Nonlinear self-compression of near- and mid-IR high power pulses in hollow core waveguides

Abstract

In this work, the process of near- and mid-IR nonlinear pulse compression in hollow-core waveguides filled with gas has been investigated. The nonlinear Schrödinger equation has been solved numerically for optimal compression regimes revealing. Nonlinear self-compression in hollow-core revolver type fiber and postcompression in hollow-core capillaries with chirped mirrors has been explored. It has been shown both experimentally and theoretically, that spectrum of 25 μJ pulse centered at 1.7 μm broadens to 130 nm in revolver fiber filled with xenon. A possibility of near-soliton 4 μm pulse dynamics and pulse compression to 30 fs in xenon filled revolver fiber has been shown theoretically. One can expect 1.24 μm pulse compression up to 20-25 fs (by a factor of 7-8) and threefold peak power increase with 65% of initial energy conservation (up to 5.5 mJ) in argon filled capillary with 1-5 reflections from chirped mirrors.