Long-wavelength spectral shift in ultraviolet filament

Vrublevskaya N.R.[1,2,@], **Shipilo D.E.**[1,2], **Nikolaeva I.A.**[1,2], **Kosareva O.G.**[1,2], **Pushkarev D.V.**[1,2], **Rizaev G.E.**[2], **Seleznev L.V.**[2] **and Panov N.A.**[1,2]

[1] Lomonosov Moscow State University, Leninskiye Gory 1, Moscow, 119991, None

[2] Lebedev Physical Institute of the Russian Academy of Sciences, Leninsky Avenue 53, Moscow, 119991, None

[@] rublik14895@gmail.com

In experiments on ultraviolet (UV) filamentation, a long-wavelength shift of the spectrum as a whole to the long-wavelength range by several nanometers was observed [1]. This long-wavelength spectral shift was experimentally reproduced in the wide range of pulse durations 450 fs–5 ps and energies 2–7.5 mJ. The numerical simulations [1] demonstrated the symmetrical spectral broadening and did not reproduce its long-wavelength shift. We conducted an experiment in which the pulses centered at ∼250 nm with a duration of ∼100 fs and energy up to 0.2 mJ were focused into the cell with gas (air or argon) of various pressures. Independently of gas in the cuvette, the increase in pressure results in the monotonic shift of the UV pulse spectrum as whole towards the long wavelengths. To calculate of the nonlinear response of a gas medium on an ultrashort laser pulse we numerically solve time-dependent Schrödinger equation with one-dimentional potential well with bound states, corresponding to energy levels of gas used in experiment and laser pulses of 10–80 fs, a central wavelength of 250 nm in a wide range of intensities. Nonlinear polarization obtained from our simulations delays on the intraperiod timescale relative to the cube of the pump electric field and induces the long-wavelength spectral shift.

[1] Tzortzakis S, Lamouroux B, Chiron A, Franco M, Prade B, Mysyrowicz A and Moustaizis S 2000 **25** 1270–1272