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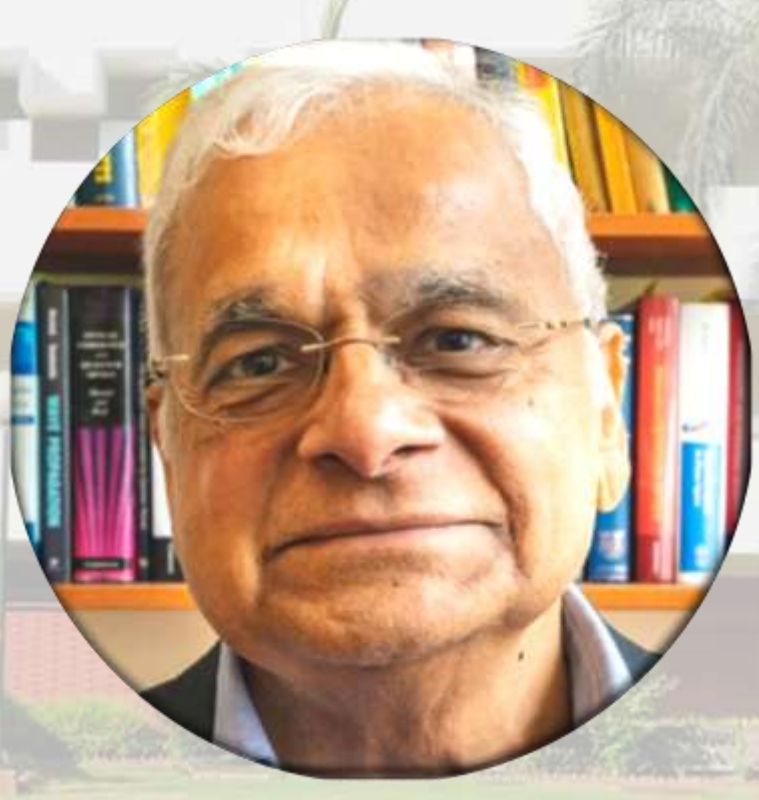
PRL Ka Amrut Vyakhyaan-25

Wednesday, 19 January 2022

@ 10:00 AM (IST)

"Squeezed light from abstraction to real-life applications: sensing and imaging well beyond standard quantum limit"



Prof. Girish S. Agarwal, FRS

Institute for Quantum Science and Engineering, Depart-ments of Biological and Agricultural Engineering, and Physics and Astronomy, Texas A&M University, USA

YouTube https://youtu.be/8BMtC2gDWsA

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Speaker: Prof. Girish S. Agarwal, FRS

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Abstract

Quantum technologies are leading to the next revolution in communication, computing, information processing and in understanding large complex systems. This revolution will largely depend on unprecedented resolution, speed, and precision. An important beneficiary of quantum technologies would be quantum sensing and imaging. The development of novel paradigms in those fields are important, since they are likely to impact all fields of science and particularly biology. Classical sensing is very efficient down to a certain point, where stability and noise start impairing measurements. Sensing below that point (i.e., the standard quantum limit (SQL)), requires sensitivities that can only be produced with quantum light. Considerable theoretical work on quantum light was done in seventies and eighties, however, it is only in last two decades many real-life applications have started emerging leading to extensive activity all over the world. Both two-mode squeezed light and entangled photon pairs are ideal sources for producing super sensitivity in metrology. In the laboratory, we produce narrow band twin beam of squeezed light with about 6.8dB intensity difference squeezing and we are using such a source for a variety of sensing, imaging and novel nonlinear spectroscopic applications which eventually would lead to highly sensitive Bio imaging. This talk will describe how the abstract theoretical developments are leading to new practical paradigms in sensing and imaging.

The Speaker

Prof. Girish S. Agarwal, FRS, is an alumnus of Banaras Hindu University. He did his Ph.D. from Rochester University, USA. He then returned to India and worked at TIFR before accepting an invitation to establish a School of Physics at the Central University, Hyderabad. He was the Director, PRL during 1995-2005 and has nurtured an internationally respected school of quantum optics in India. He has been at the Oklahoma State University, USA, as Noble Foundation Chair and Regents Professor. He is presently a faculty at the Institute for Quantum Science and Engineering, Departments of Biological and Agricultural Engineering, and Physics and Astronomy, Texas A&M University, USA. Prof. Agarwal is internationally acclaimed for his contributions to Quantum Optics, Laser Physics, and Statistical Mechanics. He is a recipient of the S. S. Bhatnagar Award, the Humboldt Research Award, the G.D. Birla Award, the M. N. Saha Birth Centenary Award, and the Albert Einstein Professorship of the Indian National Science Academy. He is a Fellow of the Royal Society, the American Physical Society, the Optical Society of America, the Indian National Science Academy, the National Academy of Sciences, the Indian Academy of Sciences, and The World Academy of Sciences. He has published more than 700 papers in peer-reviewed international journals, including Review Articles and Research Monographs. He has authored a book on "Quantum Optics" published by Cambridge University Press.

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About PRL

The Physical Research Laboratory (PRL), known as the “cradle of space science” in India, is one of the premier research institutes founded in 1947 by Prof. Vikram Sarabhai, a renowned Cosmic Ray Scientist, a great visionary and institution builder. PRL played a seminal role in producing a highly motivated cadre of space scientists and the technologists of highest international repute. The first scientific rocket launched from Thumba on 21st November-1963 and many other rockets launched thereafter contained payloads developed at PRL. Dr. Sarabhai initiated many of these scientific and technical activities at PRL which eventually led to the formation of the Indian Space Research Organization (ISRO). Therefore, PRL is known as the “cradle of space science” in India. Further, the research in the area of Plasma Physics expanded to the formation of the Institute of Plasma Research (IPR).

As an institution PRL is unique in that it conducts fundamental research in a wide range of research areas from the Earth to the cosmos, and comprising Astronomy and Astrophysics; Solar Physics; Space and Atmospheric Sciences; Theoretical Physics; Geosciences; Atomic, Molecular and Optical Physics, Astrochemistry; and Planetary Sciences and Space Exploration. PRL is one of the rare research institutes of international repute wherein research in such diverse fields of sciences is carried out using several state-of-the-art experimental facilities that exist under one umbrella.

Along with the ongoing research, several new initiatives have been taken up during the last few years. The Multi-Application Solar Telescope (MAST) at Udaipur Solar Observatory has been operationalized. PRL initiated scientific programmes in frontier areas of research, which include a search for exo-planets, laboratory studies of interstellar grains, laboratory synthesis of cold astromolecules and experimental studies in the field of quantum optics. PRL is also developing several scientific payloads as a part of ISRO’s larger vision and contributing to roadmap for competitive scientific exploration of the solar system and beyond. In particular, PRL has been contributing significantly not only in building instruments for space missions, such as Chandrayaan-1, Chandrayaan-2, AstroSat and upcoming Aditya-L1, Chandrayaan-3 and planetary and space missions, but also by bringing out new and insightful science results.

PRL contributes to several national and international research programmes and to human resource development through its Doctoral and Post-Doctoral Programmes, capacity building programmes, such as UN Course on Space Science, and science and engineering internship programmes. PRL contributes significantly to society through its Outreach Programmes by periodically organizing science exhibitions and Open Houses, planned visits of students of various school and college to PRL, and popular talks at various institutions to not only share the excitements of the advancements of contemporary scientific findings but also to encourage students to take up sciences as their research career.

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