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Majorana fermions in vortex lattices RUDRO BISWAS, University of Illinois at Urbana-Champaign — We consider Majorana fermions tunneling between vortices, within an array of such vortices in a 2D chiral p-wave superconductor. We calculate that the tunneling amplitude for Majorana fermions in a pair of vortices is proportional to the sine of half the difference between the global order parameter phases at the two vortices. Using this result we study tight-binding models of Majorana fermions in vortices arranged in a triangular or square lattice. In both cases we find that this phase-tunneling relationship leads to the creation of superlattices where the Majorana fermions form macroscopically degenerate 'flat' bands at zero energy, in addition to other dispersive bands. This finding suggests that in vortex arrays tunneling processes do not change the energies of a finite fraction of Majorana fermions and hence brighten the prospects of topological quantum computing with a large number of Majorana states.

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