Photonics, the generation, transport and detection of light particles, can help to satisfy the world’s growing appetite for data: with light, you can transport more data faster, and that also costs less energy than using electrical signals. Furthermore, photonics makes it possible to produce smaller, more accurate sensors, which can be used in applications such as telescopes, medical diagnostics or self-driving cars.

Within the MEMPHIS II programme, researchers worked on the development of so-called integrated photonics, the light variant of an electronic computer chip. On a photonic chip, they tried to build elements with similar and additional functions as the parts of an electronic chip, which are now found in computers for example.

Focus on application
The Perspectief programme is the follow-up to the SmartMix programme MEMPHIS. ‘That focussed more on the fundamental science’, says programme leader Erik Teunissen of Berenschot. ‘With MEMPHIS II, we wanted to create greater alignment in the Dutch photonics field, and focus the research more on applications.’ Producibility and scalability of technology therefore took centre stage in the thirteen projects of the programme, each of which falls within one of the four programme lines: applications, components, technologies and processes.

Aim
The MEMPHIS II programme focussed on realising the entire value chain for photonic
chips by developing standardised building blocks for the design, production and functional tests.

**What was investigated?**
The researchers started by itemising the applications for which combinations of electronics and photonics could provide added value. They subsequently determined which integrated chips, technologies and production processes were needed for this. With this approach, they developed a number of different applications ranging from a direction-sensitive radio antenna for astronomy to a sender-receiver to make ultrafast and cheap internet possible within the home. They also worked on the design and development of several standard components that can be produced on the chip, such as a microspectrometer that can detect light particles very accurately and a number of lasers with specific properties. Finally, a wide range of production and test processes were developed to produce and characterise a multitude of photonic components.

**What has the programme yielded?**
‘MEMPHIS II has helped to ensure that photonics is now no longer just a promise, but instead offers serious possibilities for solving societal challenges and creating new commercial activity’, says Teunissen. ‘To make a new technology like photonics successful, it is vital to think not only in terms of how you can produce components, but also how you can scale up the production and integrate new chips with existing electronics. Therefore an important outcome of the programme is that we now have a standardised way of producing several different chip designs on the same wafer (material used for the production of a chip). Producing photonic chips is an expensive process in which you must expose, develop and etch wafers very accurately several times. To make the technology ready for the market, manufacturers must be able to try out different designs without having to make large investments straightaway.’

MEMPHIS II has also played an important role in strengthening the Dutch photonics network, says Teunissen. ‘We really are working as one single Dutch ecosystem to bring this technology to the market. We have gained international respect for these efforts.’

**Facts & figures**

- **Research institutions & universities**
  - ASTRON
  - Delft University of Technology
  - Eindhoven University of Technology
  - University of Amsterdam
  - University of Twente
  - VU Amsterdam
- **University medical centres**
  - Amsterdam UMC
  - Erasmus MC
- **Companies**
  - 17
- **Top Sector**
  - High Tech Systems and Materials
- **Total budget**
  - 7 million euro
- **Co-funding**
  - 2.6 million euro

**Highlights**
- The Dutch ecosystem is the driving force behind the worldwide photonics roadmap
- The launching of the National Agenda Photonics in 2018

Perspectief focuses on creating strong collaborations between researchers, companies and societal organisations, leading to technological innovations with potential economical and societal impact. Visit nwo.nl/perspectief-en