Keynote Speakers

Professor Frank Stephan, National University of Singapore

Title: Automatic Structures - Recent Results and Open Questions

Abstract:

Regular languages are languages recognised by finite automata; automatic structures are a generalisation where one looks also at automatic relations which are relations recognised by synchronous finite automata and at automatic functions which are functions whose graph is an automatic relation. Functions and relations first-order definable from other automatic functions and relations are again automatic. Automatic functions coincide with the functions computed by position-faithful one-tape Turing machines in linear time. This talk gives an overview on recent results on automatic structures and provides some concurrent research questions.

ShortBio

Frank Stephan received his doctorate from the University of Karlsruhe (T.H.) in the year 1990 in mathematics. He since then worked at the University of Karlsruhe (T.H.) until 1995, then at the University of Heidelberg until 2003, at the National ICT Australia located at the University of New South Wales until 2004 and since then at the National University of Singapore. His working areas are in mathematical logic and theoretical computer science; in particular he works in algorithmic randomness, automata theory, inductive inference and recursion theory.
Abstract:

The mathematics of quantum mechanics is a natural and efficient formalism for modeling financial instruments. A brief review is made of the modeling of option theory using the Feynman path integral. The modeling of forward interest rates is carried out using the framework of a two dimensional quantum field theory and the Hamiltonian is used for determining the martingale condition. An empirical analysis shows that the quantum modeling of forward interest rates is well supported by market data.

ShortBio:

Belal E Baaquie is Professor in Department of Physics National University of Singapore, Singapore. He received a BS, Physics (1972) from California Institute of Technology and a PhD, Theoretical Physics from Cornell University in 1976. He was Research Associate at Stanford University, 1976-78; Member, Institute for Advanced Study, Princeton 1991; Physics Department, Harvard University 1998; Physics Department, National University of Singapore, 1984-2000; University Scholars Programme, Vice-Dean of Physics Dept NUS, 1998-2002.

He has published these books: Path Integrals and Hamiltonians: Principles and Methods (Cambridge University Press), The Theoretical Foundations of Quantum Mechanics (Springer Publications), Exploring Integrated Science (CRC Press), Interest Rates and Coupon Bonds in Quantum Finance (Cambridge University Press), Quantum Finance: Path Integrals and Hamiltonians for Options and Interest Rates (Cambridge University Press). His research interests are: Quantum field theory and Financial modeling based on techniques of quantum theory.
Abstract:
Diamond is a wide band gap semiconductor with atomic number close to biological tissues and cells and therefore a potential candidate among Tissue Equivalent Materials (TEM). Synthetic diamond technology has been geared up using Chemical Vapour Deposition (CVD) route to produce poly crystal and single crystal diamond sheets. Whereas sc-Diamond is more useful as dosimeter, pc-Diamond has further applications as UV and high energy particle detector. With the advancement in CVD processes for synthetic diamond substrate, understanding of material properties and related technologies has taken up momentum. The polar surface of synthetic diamond due to CVD process is often Hydrogen terminated. The oxygen termination is therefore required to suppress leakage currents in sensor applications. These issues will be addressed in the talk while explaining technology development for diamond detector in Metal-Insulator-Metal (MIM) configuration. Some experimental results shall also be shared covering I-V at different temperatures.

ShortBio:
Jamil Akhtar was born in Ghaziabad, India, in 1959. He received B.Sc (Hons) and M.Sc degrees in Physics with specialization in Electronics in 1977 and 1980 respectively. He joined BEL Ghaziabad as Planner B during 1979-80. From 1980 to 1983, he worked at CSIR-CEERI, Pilani, firstly as CSIR-JRF and then CSIR-SRF for his Ph.D. thesis work on “Study of Two-Dimensional Breakdown Phenomena in Semiconductor Devices”.

Since 1983, he has been associated with the Semiconductor Devices Area of CEERI, Pilani, as Scientist. At present he holds the grade of Chief Scientist at CSIR-CEERI and heads Sensors and Nano-Technology Group. He has visited Technical University of Munich, Germany, in the year 1991-92, under DAAD fellowship program. From 1998 to 2001, he stayed at School of Physical Sciences at J.N.U., New Delhi as research fellow and received Ph.D in 2008 on Mev Ion induced re-ordering in single crystalline silicon.
He has been involved in a number of projects sponsored by DRDO, DAE, ISRO and CSIR and completed successfully with working prototypes. He has been instrumental in imparting Hands-on-Training in MEMS under NPMASS program to faculties from Engineering Institutions including IITs and central universities from all over India. His passion is to develop working prototypes.

