer between gate-defined quantum dots in Silicon may be used to communicate distant arrays of qubits in a future quantum computer [1]. In principle, such communication can be realized by multiple dot-to-dot transitions, during which initial superposition of electron spin is adiabatically transferred to neighbouring dot by slow variation of their detuning energy. In reality however, the slower electron goes the more it suffers from random accelerations caused by omnipresent charge noise [2], which possibly leads to significant lose of transfer fidelity [3].

Even if reliable charge transfer would be achieved, it is coherence between spin states, which might be affected by unavoidable inhomogeneity of microscopic environment. This includes valley states of Si, dot-dependent g-factors and interface roughness. Because of them, spin-dependent components of wave function might become spatially separated, causing so called temporal spin-to-charge conversion [4], which eventually couples fluctuations of electric field to original spin superposition.

During my talk I will describe effective model of those phenomena and state prediction on charge transfer fidelity and decoherence rate induced by the electron shuttling in Si.

[1] L.M.K. Vandersypen et al., npj Quantum Information 3, 34 (2017),

[2] J. Yoneda et al., Nature Nanotechnology 13, 102-106 (2017).

[3] J.A. Krzywda et al., arXiv:1909.11780 (2019),

[4] X. Mi et al., Science 355, 6321 (2017)

Serdecznie zapraszamy,

M. Kowal, W. Piechocki, J. Skalski, L. Szymanowski