Erratum: Dynamics of filament formation in a Kerr medium [Phys Rev. A 71, 063811 (2005)]

Martin Centurion
University of Nebraska-Lincoln, mcenturion2@unl.edu

Ye Pu
California Institute of Technology, yepu@sunoptics.caltech.edu

Mankei Tsang
California Institute of Technology

Demetri Psaltis
California Institute of Technology

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We have found an error in this paper. In our calculation of the intensity threshold for breakdown in CS$_2$ we erroneously used the ionization energy of molecular CS$_2$ (10.08 eV). The correct value should be 3.3 eV [1], the band gap energy of liquid CS$_2$. Using the band gap energy, nonlinear absorption will be a three-photon process, and the calculated breakdown threshold becomes $8.5 \times 10^{11}$ W/cm$^2$ (as opposed to the value of $2 \times 10^{13}$ W/cm$^2$ reported previously). Multiphoton absorption and plasma defocusing could then become significant for the intensity of the filaments, $I_{fil}=(5.9\pm2.4) \times 10^{11}$ W/cm$^2$, that was measured experimentally.

In order to test our conclusion that a model including a fifth order nonlinearity is the best fit to the experimental data, we have numerically simulated the pulse propagation in CS$_2$ both with and without fifth order nonlinearity ($n_4$) and plasma effects. The numerical model is the same in this paper with the addition of plasma effects (negative index change and multiphoton absorption). The parameters for the plasma effects were calculated according to the method described in Ref. [2]. The numerical results show that for the case of only plasma effects (with $n_4=0$) a filament forms with an intensity of $3 \times 10^{12}$ W/cm$^2$, well above the experimental value. For both cases including $n_4$ (with and without plasma effects) the intensity peaks at about $10^{12}$ W/cm$^2$, and the inclusion of plasma effects results in a loss of 15% after 4 mm of propagation. It should be noted that while the losses due to multiphoton absorption can be significant, they are not essential for filament formation. In addition, the simulation with only plasma effects resulted in very high plasma density ($>10^{19}$ cm$^{-3}$) which was not observed experimentally [3].

In conclusion, our numerical results show that the effect of plasma alone cannot reproduce the experimental results, while including a fifth order nonlinearity (with or without plasma) generates good agreement with the experiments. The main conclusion of the numerical section of the original paper then remains unchanged in that the fifth order nonlinearity provides good agreement with the experiment while plasma effects alone do not.