Title:
Random walks, a link between statistical, condensed matter, mathematical and particle Physics.

Author:
Ali Alavi

Abstract:
Random walk in 2 dimensions has many applications in Physics, Chemistry, Mathematics, Biology and even in Economics.

In this contribution to the conference we study the connection between random walks in 2 dimensions and mathematical, condensed matter and particle Physics. We show that the structure of the quantum group $su_q(2)$ is intimately related to the random walks on a two-dimensional lattice. Using this connection we obtain an appropriate candidate for the exact area distribution of closed random walks of length $N$ on a two-dimensional square lattice. We compare our results with exact enumeration.

Using the exact area distribution of closed random walks obtained in previous section, we obtain an exact analytical expression for magnetoresistance. Then we will show that there is a deep relationship between magnetoresistance and the quantum group $su_q(2)$, from which we understand the quantum interpretation of the quantum corrections to the conductivity. The motion of an electron on a lattice in the presence of an external magnetic field connects the random walks in 2 dimensions to Q.E.D in 2 dimensions. The connection between random walks and Q.E.D (the most successful theory in particle Physics) in 2 dimensions is also studied.