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Superconducting analogue of the parafermion fractional quantum Hall states ABOLHASSAN VAEZI, Cornell University — Read and Rezayi Z_k parafermion wavefunctions describe $\nu = 2 + k/(kM + 2)$ fractional quantum Hall (FQH) states. These states support non-Abelian excitations from which protected quantum gates can be designed. However, there is no experimental evidence for these non-Abelian anyons to date. In this talk, we discuss the $\nu = 2/k$ FQH-superconductor heterostructure and through analytical and numerical calculations we argue that it can yield the superconducting analogue of the Z_k parafermion FQH state. The resulting topological state has a gapless chiral edge state with Z_k parafermion conformal field theory description. For instance, we find that a $\nu = 2/3$ FQH in proximity to a superconductor produces a Z_3 parafermion superconducting state. This state can host Fibonacci anyons capable of performing universal quantum computation through braiding operations. We finally discuss our experimental proposal for realizing parafermion superconductors. Reference: arXiv:1307.8069

Abolhassan Vaezi
Cornell University

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