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Parafermion braid statistics in quasi-one-dimensional networks DAVID CLARKE, JASON ALICEA, UC Irvine, KIRILL SHTENGEL, UC Riverside — One dimensional systems with Majorana zero modes at phase boundaries may be thought of as physical realizations of a discrete quantum wire model first put forth by Kitaev [1]. Proposed methods for braiding such Majorana fermions in one-dimensional wire networks [2] have greatly expanded the set of plausible avenues toward topological quantum computation. Recently, a generalization of the Kitaev model to parafermion modes has been developed.[3] Here, we describe the transport of such parafermion modes along the chain by the adiabatic transformation of the Hamiltonian, analogous to the transport of Majorana fermion modes. We determine the (braid) transformations of the ground state sector allowed by the adiabatic exchange of the parafermion modes in wire networks. We show that, as with Majorana fermions, none of the parafermion braid sets are universal for quantum computation. Certain parafermion chain models, unlike Majorana fermion systems, become universal with the addition of measurement operations. We discuss possible physical realizations of the parafermion models.

[1] J Alicea et al., Nature Physics 7, 412-417 (2011)
[2] A. Kitaev, arXiv:cond-mat/0010440v2
[3] P. Fendley, unpublished

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