



# 清华大学高等研究院

Institute for Advanced Study, Tsinghua University

## 学术报告

**Title:** Slater and Mott Physics with the SU(N) Hubbard models

**Speaker:** Congjun Wu (*University of California, San Diego*)

**Time:** 4:00pm, Monday, July 8, 2019

**Venue:** Conference Hall 322, Science Building, Tsinghua University

### Abstract

How interactions turn a partially filled electron band into an insulating state is an important question of strong correlation physics. We perform extensive projector determinant quantum Monte-Carlo simulations on the SU(N) Hubbard models to address this problem.

At half-filling, i.e., the average fermion number  $N/2$  per site, the antiferromagnetic (AF) orders in the square lattice start from the weak  $U$  regime for both SU(4) and SU(6) cases. They exhibit non-monotonic dependence on  $U$ : After reaching maximum at intermediate interaction strengths, they decrease as  $U$  further increases. Roughly at the same interaction strengths, the single-particle gap evolves from very small values to linearly increase with  $U$ , marking the onset of Mott physics. For the SU(6) case, the AF order vanishes at the critical value of  $U=13.3$  exhibiting the critical exponents of  $\nu=0.60$  and  $\eta=0.44$ . As  $U$  further increases, the valence bond solid (VBS) ordering appears. In contrast, the SU(4) and SU(6) Hubbard models of Dirac fermions in the honeycomb lattice and  $\pi$ -flux square lattice exhibit the transition from the Dirac semi-metal phase to the VBS state. We also investigated how interaction effects scale with  $N$  in the 1D SU(N) Hubbard models at half-filling. As  $N$  increases, weak and strong interacting systems are driven to a crossover region, but from opposite directions as a convergence of itinerancy and Mottness. The crossover region exhibits nearly  $N$ -independent physical quantities, including the relative bandwidth, Fermi distribution, and the spin structure factor.

#### Ref.

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