

## Prominent guests at important workshop on open quantum systems

A two-day virtual workshop devoted to new frontiers in the research in open quantum systems and entanglement was recently held by the National Institute for Theoretical and Computational Sciences (NITheCS) in collaboration with the Institute of Theoretical Physics at the Jagiellonian University (IFT UJ) in Kraków, Poland.

'In this field of research, the focus is on understanding the detrimental effects of decoherence, whereby information in the quantum system is leaked to the environment. The ways to tackle this problem form the basis of engineering new quantum devices, including quantum computers,' notes co-organizer of the workshop, Dr Vinayak Jagadish (IFT UJ, Poland). The other two organisers were Prof Francesco Petruccione (NITheCS and University of KwaZulu-Natal, South Africa) and Prof Karol Życzkowski (IFT UJ).

'The coherent evolution of quantum systems is hindered by the unavoidable coupling of quantum systems with the external environment. Understanding the open evolution of a quantum system is of real importance from the point of view of theoretical physics as well as the development of new quantum technologies,' Dr Jagadish continues.

The workshop celebrated the 60<sup>th</sup> anniversary of a very important paper authored by ECG Sudarshan, PM Mathews and J Rau titled '*Stochastic Dynamics of Quantum Mechanical Systems*' published in Physical Review (Phys. Rev. 121, 920, [1961]). Ennackal Chandy George Sudarshan had been an Indian-American theoretical physicist credited with many important contributions to the field of theoretical physics, and who was nominated six times for the Nobel Prize for Physics. In the opening address, Prof Życzkowski mentioned that the celebrated paper introduced the notion of dynamical maps—objects that determine the discrete-time evolution of density matrices (in quantum mechanics, a density matrix describes the quantum state of a physical system and allows for the calculation of the probabilities of the outcomes of any measurement performed upon this system) which is of utmost importance in quantum information theory.

At the time of publication, the paper did not receive enough attention from the community. Prof Petruccione said that the Sudarshan paper was written 'probably ten or fifteen years ahead of its times.' Its impact was only appreciated later and Prof Petruccione noted that today its effects are reflected in quantum computing, quantum simulation and even quantum communication. He also thanked the two of the co-authors of the paper, as well as the wife and son of the late Prof Sudarshan, for attending the workshop as guests of honour.

Prof Sudarshan's son Ashok Sudarshan spoke briefly during the workshop, saying his father always stressed the importance of giving credits to all authors of a paper. It was in this spirit the two co-authors of the paper were invited as the guests of honour. The first, Prof PM Mathews, retired from the Madras University, India, in 1992. His work in physics included among others stochastic processes, quantum field theory and geophysics. In addition to among others India's Meghnad Saha Award for Theoretical Sciences (1975), he was awarded the prestigious Fellowship of the American Geophysical Union (2004).

The other co-author, Dr Jayaseetha Rau, earned her doctorate in Theoretical Physics from Brandeis University in Massachusetts in 1962 and taught mathematics at the faculty at the

Normandale Community College, Minnesota until 1993. Among other notable research papers by Dr Rau was 'Relaxation Phenomena in Spin and Harmonic Oscillator Systems' published in Physical Review 129 (1963). It was the first paper on the quantum collision model that is currently gaining interest.

Also present at the workshop was Prof Gopalakrishnan Bhamathi, wife of the late Prof ECG Sudarshan. She retired as head of Professor of Theoretical Physics at the Madras University, India and was also affiliated to the University of Texas, Austin. As a mathematical physicist working on various problems in scattering theory, quantum field theory and particle physics, she co-authored several papers with Prof Sudarshan.

Links to presentations and slides used during the workshop can be found here: [www.nithecs.ac.za/workshop-sudarshan/](http://www.nithecs.ac.za/workshop-sudarshan/)

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