C. K. Majumdar Memorial Lecture

The C. K. Majumdar Memorial Lectures are organized by the Satyendra Nath Bose National Centre for Basic Sciences, Kolkata as a tribute to Late Professor Chanchal Kumar Majumdar, the Founder-Director of the Centre

Past Speakers

N Mukunda	Geometric Phases for Two- and Three-Level Quantum Systems	11 August 2001
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Sudhanshu S Jha	Superconductivity in Solids: Misconceptions and Realities	12 August 2003
Guruswamy Rajasekaran	Recent Discoveries in Neutrino Physics	11 August 2004
Jainendra K. Jain	A new class of Fermions in Physics	2 August 2005
David Logan	Optics and transport in heavy electron materials: theory meets experiment	11 December 2006
R Ramesh	Whither Oxide Electronics?	4 January 2008
Peter B Littlewood	New condensates of matter and light	5 January 2009
D Khomskii	Main problems and current challenges in systems with strongly correlated electrons	1 February 2011
Sir Michael Berry	Making Light of Mathematics	9 March 2012
Dr. Stuart Parkin	Spintronic and Ionitronic Computing Technologies	12 June 2015

12th C. K. Majumdar Memorial Lecture

Title

Percolation in finite matching lattices and holes in clusters

Speaker

Robert Ziff

Professor of Chemical Engineering
Member, Center for the Study of Complex System
University of Michigan
Ann Arbor, Michigan USA

Tuesday, 24 January 2017 at 4.00 pm

Venue

Silver Jubilee Hall

S.N. Bose National Centre for Basic Sciences
Kolkata - 700 106

About the speaker

Robert Ziff has worked in the areas of statistical mechanics, computer modeling, and kinetics for four decades. As an undergraduate, he studied at UCLA, where he began his research working on problems of liquid helium and superfluidity. His PhD work was carried out at Rockefeller University in New York, where he worked with George Uhlenbeck, Mark Kac, and E. G. D. Cohen. His thesis work was on the Bose-Einstein condensation, for which he showed that the fluctuations in the canonical and grand canonical ensembles differ markedly for the ground state.

After graduate school, he worked as a Post-Doc at the Los Alamos National Laboratory, where he worked with Laurence Campbell on vortex motion in rotating helium systems. He did a second post-doc with George Stell at Stony Brook in New York, where he worked on problems of polymerization and became interested in the percolation problem. That problem has attracted his attention ever since.

He then became a professor at the University of Michigan, where he remains until today. Working in a department of Chemical Engineering, he became interested in some practical problems such as the modeling catalytic reactions as occur on catalytic converters of automobiles. This led to the Ziff-Gulari-Barshad surface reaction model, which stands as a paradigm for non-equilibrium systems showing kinetic phase transitions. He also worked with Mark Newman, now also at Michigan in the Center for the Study of Complex Systems, on an efficient approach to simulating percolation, known at the Newman-Ziff algorithm. Other contributions to percolation include the introduction of the excess number concept, study of various crossing problems (with Peter Kleban), and the development of the triangle-triangle transformation (with Chris Scullard) to find exact thresholds for many percolation lattices. He has also had a long-standing interest in numerical values of percolation thresholds and has put together an extensive Wikipedia page summarizing those results. A new application of percolation that he is studying is in drug delivery from the dissolution of pills.

Robert Ziff is a fellow of the American Physical Society and served an the editorial boards of the journals Physical Review E, Journal of Physics A, The Philosophical Society, and Fractals. He was also associate editor of Physical Review E.

Abstract

As shown by Sykes and Essam in their classic 1964 paper, the percolation cluster number properties on a lattice and its matching lattice can be related to each other by Euler's Essam's planar graph formula, F + V-E = 1. Here we show that f or finite systems the corrections to Sykes and Essam formula depend upon the crossing probabilities on the lattice and the matching lattice, or the dual lattice in the case of bond percolation. This result yields Scullard and Jacobsen's criticality condition, which they used to find precise values of the percolation threshold for many lattices. The matching clusters themselves form holes in the percolation cluster, and many interesting properties of holes are discussed, including a size-distribution exponent $\tau = 1 + d_f/2 = 187/96$ which is less than 2, but is valid because there is an upper cutoff of the size of the cluster. The network of holes forms a tree whose diameter grows logarithmically with the size of the system. The enclosed area of all holes follows a Zipf's-law size distribution whose coefficient can be calculated exactly.

S.N. Bose National Centre for Basic Sciences

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On behalf of the Centre

I cordially invite you to the

12th

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to be delivered by

Robert Ziff
Professor of Chemical Engineering
Member, Center for the Study of Complex System
University of Michigan Ann Arbor, Michigan USA

on

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Prof. Samit Kumar Ray
Director