His research interest includes; Technology for silicon based millimeterwave IMPATTs and BARITTs, Numerical techniques for semiconductor device simulation, Silicon Microstrip detectors, MEMS micro sensors, Digital Microfluidics, Silicon Carbide detectors, Soft magnetic nano-composite materials, Nanostructures and Nanotechnology, Vibrational energy localization in discrete systems, RF MEMS and Diamond technology for radiation detection in health care and high energy applications.

He is associated with AcSIR (Academy of Scientific and Innovative Research, India) as Professor and coordinates courses in Advanced Semiconductor Electronics and teaches semiconductor Device Physics. He has guided a number of Ph.D, M.Tech and B.Tech students for their thesis work registered in different universities including AcSIR. He holds four patents to his credit and more than sixty papers in international journals and more than hundred papers in international/national conferences besides a number of invited talks, internal research/technical reports and three chapters in Books. He is coeditor of a book by Springer. Dr Akhtar has been awarded Bharat Jyoti and Bharat Shiksha Ratan in 2013 and 2014 respectively. He is a life member of Indian Physics Association, Indian Nuclear Society, Instrument Society of India and IETE, India. He is a member of IEEE, USA. He has been nominated as honorary member of Chemical Society of Georgia in May 2014.

P. N. Gajjar, Department of Physics, University School of Sciences, Gujarat University,

Title: Engineering New Materials for Thermal Devices: Simulation experiments

Abstract: Scientists have made sufficient progress in developing devices based electronics, spintronics, and photonics. But the progresses to design and develop the devices that can utilize the flow of phonons are still rare. If flow of heat in solids could be controlled as electric current in semiconductor circuits, very large numbers of innovations could happen in thermal engineering.
We know, the thermal radiation heat-ups the surface exposed by it and the efforts are always made to cool the surface. We have not made sufficient efforts to store this heat for its fruitful use at later. The first-most requirement to utilize the heat is to have a material which allows us to control the flow of heat in desire direction and/or stores the heat for longer time. At nanoscale, to study heat transport thorough a material is not an easy task because of thermal contacts to be made on nanoscale devices, heat baths and temperature sensors are to be connected at nanoscale. Not only this, the carrier of heat – Phonons is not point particle with definite properties but bundles of energy that have no mass or charge which remains unaffected by electromagnetic field. These are main causes why the devices that control the flow of heat in a desire manner are still not available for practical use.

Computer simulation helps in overcoming such problems. Because of some simulation studies, temperature profile, heat flux, thermal conductivity, negative differential thermal resistance, interface thermal resistance, thermal rectification are now known at nanoscale. Very recently, we have engineered exponential mass graded material which works as a better option for thermal rectifier as it produces 70-75% rectification of heat flow. We are also in the process of engineering new materials which may be useful in developing thermal devices. Our results of heat transport in monoatomic, diatomic chain, linear mass graded, exponential mass graded, mass defected chain, thermal diode, thermal transistor and thermal logic gates will be presented during the talk. Such study will help in understanding heat transport mechanism in conducting and non-conducting polymers, RNA/DNA chains, nanowires, nanotubes, etc.. Such study is useful in designing molecular/nano-heat pumps and nano-thermal devices.

**Shortbio:**
Prof. P. N. Gajjar born on September 15, 1966. He had his M. Sc., M. Phil. and Ph. D. in Physics. His field of specialization is Condensed Matter Theory / Computational Materials Science / Non linear dynamics. He is Professor and Head, Department of Physics, Gujarat University, Ahmedabad, Gujarat, India. He has visited Italy, Vietnam, Sri Lanka, France, Poland, Singapore, Malaysia, Hong Kong, Indonesia for the presentation of research work and invited talks. He is a member of many academic committees and Fellow of Gujarat Science Academy. He had successfully completed many research projects and guided doctorate students. He has authored/co-authored more than 160 scientific papers in refereed journals of repute. He is recipients of Bharat Jyoti Award. He has credit of receiving best research papers award for five times.