

ANNUAL HIGHLIGHTS

The second year of SPOC has seen several frontline and breakthrough results produced. The biggest achievement has been winning the EU Horizon 2020 Competition Prize for “Breaking the optical transmission barriers,” [ref. <http://dg.dk/2016/11/12/spoc-faar-stor-eu-pris-for-verdens-hurtigste-datasignal/>]. The prize was primarily based on our achieved world record result of transmitting the equivalent of more than twice the total worldwide internet traffic on the light generated in one single photonic chip, [ref. <http://videnskab.dk/teknologi-innovation/rekord-dtu-forskere-udvikler-verdens-hurtigste-datasignal/>]. This breakthrough result clearly demonstrated the powers of nonlinear optical chips. The results were presented as a prestigious *postdeadline paper* at the annual Conference on Lasers and Electro-Optics (CLEO2016) in the US.

Furthermore, and clearly fueled by SPOC, the partners in SPOC were able to generate an unprecedented number of six such *postdeadline papers* at various international conferences around the world (OFC 2016 (US), CLEO 2016 (US), OECC 2016 (Japan), 2xECOC 2016 (Germany) and IPC 2016 (US)). Each paper represents a major breakthrough in the field, or a record-breaking demonstration. The results include ultra-high capacity data transmission by spatial multiplexing schemes, single-chip transmitter for record high data capacity, single-unit regenerator for multiple parallel channels using parallel-to-serial conversion and ultra-fast nonlinear optical regeneration, and record-high wireless terahertz data transmission for beyond-5G applications.

The European Research Council (ERC), Science, Nature Photonics and APL Photonics chose to highlight our results on nonlinear effects in an optical chip to create broadband light, and the wireless record results [ref. <http://science.sciencemag.org/content/353/6302/883.2>, <http://palgrave.nature.com/nphoton/journal/v10/n11/full/nphoton.2016.220.html>, <http://aip.scitation.org/journal/app/>]. The ERC wrote a piece on our work in their series of ERC Stories [ref. <https://erc.europa.eu/projects-figures/stories/towards-new-quality-sports-broadcast>], which led to an invitation to join an innovation conference in Bruxelles under the theme of “10 tech enablers: Europe’s rising university-industry clusters,” to discuss future technologies and university innovation [ref. <http://sciencebusiness.net/events/2016/10-tech-enablers-europe-s-rising-university-industry-clusters>].

All research themes in SPOC have done well. The above mentioned hero experiments are particularly outstanding, and are backed up by other novel research results, as e.g. quantum key distribution (QKD), where we have devised a new 4-dimensional QKD scheme relying on spatial multiplexing and silicon photonic on-chip key imprinting, in collaboration with international partner at Bristol University. We demonstrated the highest number of simultaneously transmitted optical modes without need for post-transmission digital processing by using orbital angular momentum modes, in collaboration with international partner from Boston University. We have shown that using ultra-low noise laser sources allows for the highest orders of data modulation (1024 QAM) for optical transmission, and that such a laser source can be locked stably to an absolute frequency reference. These results together with tunable frequency comb generation will be very important for our future plans.

In the fall of 2016, we were able to move into our new building. This means that all SPOC employees are now gathered together next to the new High-Speed Optical Communications Lab, and that new lab facilities for clean chip testing are now available. The moving unavoidably brought some delays of planned research with it, however our research production of 2016 still stand unparalleled, and we feel we will soon have caught up with the lost time. We have also through 2016 worked on updating our homepage. A dedicated team of PhD students and the centre administrator have made this new SPOC page become a reality. We hope you like it.