Deutsches Museum

MCQST

Press Release

A „Quantum“ Insight

The new special exhibition ‘Light and Matter’ makes quantum physics tangible

View into the new exhibition with many interactive elements. Photo: Deutsches Museum

(Munich, 18 June 2024) From the scanner at the supermarket checkout to high-speed internet surfing through fibre optic cables: developments in quantum physics have long been part of our everyday lives and are widely used. In the new special exhibition ‘Light and Matter’, quantum optical phenomena are now being illuminated and made tangible at the Deutsches Museum. With numerous objects, in scenoramas and above all at many hands-on stations, the exhibition shows how the understanding of the interaction between light and matter has changed over the last century. As part of the Cluster of Excellence Munich Centre for Quantum Science and Technology (MCQST), the exhibition also offers an insight into current research and an outlook on future applications.

It's straight to the point here: at the entrance to the new special exhibition ‘Light and Matter’, visitors are ‘transformed’ into photons. The area is designed as a two-part, darkened room with two narrow passages. And after you walk through one of them, a dot lights up at a certain point on the rear wall. When a large number of ‘photons’ pass through the openings like a beam of light, a wave-shaped interference pattern is created. And you are right in the middle of the topic, because “the distribution of the dots follows the measurement results from the double-slit experiment - one of the key experiments in physics,” says Eckhard Wallis, one of the curators of the new exhibition.

The experiment and its history are explained in more detail in the following, actually the first section of the exhibition, and made tangible with a demonstration. The fundamental question here is: What is light?

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The entrance area with the "double-slit" doors. Photo: Deutsches Museum

"It's obviously more than just what's visible to the human eye," says Wallis, "just think of infrared rays or ultraviolet light." Ultimately, light is categorised as an electromagnetic ray, with the physical properties of waves and particles and the statement that light can only release its energy in small portions - the quanta.

As you continue your tour of the exhibition, you will find out what was done with this knowledge in the first half of the 20th century: Initially, 'spectroscopy', in which electromagnetic radiation is broken down into its components with different wavelengths, had a heyday. "Spectroscopy has enabled researchers to gain important insights into the structure of atoms and molecules, i.e. the structure of matter," says Johannes-Geert Hagmann, one of the curators of the exhibition and Head of Research at the Deutsches Museum.

Specialised measurement techniques were developed and continuously refined. Technologies that emerged from this new knowledge in the context of research funding during the Second World War and the Cold War include radar and maser (microwave amplification by stimulated emission of radiation). "The exhibition presents new findings from historical research into science and technology in the 20th century. It also emphasises that, then as now, science and technology have always interacted with diverse social, economic and political conditions and do not act in isolation," says Hagmann.

From maser to laser (light amplification by stimulated emission of radiation), the next exhibition area continues. Here you can see original parts from a laser by Theodore Maiman, who built the first functional device in 1960. Less than four years later, laser beams were already being used as a nasty weapon on the cinema screen. The scene in which 'Goldfinger' Gert Fröbe tries to split agent 007, alias Sean Connery, in half using a laser was recreated by the workshops of the Deutsches Museum for the exhibition. "In addition to such scenoramas, we naturally also use classic demonstrations in all areas to make this challenging topic easier for our visitors to understand," says Wallis.

The next, penultimate section of the exhibition is dedicated to the quantum physics of light up to the present day. Among other things, a model of a magneto-optical trap is shown in which atoms can be trapped and controlled. A scenorama tells the story of the unknown scientist Alice Golsen, who was the first to accurately measure radiation pressure. The original apparatus for generating a Bose-Einstein condensate, for the discovery of which Wolfgang Ketterle was awarded the Nobel Prize in Physics in 2001 together with Eric Cornell and Carl Wiemann, is on display. A quantum computer is also being shown, offering a glimpse of future technological developments.

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The scenorama shows the story of Alice Golsen. Photo: Deutsches Museum

You can get to know the people behind this research in the final section of the exhibition. In the MQCST module, scientists present their current projects on an interactive screen. For example, they discuss approaches to the realisation of quantum computers and the researchers reveal how they came to their profession and what inspires them about their work. And last but not least, there is a 'mailbox' through which you can get into a dialogue with the quantum specialists.

"This exhibition is a fantastic example of lively, contemporary science communication," says Wolfgang M. Heckl, Director General of the Deutsches Museum. "Here, research takes a direct route to society, presents its findings, answers questions and, in the best-case scenario, even generates new ideas." The fact that the United Nations has just proclaimed the next year 2025 as the International Year of Quantum Science and Technology shows just how up to date and important the subject is. "Thanks to the collaboration with the MCQST, we can already give people a basic understanding of this with 'Light and Matter'," says Director General Heckl.

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The Cluster of Excellence 'Munich Center for Quantum Science and Technology' brings together intensive research on quantum science and technology in Munich and the surrounding area and has been funded by the German Research Foundation since 2019. "MCQST is immensely proud to have the German Museum as a partner, providing us with outstanding outreach opportunities to spread the wonders of quantum science. We are truly privileged to collaborate in this exceptional exhibition, showcasing groundbreaking advancements to a wide audience," says speaker of the cluster Ignacio Cirac.

Bavaria's Science Minister Markus Blume is enthusiastic: "Innovative, interactive, informative: with Nobel Prize-winning exhibits and a recreated James Bond scene, the special exhibition 'Light and Matter' conveys the basics and possibilities of highly complex quantum physics to laypeople at the speed of light – that's science communication at its best! Thanks to the cooperation with the 'Munich Center for Quantum Science and Technology', the Deutsches Museum presents itself on the same wavelength as our excellent scientific institutions in Bavaria and lives its spirit of a world-class research museum: out of the laboratory, into life!"

With 'Light and Matter', a chronological and thematic continuation of the 'Classical Optics' exhibition has been created in cooperation with the MCQST. While 'Classical Optics' focuses on the propagation of light in rays and waves, 'Light and Matter' is about how the understanding of the interaction between light and matter has changed over the last century and how we can utilise this knowledge. To be seen and experienced from 19 June 2024 in the special exhibition area in the entrance hall of the Deutsches Museum.

Light and Matter - facts and figures
- Area 250 square metres, special exhibition area in the entrance hall
- 5 sections (What is light?, Spectroscopy, Lasers, Quantum Physics of Light, MCQST Module)
- 86 objects
- 24 demonstrations
- 5 media stations
- 6 models
- 6 scenoramas
- Opening on 19 June 2024, duration until the end of 2025 (subsequently part of the new permanent exhibition Physics after completion of the renovation of the Deutsches Museum)

The Cluster of Excellence 'Munich Centre for Quantum Science and Technology'

At the MCQST, scientists work on interdisciplinary research questions that cover all aspects of quantum science from basic research to application. The aim is to research and utilise quantum effects such as entanglement. In this way, new quantum technologies can be developed, such as highly sensitive sensors, tap-proof communication and quantum computers.
In addition to a structured and long-term research programme, MCQST also offers the opportunity to address current issues and ideas and promote them through targeted measures. These benefit young researchers in particular. MCQST aims to increase the visibility of Munich as a research location through international conferences and workshops, a guest programme and scientific exchange with other research centres. The aim of MCQST is to become a world-leading centre for quantum science and technology. Alongside Ludwig-Maximilians-Universität München and the Technical University of Munich, the Max Planck Institute of Quantum Optics, the Walther Meißner Institute of the Bavarian Academy of Sciences and Humanities, and the Deutsches Museum are as partners in MCQST.

Contact:
Gerrit Faust,
head of Press and Public Relations
Tel. +49 89 2179 - 281
Email: presse@deutsches-museum.de