ANNUAL HIGHLIGHTS

2020 has been a challenging year for most, also SPOC. We have seen delays in our research and purchases, due to the Covid-19 lockdown, both because of labs being locked up in periods and chip fabrication delays, but also because of home-working adaptations. We are happy to observe that we have not suffered from severe depressions or loss of motivation among the researchers and students in SPOC. We even achieved some of our biggest results to date—achieved with extra efforts of motivation and dedication. So, we are satisfied, because we have done well, but it has been harder than normal, and we have not been able to celebrate our victories.

In 2020 we managed to break through the petabit-per-second barrier for single chip sources, which had so far eluded us. We previously demonstrated 661 Tbit/s, 909 Tbit/s, and now doubled that to 1.84 Pbit/s data transmission on the light from a single ring-resonator, the highest ever reported for a chip-based light generator. A detailed theoretical analysis was also finalized in 2020, accurately predicting our 1.84 Pbit/s result, and pointing to the realistic prospects of single-chip sources supporting 100-Pbit/s class communication systems. This is quite a breakthrough, and will now be a future goal for SPOC-II.

Our work on nonlinear optical materials has resulted in octave-spanning frequency combs, more than 700 nm conversion bandwidth linking two distant optical transmission bands and more than 200 data channels simultaneously converted from time to frequency channels, using our aluminum gallium arsenide (AlGaAs) material. Our amorphous silicon platform, has met an important milestone with a record-high continuous-wave nonlinear conversion efficiency. In addition to previous steps making the material optically stable, this is a breakthrough, with potential major impact.

On our quantum communication efforts, we teleported a quantum state from one chip to another, which was published in Nature Physics in 2020. This could become a cornerstone in efforts to extend quantum links. Our efforts to control spatial modes of light resulted in an orbital angular momentum chip-based generator and multiplexer. We also demonstrated joint digital and optical processing enabling additive transmission performance improvement. So research wise it has been a good year, after all.

We also managed to run the annual SPOC Workshop, in late August, when Denmark was open. We did not receive any international guests, unfortunately, but had online meetings to plan joint efforts, and to prepare for SPOC-II. It was great to meet in person, and plans included outreach via Wikipedia.

The centre leader is by now a well established expert in the field, and his opinions often consulted: The IEEE Photonic Society elected him as a member of the Board of Governors (BoG) for 2020-2022, where the PI is asked directly to influence the community and the conditions for research and knowledge sharing, e.g. by developing a new high-impact journal to get the highest visibility of photonics research, and e.g. by working on the current and future challenges of scientific meetings.

Public relations and outreach was virtual in most of 2020: SPOC and the PI was involved in several webinars on the theme of energy consumption of the internet, a topic that has created a lot of attention, not least during the lock down. The PI was also interviewed for several media outlets, like newspapers, radio stations and magazines, such as a large feature in the PROSA magazine. This theme has been a focus area for SPOC all along, and it's great to see it gaining traction broadly.