Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

" Uncovering the Fibonacci Phase in Parafermion Systems "

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Abstract: There has been great progress in realizing platforms for topological quantum computation, with recent evidence of the experimental observation of Majorana zero modes. However, braiding such zero modes does not yield a set of transformations sufficient to perform universal, fault tolerant computation. One way forward is to engineer systems realizing parafermion zero modes, which generalize Majorana zero modes. Coupled (Z3) parafermions could then hybridize into a phase supporting bulk Fibonacci anyons, a type of non-Abelian anyon that does have universal braiding statistics.

Using the density matrix renormalization group (DMRG), we study a two-dimensional lattice model of coupled Z3 parafermions. By working close to the weakly-coupled chain limit, we are able to identify the Fibonacci phase on cylinders as small as four sites in circumference then track its evolution, finding it survives even to the isotropic limit of our model on larger cylinders. We examine the extent of this phase and the wider phase diagram of our model, which turns out to harbor a second topological phase.

Short bio: Miles received his PhD from UC Santa Barbara, working with Leon Balents. He then moved to UC Irvine where he was a postdoc with Steve White, and is now at the Perimeter Institute. Miles is an expert computational physicist with major contributions both in terms of the development of algorithms (the first parallelization of DMRG, pioneering work in DMRG calculations for DFT) as well as their application to forefront research problems in frustrated magnetism, Fibonacci anyons etc.. Miles is also an avid sought-after teacher and has been invited to teach at various Summer schools around the world.

12:00noon
Tuesday, April 14, 2015
Duboc Room (4-331)

Host: Senthil Todadri