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Braiding of majorana fermions and topological quantum computation

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Majorana fermions are fermionic particles that are their own anti-particles. Mathematically, a standard fermion such as an electron can be seen as a composite of two Majorana fermions. At the level of operators in quantum field theory this is seen by writing F=a+ib where F is the fermion annihilation operator and a and b are elements of a Clifford algebra where a^2=b^2=1 and ab=-ba. Then, F*=a-ib and we have FF=F*F*=0 and FF*+F*F is a scalar, the usual fermion relations. Remarkably, rows of electrons in nanowires have been shown to have correlation behaviors that correspond to this decomposition, and topologically remarkable is the fact that the underlying Majorana fermions have a natural braiding structure. This talk will discuss the braiding structure of Majorana fermions and possible applications to topological quantum computing.

Biography

Louis H Kauffman received a BS in Mathematics from MIT in 1966 and a PhD in Mathematics from Princeton University in 1972. He has taught at the University of Illinois at Chicago since 1971 and has been a Full Professor since 1984. He is the Editor in Chief of the *Journal of Knot Theory and Its Ramifications* and the Editor of the World Scientific book "*Series on Knots and Everything*". He is a Fellow of the American Mathematical Society since 2014. He is Past President of the American Society for Cybernetics and the recipient of the Warren McCullocy Award (1993) and the Norbert Wiener Gold Medal (2014) of that society. He is the 2015 recipient of the Bertalanffy Medal for Significant Contributions to Complexity Thinking. He is the Author of numerous books on knots and their applications. His research is primarily focused on the structure and discovery of topological invariants of knots and links.

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