

Almost commuting unitary matrices related to time reversal

Terry A. Loring, Adam P. W. Sørensen

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The behavior of fermionic systems depends on the geometry of the system and the symmetry class of the Hamiltonian and observables. Almost commuting matrices arise from band-projected position observables in such systems. One expects the mathematical behavior of almost commuting Hermitian matrices to depend on two factors. One factor will be the approximate polynomial relations satisfied by the matrices. The other factor is what algebra the matrices are in, either the matrices over A for A the real numbers, A the complex numbers or A the algebra of quaternions.

There are potential obstructions keeping k -tuples of almost commuting operators from being close to a commuting k -tuple. We consider two-dimensional geometries and so this obstruction lives in $KO_{-2}(A)$. This obstruction corresponds to either the Chern number or spin Chern number in physics. We show that if this obstruction is the trivial element in K -theory then the approximation by commuting matrices is possible.

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