Chiral solitons for robust informatics

Han Woong Yeom*

Center for Artificial Low Dimensional Electronic Systems, Institute for Basic Science Pohang, 790-784 Korea
Department of Physics, POSTECH, Pohang, 790-784 Korea

*E-mail: yeom@postech.ac.kr

Storing and manipulating information in robust ways is of prime interest in various fields of science and technology. Using topologically protected local excitations, such robust imformatics may be realized. In magnetic information processing, the recent interest is focused on topological excitations of spins such as skyrmions. In electronic systems, Mayorana Fermions of topological edge states are expected to realize topological quantum computation. This talk reviews our recent approach to this issue, which deals with new types of solitons in electronic systems. We will discuss an one dimensional topological insulator, atomic wires in a charge density wave ground state [1], and its soliton edge state [2]. We recently identified individual electronic solitons in indium atomic wires on silicon surfaces [2]. Due to the wire's unique structure composed of double Peierls atomic chains, this system constitutes an unprecedented Z4 topological system and its edge excitations correspond to solitons with chiral dimension [3]. These chiral solitons can store multi-level information, which is protected topologically. We further demonstrate the switchability of this multi-level information through the newly found soliton-soliton interaction. Thus, the possibility of multi-level, topologically protected, information processing is demonstrated for the first time.

References:

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