FM 47: Industry I: Photonics

Time: Wednesday 11:00–13:00 Location: Aula

Invited Talk FM 47.1 Wed 11:00 Aula

Enabling Industrial Quantum Technology — •Michael Förtsch — Q.ANT GmbH, Handwerkstraße 29, 70565 Stuttgart

After more than 30 years of successful scientific demonstration of quantum mechanical phenomena, we are reaching the point to realize first industrial products with this novel technology. It is expected that in the 21st century quantum phenomena will create significant economic value in at least four technology fields: Communication, Computing, Imaging, and Sensing.

This expectation for everyday products is bringing key industrial parameters such as usability, price, durability and scalability into the focus of current developments. I am convinced that this shift in priorities can only succeed, if we:

1. Establish education in quantum technology beyond physics
2. Collaborate together in highly multidisciplinary teams
3. Generate public interest by explaining the advantages and possibilities instead of 'how it works'
4. Manage the expectations both in terms of value proposition and 'time-to-market'

It is time to develop the next generation of technologies.
Let's drive quantum technology to industry.

Invited Talk FM 47.2 Wed 11:20 Aula

An industry perspective on Quantum Technologies — •Nils Trautmann — Carl Zeiss AG, Oberkochen, Germany

At the beginning of the 20th century, quantum technology first revolutionized physics and then it also revolutionized technology. Without quantum physics, we would have no lasers, no LEDs, no integrated circuits, no smartphones, no fiber optic networks, no internet. This explains, at least in part, industry's great interest in the quantum technology of the early 21st century. While the quantum technology of the 20th century uses the quantum properties of matter, quantum technology of the 21st century controls them. Now the quantum states of individual or coupled systems are in focus. The question that concerns industrial players is which industrial applications will benefit from quantum technologies. In which areas do we expect significant benefits from QT that we cannot otherwise receive? Where can we provide completely new solutions (new imaging modalities, ..) or where can we improve specifications by at least one order of magnitude? Four foreseeable applications are in the focus of the community: (i) quantum communication, (ii) quantum sensors & metrology, (iii) quantum computing & simulation, and (iv) quantum-enhanced imaging. In this talk, their relationship to optics will be discussed with a specific focus on optical imaging and sensing.

Invited Talk FM 47.3 Wed 11:40 Aula

A proposal for a topological phase modulator with π Berry phase shift — •Ulrich Gaubatz — Coriant R&D GmbH - Part of the Infinera Group

A proposal is made for a π phase shift of a polarized laser field when it passes an elementary birefringent wave plate. With a slight reorientation of the wave plate relative to the input polarization state the overall phase of the light field (common to x and y component) suddenly changes by π which could be used for binary signal generation in modern high speed phase modulated optical transmission systems. The π phase shift is a topological or Pancharatnam-Berry phase variation which promises a new type of high speed optical modulators with low drive voltage. Due to the topological nature of the phenomena this type of modulator should be robust and well suited for optical integration. One experiment from the past is presented suggesting the existence of the proposed π jump, but also the non-supporting outcome from a single photon experiment. Topological arguments for the existence are discussed.

Invited Talk FM 47.4 Wed 12:00 Aula

Quantum Technologies in Thales — •Thierry Debuisschert — Thales Research and Technology, 1 avenue Augustin Fresnel, 91767 Palaiseau Cedex

The ability of quantum technologies to control matter on the scale of a single quantum object opens up entirely new possibilities for many applications. Quantum technologies have been identified by Thales as leading-edge technologies with a high potential impact on future navigation, detection and communication systems. In recent years, we have studied technologies such as spin impurities in diamond, rare earth-doped crystals, cold atoms, quantum photonics, with a particular focus on practical operational considerations. Quantum technologies, combined with integration techniques, will improve the performance of navigation systems through ultra-precise compact atomic clocks, accelerometers and gyroscopes. They will improve magnetic field sensors but also electric field or pressure sensors. They will have an impact on radar and electromagnetic detection as well. In addition, quantum technologies are expected to have a strong impact on secure communications, particularly in the space sector.

Invited Talk FM 47.5 Wed 12:20 Aula

Opticlock: Towards a transportable and user-friendly optical single-ion clock — •Juergen Stuhler[1] and opticlock Consortium[2] — [1]TOPTICA Photonics AG — [2]www.opticlock.de

Today's most precise clocks are research prototypes based on optical reference transitions of neutral atoms or single ions. Their unprecedented precision of few parts in 10^{18} opens up numerous applications, e.g. improved network synchronization or navigation as well as geodetic height measurements.

The opticlock consortium of industrial and academic partners (www.opticlock.de) is developing an easy-to-use optical clock based on a single $^{171}Yb^{+}$ ion. The complete clock system will be integrated into two mobile 19" rack assemblies. It comes with a fully autonomous control system and is designed for reliable operation in a standard industrial environment. The key technologies of this project will extend the portfolio of commercially available components to the benefit of many applications of quantum technology.

We will give an overview of the opticlock system design, present the current development status of selected subsystems or components and report on first clock performance tests.

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Invited Talk FM 47.6 Wed 12:40 Aula

Quantum-dot based single photon sources: Commercialization of near optimal solid-state sources for Quantum Applications — •Valerian Giesz and Niccolo Somaschi — Quandela, Palaiseau, France

Quantum light sources are key building blocks for the development of quantum enhanced technologies. Single photon sources based on semiconductor quantum dots have emerged as an excellent platform for high efficiency quantum light emission. However, the question of commercialization of such devices remains a challenge.

In this talk, we report about the first commercialization of efficient single photon sources based on self-assembled quantum dots. We demonstrate the robustness and the repeatability of the fabrication of efficient sources by using innovative fabrication techniques.