Turkish Journal of Physics

Turkish Journal

of

Physics

Keywords
Authors

phys@tubitak.gov.tr

Scientific Journals Home Page

Towards Quantum Communication with Electron Spins

D.S. SARAGA[1], G. BURKARD[2], J. C. EGUES[3], H.-A. ENGEL[1], P. RECHER[1], D. LOSS[1]

[1]Department of Physics and Astronomy, University of Basel Klingelbergstrasse 82, 4056 Basel, Switzerland

[2]IBM T. J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY 10598

[3]Department of Physics and Informatics, University of São Paulo at São Carlos, 13560-970 São Carlos/SP, Brazil

Abstract: We review our recent work towards quantum communication in a solid-state environment with qubits carried by electron spins. We propose three schemes to produce spin-entangled electrons, where the required separation of the partner electrons is achieved via Coulomb interaction. The non-product spin-states originate either from the Cooper pairs found in a superconductor, or in the ground state of a quantum dot with an even number of electrons. In a second stage, we show how spin-entanglement carried by a singlet can be detected in a beam-splitter geometry by an increased (bunching) or decreased (antibunching) noise signal. We also discuss how a local spin-orbit interaction can be used to provide a continuous modulation of the noise as a signature of entanglement. Finally, we review how one can use a quantum dot as a spin-filter, a spin-memory read-out, a probe for single-spin decoherence and, ultimately, a single-spin measurement apparatus.

Turk. J. Phys., **27**, (2003), 427-442.
Full text: pdf
Other articles published in the same issue: Turk. J. Phys.,vol.27,iss.5.