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Optics at the Core of Innovation – From ZEISS' History to the Technologies of Tomorrow

Abstract

Starting with the history of ZEISS we explore how optics became what it is today: A key technology with an extremely broad impact. Many current hotspots of innovation have a strong optical component. Digitalization and AI would not be possible without optical lithography as an enabler of microelectronics. At the same time, technologies such as computational imaging and AI-based data analysis are revolutionizing optics from the ground up by enabling new functions and thereby opening up new areas of application.

Conversely, microelectronic manufacturing processes enable new components such as photonic integrated circuits, holographic elements, and metamaterials. This miniaturizes optical systems on multiple levels. This, in turn, enables deep functional integration for applications such as optical computing, mixed reality, advanced manufacturing, and others.

In quantum technology as well, many applications are only made possible by optics—whether in quantum communication with entangled photons, quantum sensing with NV centers, or quantum computing with atoms.

These examples demonstrate that optics is not “fully explored” but rather the core component of a complex value chain characterized by intense innovation activity. This, in turn, is based on a vibrant ecosystem of research, development, and application

CV

Michael Totzeck studied physics at the Technical University of Berlin, where he also completed his PhD and habilitation. He subsequently joined the University of Stuttgart as a postdoctoral researcher, where he founded a research group in quantitative microscopy.

In 2002, he joined ZEISS in the field of semiconductor optics and moved to central research in 2008. Since 2015, he has held the position of Fellow within the ZEISS expert career track.

Since June 2013, Totzeck has also been an honorary professor at the University of Konstanz, where he teaches applied optics. His research interests lie at the intersection of optics and innovation, particularly in imaging, metrology, lithography, quantum technology, and digitalization.