

ANNUAL HIGHLIGHTS

2019 has been a very exciting year for SPOC. We have consolidated our position as a key player in the field with several key publications and record research demonstrations. The initial ideas we launched with SPOC's five flagship themes have almost all born fruit, and this has been particularly visible through 2019. We have designed and fabricated the first scalable silicon chip that can multiplex several orbital angular momentum modes into an optical fibre, which was selected as a prestigious postdeadline paper at the CLEO Europe conference in 2019. We have demonstrated a field trial of optical quantum keys in the Italian national deployed testbed. We have successfully shown that we can compensate for nonlinear transmission distortions using optical phase conjugation, and received a Best Student Paper Award at the OECC Conference in Japan for it. We demonstrated a record-high number of optical channels (256) processed in a single nonlinear optical time lens, and the centre leader was invited to give an invited talk on the subject at the biggest international conference on optical communications, OFC'2019. Our quantum activities are creating a stir, and the centre leader was also invited to give a talk on this at the Advanced Photonics Conference in San Francisco. Interestingly, no less than 5 of our papers, describing our breakthroughs in core areas of SPOC, were chosen as Editor's Picks in Optics Letters in 2019. The papers addressed new nonlinear materials, with record performance, quantum chips, octave-spanning supercontinuum generation, and conversion of wavelength to the 2 μm range. We had a postdeadline paper at CLEO US, on chip-to-chip teleportation, which was later expanded into a Nature Physics paper. Another Nature Physics paper was on our demonstration of a chip that could perform a quantum simulation of a simple molecule. Other work gave rise to 2 frontpage covers of the journals Advanced Photonics and Advanced Quantum Technologies, with the former elected the best cover of the year. We set a new world record for the highest key rate of a QKD quantum key ever achieved—by multiplexing several keys into a special 37-core fibre (Nature Communications Physics). SPOC'ers were asked to write a chapter on nonlinear optical signal processing in the highly exclusive 40-year running book series *Optical Fiber Telecommunications* (OFT VII), which was published late 2019.

The site visit related to the evaluation of SPOC was a good opportunity for all SPOC'ers to come together, and we had a great day. It was a very rewarding event, where we enjoyed getting the time to tell learned peers about our ideas, interests, strategies and infrastructure, whilst having very fruitful discussions.

SPOC partook in the KulturNatten, for the third year running. This time, at IDA (Ingeniørforeningen). SPOC played a big part in the DK-Japan Quantum event in November, organized by the DK-Japan embassies, Invest in Denmark, NBI, SPOC and BigQ, owing to our close links with the DK-embassy in Tokyo and our ongoing International Network Programme (INP) project with NICT in Japan.

We received a new INP grant in 2019, with start 2020, to start collaborations with the National Institute of Advanced Industrial Science and Technology (AIST) in Japan, with the centre leader as PI. Dr. Minhao Pu, received an ERC starter grant, Dr. Francesco Da Ros received a Villum Young Investigator grant, and SPOC's quantum team is partner in the IFD Grand Solutions project Fire-Q with the Hy-Q centre at NBI.

The centre leader has had many interactions with media and organisations (DI Digital, Dansk Erhverv, IT-Branchen) on the energy consumption of the internet, so SPOC is becoming the go-to source for reliable information on this topic. Finally, the centre leader was elected member of the IEEE Photonics Society's Board of Governors for a 3 year period. This is a big honour and responsibility.