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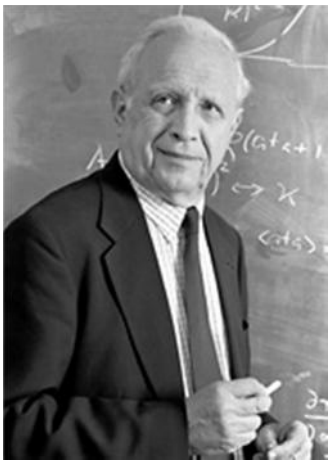
Nobel Prize in Physics 2005



Roy J. Glauber **John L. Hall** **Theodor W. Hänsch**

The Nobel Prize in Physics 2005 was divided, one half awarded to Roy J. Glauber *"for his contribution to the quantum theory of optical coherence"*, the other half jointly to John L. Hall and Theodor W. Hänsch *"for their contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique"*.

Information about winners:

Roy J. Glauber
Harvard University, Cambridge, MA, USA

John L. Hall
JILA, University of Colorado and National Institute of Standards and Technology, Boulder, CO, USA and

Theodor W. Hänsch
Max-Planck-Institut für Quantenoptik, Garching and Ludwig-Maximilians-Universität, Munich, Germany

RESEARCH INFORMATION:

New light on modern optics

As long as humans have populated the Earth, we have been fascinated by optical phenomena and gradually unravelled the nature of light. This year's Nobel Prize in Physics

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is awarded to three scientists in the field of optics. Roy Glauber is awarded half of the Prize for his theoretical description of the behaviour of light particles. John Hall and Theodor Hänsch share the other half of the Prize for their development of laser-based precision spectroscopy, that is, the determination of the colour of the light of atoms and molecules with extreme precision.

Just like radio waves, light is a form of electromagnetic radiation. Maxwell described this in the 1850s. His theory has been utilised in modern communication technology based on transmitters and receivers: mobile telephones, television and radio. If a receiver or a detector is to register light, it must be able to absorb the radiation energy and forward the signal. This energy occurs in packets called quanta and a hundred years ago Einstein was able to show how the absorption of a quantum (a photon) leads to the release of a photoelectron. It is these indirect photoelectrons that are registered in the apparatuses when photons are absorbed.

Thus light exhibits a double nature – it can be considered both as waves and as a stream of particles. Roy Glauber has established the basis of Quantum Optics, in which quantum theory encompasses the field of optics. He could explain the fundamental differences between hot sources of light such as light bulbs, with a mixture of frequencies and phases, and lasers which give a specific frequency and phase.

The important contributions by John Hall and Theodor Hänsch have made it possible to measure frequencies with an accuracy of fifteen digits. Lasers with extremely sharp colours can now be constructed and with the frequency comb technique precise readings can be made of light of all colours. This technique makes it possible to carry out studies of, for example, the stability of the constants of nature over time and to develop extremely accurate clocks and improved GPS technology.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/physics/laureates/2005/popular-physicsprize2005.pdf