

## Cluster of Excellence PhoenixD: Here begins the revolution in optics



### Auf einen Blick

- Precision optics should become more compact and less expensive
- Production scientists pave the way to mass production
- Goal: Technological leap as once in electronics
- 52.2 million euros in subsidies from the Federal Government and the State of Lower Saxony

17. 2020

**PhoenixD | 52 million euros, 110 scientists, one common goal: the technological revolution in optics. In the Cluster of Excellence PhoenixD, researchers are working on small and inexpensive high-performance optics that open up completely new fields of application.**

Incredible sounded the idea 60 years ago that in 2020 almost everyone would own several computers. Today, it is impossible to imagine our everyday life without high-performance electronics - whether in the office, in the car or in our pockets. The foundation for this was laid by the invention of the integrated circuit in the 1960s. Electronic systems that previously filled entire rooms could now be reduced to microchips. And electronics not only became significantly more compact, but also increasingly cheaper - thanks to new manufacturing processes, new materials and automated production.

### Technological leap in optics

Scientists in the Cluster of Excellence PhoenixD for Optics and Photonics want to make a similar technological leap - 60 years after the invention of the laser. Their goal is a paradigm shift from large and complex free-field high-performance optics to intelligent, compact and adaptive optical systems manufactured in an integrated production network.

Photonics is one of the key technologies of the 21st century. Optical fibers are the backbone of the Internet and mobile networks. Optical sensors and high-resolution cameras are a prerequisite for the autonomous driving of the future and lasers are replacing the scalpel in medical technology. In order to accelerate this development and open up completely new fields of application, optics - just like electronics in the past - must become much more compact

and can be produced faster and more economically. This is the goal of the Cluster of Excellence PhoenixD.

### **Basic research meets practice**

Around 110 scientists from six disciplines are working together on the road to compact and inexpensive precision optics: Physicists, chemists, electrical engineers, computer scientists, mathematicians and mechanical engineers devote themselves partly to basic research and partly to practical application.

At present, the members are still working scattered at various locations in Hanover and Brunswick. In early 2021, several research groups will move into two buildings directly adjacent to the main building of Leibniz Universität Hannover. A new research building, the OPTICUM, is also being planned. From 2026, the activities in the field of optical technologies are to be bundled there under one roof.

### **Mass production of precision optics**

How the precision optics of tomorrow can be manufactured in large quantities is the subject of research by engineers at the Produktionstechnisches Zentrum Hannover (PZH) and the Laser Zentrum Hannover e.V. (LZH). In the so-called Research Area M - that part of the Cluster of Excellence that deals with production technology - they are jointly building a Manufacturing Grid, i.e. a production grid for manufacturing precision optics.

The production scientists are investigating the extent to which 3D printing, plastic injection moulding and embossing processes are suitable for manufacturing precision optics. They are developing techniques for high-precision component assembly - from gluing to tactile actuators to self-assembly techniques. They simulate additive manufacturing processes, deal with the supply chain configuration, research new materials and show with a practical example that printed optical fibres are possible.

### **Funding information and cooperation partners**

The Cluster of Excellence PhoenixD is an interdisciplinary scientific institution of Leibniz Universität Hannover. It is funded by the Federal Government and the State of Lower Saxony via the German Research Foundation (DFG). From January 2019 to December 2025, the Cluster of Excellence PhoenixD has 52.2 million euros in funding at its disposal. 75 percent of the funds come from the federal government, 25 percent from the state of Lower Saxony.

The cluster's cooperation partners are the Technical University of Braunschweig, the Max Planck Institute for Gravitational Physics (Albert Einstein Institute), the Physikalisch-Technische Bundesanstalt and the Laser Zentrum Hannover e.V. (LZH).

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