abstract

WORKSHOP ON TOPOLOGY: IDENTIFYING ORDER IN COMPLEX SYSTEMS
Topic:

Speaker:

Affiliation:

Date:

Time/Room:

Optical fields propagating in three-dimensional free space are complex scalar fields, and typically contain nodal lines (optical vortices) which may be thought of as interference fringes. Random wave fields, representing speckle patterns randomly scattered from rough surfaces, have a tangled skeleton of nodal lines, some of which are closed loops, and others are infinite, open lines. We have found, in computer simulations of random superpositions of plane waves, that these lines have the fractal properties of brownian random walks with characteristic scaling of the probability that pairs of loops are linked. Holographically-controlled laser beams provide the opportunity to control the form of optical fields and the nodal line within them. Using the theory of fibred knots, we design superpositions of laser modes (effectively solutions of the 2+1 Schrödinger equation) which contain isolated knots and links. I will conclude by explaining how these mathematical fields have been experimentally realized.