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### Integrated III-V semiconductor components for all-optical analog-to-digital conversion

Ever-growing demand for high-speed internet, optical interconnects in data centers; development of cloud technologies set a trend for moving communication technologies from electronics to photonics. Volumes of information transmitted in the last ten years increased by 50 times, continuing to grow at the same rate. 10% of all electric energy in the world is consumed by Internet, this demand doubles every four years. Combinations of optical and wireless communication technologies resulted in development of a new area of photonics – microwave photonics (MWP). Using MWP systems in hybrid fiber-radio system becomes crucial for reliable operation of next-generation intelligent optical network. To become a viable alternative for electronic components, photonic components must be fabricated in integrated-circuit form. Integration makes them reliable, compact, cost- and energy- effective, convenient for signal and inter-connect matching. III-V compound semiconductor materials are very promising for photonics integrated circuits (PIC) due to their ability to integrate both active and passive devices along with potential of offering cost effective mass production. Currently, PICs are essentially operating in analog mode. As a result, they accumulate the errors while cascading a number of devices. This results in severe degradation of signal quality and requires regeneration of signals. Electronic high speed analog-to-digital converters (ADC) are facing a limited effective number of bits at frequencies of more than 1 GHz due to timing jitter of electronic sampling clocks and ambiguity bottlenecks. To overcome the aperture jitter, it is crucial to perform sampling in the optical domain using low-jitter optical pulse trains generated by a mode-locked laser. We report on different layouts of photonic ADCs based on III-V semiconductor components. We report on modeling and fabrication of integrated 10 GHz III-V semiconductor components, such as monolithic mode-locked lasers, PIN photo-detectors based on InGaAs/InAlGaAs heterostructures, operating at wavelengths of 1520-1580 nm.

### Biography

Vladislav E Bougrov is the Director of School of Photonics and Head of Chair of Light Technologies and Optoelectronics at the ITMO University, St. Petersburg, Russia. He has obtained his Master's degree in Optoelectronics from Department of Optoelectronics, PhD in 1999 and DSc in Physics in 2013 from Ioffe Institute, St. Petersburg, Russia. He is the author of more than 60 papers in reputed journals, inventor in more than 100 patent applications, including more than 30 granted patents and has extensive experience with dynamic management of growing international start-up companies. He is the founder of Optogan.

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