Bachelor diploma abstract

# «Generation of extremely short mid-infrared laser pulses with hollow anti-resonant photonic crystal waveguides for electron dynamic control in semiconductors»

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The generation of ultrabroad supercontinua in single-ring hollow core anti-resonant photonic crystal fiber is investigated both experimentally and theoretically. Multioctave supercontinua generation is experimentally demonstrated by ultrashort mid-infrared pulse compression while propagating in fiber. The spectra of the broadest supercontinua achieved spans from 300 nm to 5200 nm which is more than 4 octaves.

Analysis of nonlinear optical interaction of ultrashort mid-infrared pulses in hollow core antiresonant fibers was conducted by the numerical solving of generalized nonlinear Schrodinger equation. The main mechanism leading to the dramatic broadening of pump pulse spectra is shown to be soliton self-compression. Comparison of experimental data and results of numerical modelling in a wide range of pulse energies from 5 $\mu$J to 50 $\mu$J and argon pressures from 1 torr to 16 torr in fiber core shows the possibility of generation of sub-half-cycle pulses at central wavelength 2.1 $\mu$m. The possibility of time-domain compression of laser pulses to durations less than half-cycle in hollow core antiresonant photonic crystal fiber is due to the joint action of pulse self-steepening, high order dispersion and plasma nonlinearity to the soliton dynamics of the pulse.