Majorana Fermions and Orthogonal Complex Structures

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Abstract

Ground states of quadratic Hamiltonians for fermionic systems can be characterized in terms of orthogonal complex structures. The standard way in which such Hamiltonians are diagonalized makes use of a certain "doubling" of the Hilbert space. We show that this redundancy in the Hilbert space can be completely lifted if the relevant orthogonal structure is taken into account. Such an approach allows for a treatment of Majorana fermions which is both physically and mathematically transparent. Furthermore, an explicit connection between orthogonal complex structures and the topological Z2-invariant is given. Talk based on MPLA 33 (14), 1840001 (2018) (ArXiv: 1712.05069)