RICE QUANTUM GROUP MEETING SEMINAR SERIES

Date: February 25, 2022, Friday

Time: 3PM - 4PM

Venue: SST 300

Research Group: Prof. Kaden Hazzard's Group

Presenter: Zhiyuan Wang

Title: Emergent parastatistical quasiparticles in solvable quantum spin models

Abstract: Parastatistics is one of the few alternatives to the usual fermion and boson statistics. Parastatistical particles transform in higher dimensional representations of the permutation group under particle exchange, and satisfy generalized exclusion principles. Their existence as elementary particles has been ruled out by a no-go theorem [1] in relativistic quantum field theory. However, in this talk, I show that they can emerge as quasiparticles in a family of PT-symmetric one-dimensional quantum spin models. This family of models can be exactly solved using a generalized Jordan-Wigner transformation, which transforms the spin operators into paraparticle creation and annihilation operators satisfying generalized quadratic commutation relations. The single particle spectra are the same as certain lattice free fermion systems, but the paraparticles satisfy generalized exclusion principles, i.e. the same state can hold up to n paraparticles, where n is a constant integer. I will discuss some interesting physical properties of these models, and will also comment on potential experimental realizations as well as possible generalization to higher dimensions.

References:
[1] S. Doplicher, R. Haag, and J.E. Roberts, Commun. Math. Phys. 23, 199–230 (1971); Commun. Math. Phys. 35, 49–85 (1974).

Short Bio: Zhiyuan Wang received his B. Sc. at Peking University, and is currently a 5th year Ph.D. student in Prof. Kaden Hazzard's research group at Rice University. His main research interest centers around using mathematical physics techniques to solve problems in quantum many-body physics, including rigorous bounds on physical observables in and out of equilibrium, and the construction and solution of new exactly solvable models that shed light on exotic phases of matter, such as topological phases and gapless quantum spin liquids.

Note: Snacks and Coffee will be served during the event.