Manu Mathur

Professor
Theoretical Sciences
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Professor Manu Mathur finished his PhD at The Institute of Mathematical Sciences, Chennai in 1992. He was a Post-Doctoral Fellow at TIFR-Mumbai and then an INFN fellow at University of Pisa, Italy.

Supervision of Research / Students

Ph.D. Students

1. T. P. Sreeraj, Title of Thesis: "Canonical Transformations and Loops Formulation of Lattice Gauge Theories" Completed.
2. Atul Rathor, Title of Thesis: "Duality Transformations in SU(N) Lattice Gauge Theories", just started.

Projects of M.Sc./ M.Tech./ B.Tech./ Post B.Sc. students

1. Atul Rathor; 'Duality in Ising Model'; Completed and 'Entanglement in SU(N) Lattice Gauge Theories'; Completed.

Teaching activities at the Centre

1. 3rd Semester, Electromagnetic Theory, Physics 203, 10, Prof. S. K. Sharma

Publications in Journals

1. **Manu Mathur,** T.P. Sreeraj; *Lattice Gauge Theories and Spin Models;* Phys. Rev. D; 2016; **94**(8); 085029.

Significant research output / development during last one year

General research areas and problems worked on

Lattice gauge Theories and Loop Formulation:

The Wegner Z_2 gauge theory-Z_2 Ising spin model duality in (2 + 1) dimensions is revisited and derived through a series of canonical transformations. The Kramers-Wannier duality is similarly obtained through Z_2 canonical transformations. The Wegner Z_2 gauge-spin duality is directly generalized to SU(N) lattice gauge theory in (2 + 1) dimensions to obtain the SU(N) spin model in terms of the SU(N) magnetic fields and their conjugate SU(N) electric scalar potentials. The exact & complete solutions of the Z2, U(1), SU(N) Gauss law constraints in terms of the corresponding spin or dual potential operators are given. The gauge-spin duality naturally leads to a new gauge invariant magnetic disorder operator for SU(N) lattice gauge theory which produces a magnetic vortex on the plaquette. A variational ground state of the SU(2) spin model with nearest neighbor interactions is constructed to analyze SU(2) gauge theory.

Interesting results obtained

As a natural consequence of the exact duality we are able to construct the the most general disorder operator for SU(2) lattice gauge theories in (2+1) dimension. This disorder operator creates magnetic vortex on a plaquette and reduces to the well known t'Hooft disorder operator in a special case.

Proposed research activities for the coming year

1) Generalization of exact duality in (3+1) dimensions.
2) Generalization of the disorder operator in (3+1) dimensions.