

LECTURES ON FRONTIERS OF QUANTUM MATTERS

量子物质前沿讲座



清华大学
Tsinghua University

TITLE |

Generalized Lieb-Schultz-Mattis Theorems

SPEAKER |

Chao-Ming Jian
(University of California,
Santa Barbara)



TIME |

3:00-4:30 June 7, 9, 2017



VENUE |

Room 322, Science Building
Tsinghua University

主办方：清华大学高等研究院

ABSTRACT

The Lieb-Schultz-Mattis (LSM) theorem and its extensions forbid trivial phases from arising in certain quantum magnets. Constraining infrared behavior with the ultraviolet data encoded in the microscopic lattice of spins, these theorems are particularly important because they tie the absence of spontaneous symmetry breaking to the emergence of exotic phases like quantum spin liquids.

I will give two lectures reviewing the recently progress on generalized LSM theorems. In the first lecture, I will review the “lattice homotopy” approach to generalizing the LSM theorem to quantum magnets with all possible space group symmetries. In this lecture, I will explain how the obstruction to a trivial phase given by the LSM theorems is related to the obstruction to “trivializing” the lattice under smooth, symmetric deformations.

In the second lecture, I will focus on the connections between the LSM theorems and the physics of symmetry protected topological (SPT) states. I will argue that D-dimensional quantum systems subject to LSM theorems can be viewed as the surfaces of (D+1)-dimensional systems with non-trivial SPT orders. The consequence of the LSM theorem, which is the non-existence of trivial symmetric phases, can then be understood as the consequence of the non-trivial “bulk SPT”.