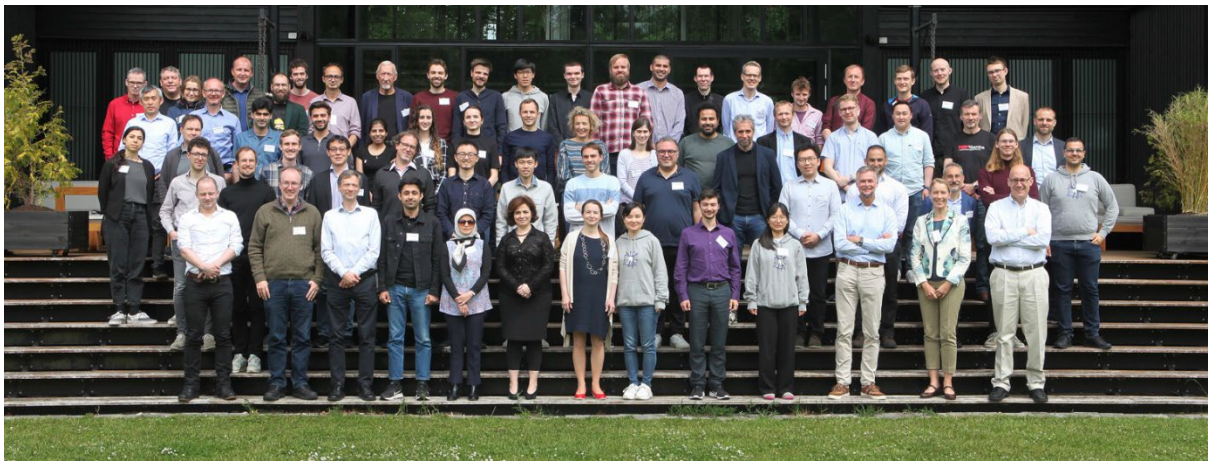
ANNUAL HIGHLIGHTS

The NanoPhoton research centre is devoted to investigating deep sub-wavelength confinement of light in optical cavities and its use in the science and technology of tomorrow. The third year of NanoPhoton saw the first applications of topology-optimized cavities with Extreme Dielectric Confinement (EDC) for advanced functionalities, such as measurements on our recently fabricated two-photon absorption detector and measurements of all-optical switching with topology-optimized cavities. On the more fundamental side, we made significant advances in the self-assembly of nanocavities with critical dimensions less than a nanometer via Casimir and van der Waals forces as well as deep sub-wavelength imaging of confined electromagnetic fields by use of electron energy loss spectroscopy.

A major scientific highlight of the third year of NanoPhoton was the fabrication and demonstration of a semiconductor laser with an extremely small threshold current of only 730 nA [1]. In addition to being the lowest room-temperature threshold current achieved for any laser, this result is central to the ambitious NanoPhoton goal of replacing parts of the energy-consuming electronic communication in modern computer chips with optical interconnects. Moreover, 2022 saw the publication in Nature Communications [2] of the first demonstration of a topology-optimized cavity with deep subwavelength confinement. The publication received substantial coverage in popular physics and technology magazines and was featured as the cover story of Laser Focus World. As a final highlight, we secured another world record for quantum emitters operating in the telecom C-band achieving both high single-photon purity and indistinguishability [3].

In June, we had the pleasure of welcoming more than 20 distinguished researchers from around the world, including speakers from MIT, Harvard, and Columbia University, to a focused conference on the fundamentals and applications of semiconductor nanocavities. For many of us, this represented the first in-person meeting since the outbreak of the Covid-19 pandemic. The three days of excellent scientific presentations and intense discussions confirmed to us the timeliness of the research focus of NanoPhoton. The conference was partially covered by a dedicated grant from DNRF.

During the third year of the centre, we are proud that NanoPhoton members were able to attract considerable additional funding through an ERC consolidator grant, an ERC pathfinder grant, a Marie Curie fellowship, and a Villum Young Investigator grant. With the additional welcoming of 10 new colleagues to the research centre, the NanoPhoton lineup is almost complete.



Participants of the NanoPhoton conference on fundamentals and applications of semiconductor nanocavities on 7-9 June 2022.