



# 复旦大学物理系 物质科学报告

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## Chiral solitons for robust informatics

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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 informatics may be realized. In magnetic information processing, the recent interest is focused on topological excitations of spins such as skyrmions. In electronic systems, Majorana 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, and its soliton edge state. We recently identified individual electronic solitons in indium atomic wires on silicon surfaces. Due to the wire's unique structure composed of double Peierls atomic chains, this system constitutes an unprecedented  $Z_4$  topological system and its edge excitations correspond to solitons with chiral dimension. These chiral solitons can store four-level information, which is protected topologically. We further demonstrate the switch-ability of this multi-level information through the soliton-soliton interaction or the soliton fusion. Through this series of works, the possibility of multi-level, topologically protected, information processing is demonstrated for the first time, which I would like to call 'solitonics'.



Professor Han Woong Yeom got his Ph.D. degree in Tohoku University, Japan, in 1996. Since 2010, he has been a Professor in Department of Physics of POSTECH (Pohang University of Science and Technology). And since 2013, he has been a director in the Center for Artificial Low Dimensional Electronic Systems, Institute for Basic Science. Since 2017, he has been Vice Chair of Presidential Advisory Committee for Science and Technology of Korea.

Professor Han Woong Yeom have a number of Awards and honors. He got **Academic Achievement Award** of Korean Physical Society in 2007; **Outstanding Referee (Lifetime honor)** of American Physical Society in 2010; **Leading Korean Research Scientist** of Korean Academy of

Science and Technology in 2012; **Korea Science Award** from President of Korea in 2015; **the 30th Incheon Prize for Science and Technology** from the Incheon Memorial Foundation and Dong-Ah Daily News Paper in 2016 and **Kyugn-Am Award for Natural Science** from Kyung-Am Foundation in 2017.

Professor Han Woong Yeom now interests in **Nano and atomic-scale structures on solid surfaces** and **Low dimensional electronic properties of atomic-scale artificial materials**, through the techniques of Photoelectron spectroscopy and scanning tunneling microscopy/spectroscopy.