清华大学高等研究院
Institute for Advanced Study, Tsinghua University
物理学术报告
Physics Seminars (biweekly)

Title: Manipulating Quantum Defect-states of Topological States

Speaker: Su-Peng Kou

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Time: 3:15pm, Wednesday, March 6, 2013
(2:45~3:15pm, Tea, Coffee, and Cookie)

Venue: Conference Hall 322, Science Building, Tsinghua University

Abstract: Lattice defects always have trivial quantum properties in solid state physics. While in topological states, the lattice defects may have nontrivial quantum effects. For example, we found symmetry–protected zero modes of the lattice vacancy in topological states, including topological band insulators and topological superconductors on honeycomb lattice with particle-hole symmetry. In a Z2 topological order, the quantum states of a lattice defect have two-fold degeneracy. By manipulating these quantum defect-states, we found new ways towards fault-torrent quantum computation. I) We used the degenerate ground states of Z2 topological order on a plane with holes (the planar codes) to do topological quantum computation. II) We used the Majorana states of defect-lines in a p-wave superconductor on honeycomb lattice to do fermionic quantum computation.

References：
1．Kou SP, Quantum Computation via Quantum Tunneling Effect, PHYS. REV. LETT. 102, 120402 (2009).
2．Yu J and Kou SP, Macroscopic Quantum Tunneling Effect of Z2 Topological Order, PHYS. REV. B 80, 075107 (2009).
3．Kou SP, PHYS. REV. A 80, 052317 (2009).
4．Jing He, Ying-Xue Zhu, Ya-Jie Wu, Lan-Feng Liu, Ying Liang, and Kou SP, Protected Zero Modes on Vacancies in the Topological Insulators and Topological Superconductors on the Honeycomb Lattice, PHYS. REV. B 87, 075126 (2013).
5．Jing He, Jing Yu, Xing-Hai Zhang and Kou SP, Emergent Supersymmetric Many Body Systems in a Doped Z2 Topological Order, arXiv:1210.3232.