Physics in the national high-tech industry
Room: Auditorium 3
Session chair: Andrea Fiore (TU/e)

This session will put the spotlight on exciting technological developments enabled by advanced physics research. The speakers will discuss technologies which are having impact in fields varying from chip production to climate change mitigation. Their stories will also provide a glimpse into the many career opportunities for physicists in industry.

Future developments in EUV Lithography
Mark van de Kerkhof (ASML)

In the past years, EUV lithography has been adopted for manufacturing of state-of-the-art Integrated Circuits, with critical dimensions down to 10 nm. With the introduction of a larger NA=0.55, these dimensions will become smaller still, and even higher NA systems are foreseen to reach below 5 nm. This will further tighten requirements on CD and pattern placement control to ensure yielding devices. This also raises questions on the limits of the shrink that may be achieved in manufacturing reality, in terms of both exposures and chemical and etching processes.
This presentation will discuss the principles of EUV Lithography, its challenges and limitations, and possible solution paths being explored.

How physics and chemistry can join forces to capture CO2 from the atmosphere
Hans de Neve (Carbyon)

For a long time most researchers and engineers believed that it would never be possible to design a system that could capture CO2 from air in a cost-effective way. In the past the problem was mostly addressed from a chemical engineering perspective only. By using a smart combination of chemical engineering and thin film technology developed in the world of solar and semiconductor materials Carbyon has demonstrated that the costs of the technology can be drastically reduced.
As such a multi-domain approach of physics, materials science, chemistry and mechanical engineering yielded solutions that were deemed impossible before, opening a new pathway to mitigate climate change.

Efficient photon conversion in a scalable microwave-to-optics transducer
Mathilde Lemang (QphoX)

Quantum computers expand on the existing capabilities of modern computers by solving previously intractable problems. For qubits operating at cryogenic temperatures, the limited cooling power pose severe restrictions on the scalability of quantum computers. Accordingly, transduction between microwave and optical frequencies is a key technology, enabling both long-range quantum interconnects at room temperature and qubit interfaces with a minimal heat load.
We present a scalable platform for large bandwidth and ultra-low-noise microwave-to-optics transduction based on a planar superconducting resonator coupled to a photonic cavity through a nanomechanical intermediary. Our system allows us to simultaneously realise strongly coupled electro-mechanical and high-performance opto-mechanical interfaces. The device is extremely compact (< 0.15 mm2), and fully integrated for wafer-scale fabrication.

Fibre optics, an enabling tool for innovative sensing
Grzegorz Gruca (Optics11)

Fiber optic sensing was introduced decades ago. Since then, various sensing techniques have been developed, but only a select few have successfully made their way to the market. In this presentation, our aim is to provide a concise overview of our sensing techniques and their applications in the Life Science, Energy, and Security markets. Our emphasis will be on interferometry and specific aspects of spectral-based measurements, where outstanding precision and accuracy are key enablers for high-performance sensing. Additionally, we will discuss the influence of scalability, manufacturability, and cost-effectiveness as factors shaping the final solution.