International Day of Light

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Prof. Masud Mansuripur

Mechanical Effects of Light: Radiation Pressure, Photon Momentum, and the Abraham-Minkowski Controversy

Masud Mansuripur

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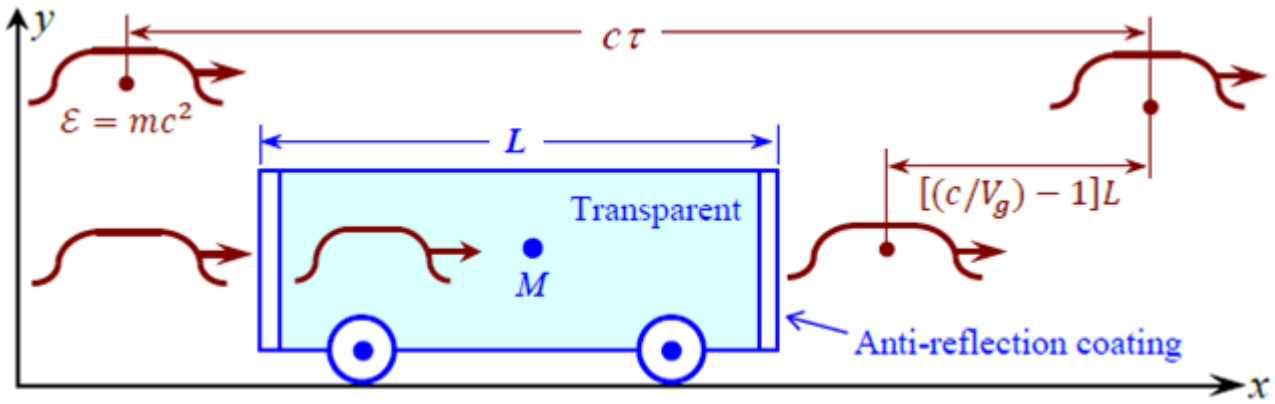
Abstract: The rays of light carry energy as well as linear and angular momenta. The latter properties are exploited in solar sails, optical tweezers, and micro/nano opto-mechanical motors and actuators. A fundamental characteristic of photons, their momentum inside material media, has been the subject of debate and controversy for more than a century. The so-called Abraham-Minkowski controversy involves theoretical arguments in conjunction with experimental tests to determine whether the vacuum photon momentum must be divided or multiplied by the refractive index of the host medium. Also, momentum conservation is intimately tied to the force law that specifies the rate of exchange of electromagnetic and mechanical momenta between light and matter. In this presentation, I will discuss the foundational postulates of the Maxwell-Lorentz theory of electrodynamics with the goal of clarifying the prevailing ambiguities and resolving the reigning controversies.



About the Speaker:

Masud Mansuripur (PhD, 1981, Electrical Engineering, Stanford University) is Professor and Chair of Optical Data Storage at the College of Optical Sciences of the University of Arizona in Tucson. He is the author of "*Introduction to Information Theory*" (Prentice-Hall, 1987), "*The Physical Principles of Magneto-Optical Recording*" (Cambridge University Press, 1995), "*Classical Optics and its Applications*" (Cambridge University Press, 2nd edition, 2009, Japanese translation 2012), "*Field, Force, Energy and Momentum in Classical Electrodynamics*" (Bentham e-books, 2nd edition, 2017), and "*Mathematical Methods in Science and Engineering: Applications in Optics and Photonics*" (Cognella Academic Publishing, 2019). A Fellow of OSA and SPIE, he is the author or co-author of over 300 technical papers in the areas of optical data recording, magneto-optics, optical materials fabrication and characterization, thin film optics, diffraction theory, macromolecular data storage, and problems associated with radiation pressure and photon momentum.

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Prof. Gerd Leuchs

Taking focusing to the extreme: Is there something new?
- an intermediate report from a long journey

Gerd Leuchs

Max Planck Institute for the Science of Light
Institute of Applied Physics of the Russian Academy of Sciences
Department of Physics, University Erlangen-Nürnberg
Department of Physics, University of Ottawa

About Speaker

Gerd Leuchs is Director Emeritus at the Max Planck Institute for the Science of Light in Erlangen, and an adjunct professor within the physics department of the University of Ottawa. After 15 years in academic research at the Universities of Cologne, Munich and at JILA, Boulder, Colorado, he worked at a Swiss optics company for five years before becoming full professor at the University of Erlangen-Nürnberg. His scientific work includes quantum beats, photo-electron angular distributions in multi photon ionization, quantum noise reduced

and entangled light beams and solitons in optical fibres, quantum communication protocols, focusing light beams and nanophotonics.

For five years, Gerd Leuchs led the German gravitational wave detection group (1985-1989). He has been a Visiting Fellow of JILA, Feodor-Lynen Fellow of the Alexander von Humboldt Foundation, Heisenberg Fellow of the German Science Foundation, Visiting Professor at the Australian National University, at the University of Adelaide and the Laboratoire Kastler Brossel of the Ecole Normale Supérieure. He is member of the German Physical Society, the German Society for Applied Optics, the European Physical Society and the German Academy of Sciences Leopoldina, and Fellow of the Institute of Physics, of The Optical Society (OSA), and of the American Association for the Advancement of Science. He is a foreign member of the Russian Academy of Sciences. He holds honorary degrees from the Danish Technical University and Saint Petersburg State University.

In 2005, he received the Quantum Electronics Prize from the European Physical Society, and in 2018, the Herbert Walther Prize jointly awarded by OSA and the German Physical Society (DPG). He won an advanced grant from the European Research Council, a mega-grant from Russia as well as a Julius-von-Haast Fellowship award from the Royal Society of New Zealand. With his research, Gerd Leuchs is contributing to the field of quantum technology. He is member of a number of advisory boards for quantum technology application and innovation in Germany and abroad.

Time table

Speaker	Talk	Time (Talk + Discussion)
Prof. Masud Mansuripur	Mechanical Effects of Light: Radiation Pressure, Photon Momentum, and the Abraham-Minkowski Controversy	09:00 – 10:00
Prof. Gerd Leuchs	Taking focusing to the extreme: Is there something new? - an intermediate report from a long journey	14:00 – 15:30