第２回トポロジカル物質科学セミナー
Topological Materials Science Seminar (2)

Long-distance entanglement of spin qubits via quantum Hall edge states

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Place: Room 239, Honkan (main building), Ookayama campus,
Department of Physics, Tokyo Institute of Technology
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Time: 14:00 -15:00

Abstract:
The implementation of a functional quantum computer involves entangling and coherent manipulation of a large number of qubits. For qubits based on electron spins confined in quantum dots, which are among the most investigated solid-state qubits at present, architectural challenges are often encountered in the design of quantum circuits attempting to assemble the qubits within the very limited space available. Here, we provide a solution to such challenges based on an approach to realizing entanglement of spin qubits over long distances. We show that long-range Ruderman-Kittel-Kasuya-Yosida interaction of confined electron spins can be established by quantum Hall edge states, leading to an exchange coupling of spin qubits. The coupling is anisotropic and can be either Ising-type or XY-type, depending on the spin polarization of the edge state. Such a property, combined with the dependence of the electron-spin susceptibility on the chirality of the edge state, can be utilized to gain valuable insights into the topological nature of various quantum Hall states.

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