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Advances in mid-infrared mode-locked fiber lasers

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Mid-infrared light sources have become an object for wide research and industrial interest since early 2000, due to numerous of practical applications: greenhouse gases and pollutants monitoring to help climate change mitigation, high precision optical frequency standards for spectroscopy, global positioning systems (GPS) and optical clocks, LIDAR systems, and novel diagnostic techniques in medicine. All-fiber femto-second laser configuration is beneficial, since the laser fabrication process is straight forward, does not require "clean room" facilities and photolithography, and decreases the cost metric and power consumption. In my review I will start with silica Thulium and Holmium doped fiber lasers, demonstrating both ultrashort pulse durations and high output power the 1.8-2.1 μm wavelength range. However, the exceptional performance of fiber lasers cannot be extended far beyond the 2.5 μm wavelength, owing to the rapid decrease of emission intensity due to high losses in silica fibers. The fiber laser generation around 3 μm was enabled with the availability of high-purity fluoride, chalcogenide and ZBLAN glass fibers. I will review the application of these special glass matrixes to support generation at 2.75 μm in Erbium-doped fibers and at 2.85 μm in Holmium and Prazeodinium -doped optical fibers. In 2002, M.C. Downer presented pioneer work on gas-filled hollow-core fibers and announced "a new era in the nonlinear optics of gases". Different gasses, such as acetylene and HCN, can provide gain at Mid-infrared wavelengths at low vapor pressure when pumped with nanosecond pulses. Finally I will analyze the saturable absorbers suitable for operation in Mid-infrared wavelength region.

Biography

Maria Chernysheva has completed her PhD from Fiber Optics Research Center of the Russian Academy of Science in 2014. Currently, she is the Marie Sklodowska-Curie Fellow at Aston University. She has an internationally recognized track record of 13 publications in high-impact factor peer review journals in the fields of rare-earth-doped mode-locked fiber lasers. The area of her research expertise include development of mode-locked lasers and pulse amplifiers; analysis of advanced saturable absorbers and their implementation; numerical modeling of higher-order soliton; dispersion managed soliton pules in passive silica and special fibers.

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