
Research Report for Focus Workshop – Topology in Matter

(Coordinator - Hee Chul Park)

A Focus Workshop entitled “Topology in Matter” was held at a PCS center seminar room from 25th - 27th November 2015 with ten invited speakers and contributing members. The speakers were invited to achieve the aim of gathering together the various young Korean scientists studying topological properties of matter, as our center provides scientific opportunities to students and young scientists as potential researchers. The demand for research on this issue has been revealed through both young and mature scientists recently concentrating on the topics with robust cooperation, as these are incredibly interesting issues containing prolific theoretical features.

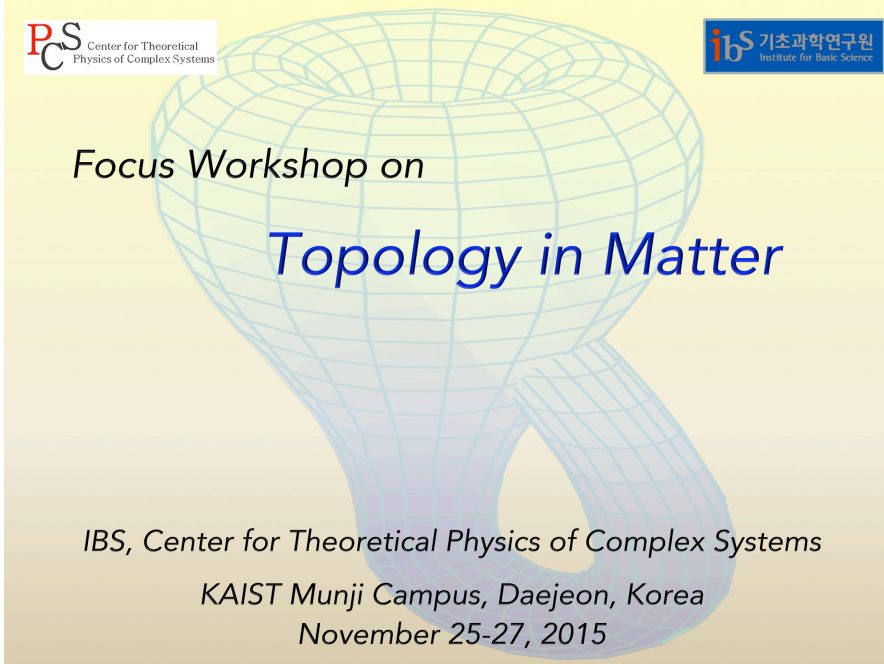
Topologically nontrivial phases host new phenomena in matter such as topological surface states, topological superconductors, Weyl semi-metals, and AQHE, among others. In many cases, they are characterized by specific symmetries, and these topological properties are related to fundamental features in basic science. For instance, bulk-boundary correspondence, which is the interface between normal and abnormal phases, presents topologically protected states due to the change of the axionic field related to the symmetries. Relating to fundamental physics, a variety of exotic phenomena theoretically converge—this workshop focused on new exotic phenomena in various materials arising from topologically nontrivial phases, a milestone in new research and development. Speakers and participants enjoyed an interactive workshop with lively discussions between pioneers actively working in this field.

The workshop commenced with an opening address by Prof. Sergej Flach, Director of PCS-IBS, and concluded with closing remarks by Dr. Suk Bum Chung, a Young Scientist in CCES-IBS. Prof. Han Woong Yeom, Director of CALDES-IBS, gave us a unique experimental talk about a new topological class in 1D. The other main topics consisted of topological band theory, topological phase transitions, quantum criticality, vortex dynamics, Weyl semimetals, topological phases in He-3, and topological magnetoelectric effects, with details as follows.

- Han WoongYeom (CALDES IBS, Pohang) - Chiral edge state of 1D Z_4 topological insulator
- Suk Bum Chung (CCES IBS, Seoul) - Topological Phases and Majorana fermions in He3 superfluid
- Hosub Jin (UNIST, Ulsan) - s-orbital Dirac fermions and topological electronics at oxide heterostructures
- Eun-Gook Moon (KAIST, Daejeon) - Topological Phase Transitions in Line-nodal Superconductors
- Pilkyung Moon (NYU Shanghai) - Fractal energy spectrum and quantum Hall effect in graphene superlattices
- Myoung Joon Han (KAIST, Daejeon) - First-principles study of large spin-orbit coupling transition-metal compounds: electronic structure and new possibilities
- Kun Woo Kim (KIAS, Seoul) - Weyl semimetal Fermi arc and its characterization in bulk
- Woo Ram Lee (KIAS, Seoul) - Fundamental connection between band topology and the winding number of the Wannier-Stark Ladder
- Yea-Lee Lee (SNU, Seoul) - Axion electrodynamics description of magnetic ordering on edges of topological insulators
- Gil Young Cho (KAIST, Daejeon) - Entanglement spectrum, symmetry-protected topological phases, and boundary conformal field theory.

The primary subject of the topological aspects of various materials, from graphene physics to He3 superfluid, was met with the strong cooperation and fruitful discussion that we had expected. This workshop, as a valuable opportunity for scientific exchange, also

enabled PCS to build good relationships with KAIST, KIAS, Postech, SNU, and other IBS centers.



PS Center for Theoretical Physics of Complex Systems

IBS 기초과학연구원
Institute for Basic Science

Focus Workshop on
Topology in Matter

IBS, Center for Theoretical Physics of Complex Systems
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