optica

Temporal, spectral, and polarization dependence of the nonlinear optical response of carbon disulfide: erratum

Matthew Reichert,[1] Honghua Hu,[1] Manuel R. Ferdinandus,[1,2] Marcus Seidel,[1] Peng Zhao,[1] Trenton R. Ensley,[1] Davorin Peceli,[1] Jennifer M. Reed,[1] Dmitry A. Fishman,[1] Scott Webster,[1] David J. Hagan,[1,3] and Eric W. Van Stryland[1,3,*]

[1]CREOL, The College of Optics and Photonics, University of Central Florida, Orlando, Florida 32816, USA
[2]Department of Engineering Physics, Air Force Institute of Technology, Dayton, Ohio 45433, USA
[3]Department of Physics, University of Central Florida, Orlando, Florida 32816, USA
*Corresponding author: ewvs@creol.ucf.edu

Received 17 March 2016; posted 17 May 2016 (Doc. ID 261423); published 13 June 2016

We provide a correction to the values of $n_{2,el}$ reported in [Optica 1, 436 (2014)].

OCIS codes: (190.4400) Nonlinear optics, materials; (300.6420) Spectroscopy, nonlinear; (190.3270) Kerr effect; (320.7110) Ultrafast nonlinear optics.

http://dx.doi.org/10.1364/OPTICA.3.000657

An analysis of experiments included the contribution of the fused silica cuvette, resulting in an overestimate of the reported $n_{2,el}$ for carbon disulfide (CS_2) [1]. Here we give the corrected values for CS_2 by subtracting the measured total nonlinear refraction contribution of the empty cuvette from the data with it filled. The value obtained for $n_{2,el}$ of the fused silica cuvette (two 1 mm-thick walls) agrees with the accepted literature value [2]. The result of this correction on the beam deflection measurement is a value of $n_{2,el} = (1.5 \pm 0.4) \times 10^{-19}$ m^2/W for CS_2. We reproduce Figs. 4–6 with this correction and include the corrected Table 1. The data in Fig. 6(b) was corrected using the dispersion of $n_{2,el}$ of fused silica from [2]. The SOS model has also been re-fitted following Ref. [3], as shown in Fig. 6(b) and Table 2. While the model reproduces the trend, it underestimates $n_{2,el}$ by a factor of 2.4, which is most likely due to the neglect of higher-lying absorption bands.

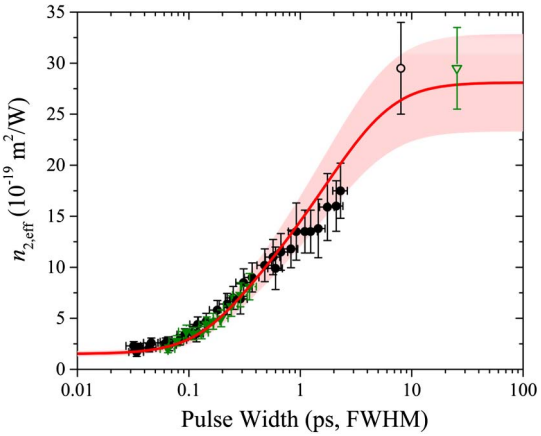

Fig. 4. Comparison of Z-scan measurements using the Ti:sapphire (closed) and Nd:YAG laser system (open) at both 700 (black) and 1064 nm (green) and calculation using Eq. (17) (red curve) of $n_{2,\mathrm{eff}}$ of CS_2 versus pulse width. Shaded region represents errors in response function from Table 1.

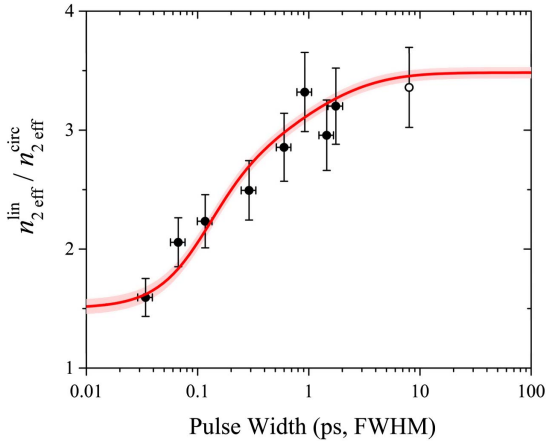

Fig. 5. Comparison of $n_{2,\mathrm{eff}}^{\mathrm{lin}}/n_{2,\mathrm{eff}}^{\mathrm{circ}}$ versus pulse width between Z-scan measurements with both Ti:sapphire (closed circles) and Nd:YAG (open circle) laser systems at 700 nm and calculated (red curve). The shaded region represents only relative errors that contribute to uncertainty. For long pulse widths, $n_{2,\mathrm{eff}}^{\mathrm{lin}}/n_{2,\mathrm{eff}}^{\mathrm{circ}} = 3.5$.

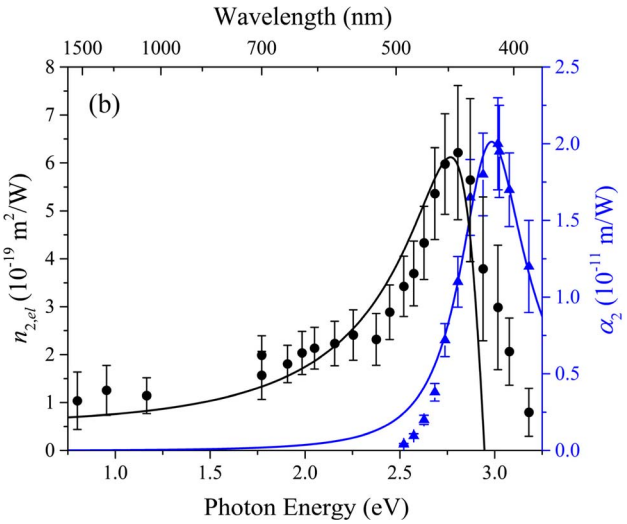

Fig. 6. (b) Z-scan measurements of NLR (black circles) for femtosecond pulses with noninstantaneous component subtracted, and α_2 (blue triangles). Curves represent the SOS model fit for 2PA (blue) and $n_{2,el}$ (black), which has been multiplied by a factor of 2.4.

Table 1. Fit Parameters of Third-Order Response of CS_2[a]

Mechanism	$n_{2,m}$	$\tau_{r,m}$ (fs)	$\tau_{f,m}$ (fs)	Symmetry
Electronic	1.5 ± 0.4	Instantaneous		iso
Collision	1.0 ± 0.2	150 ± 50	140 ± 50	iso
Libration	7.6 ± 1.5	[b]	450 ± 100	re
Diffusive	18 ± 3	150 ± 50	1610 ± 50	re

[a] $n_{2,m}$ are given in units of 10^{-19} m^2/W.
[b] $\omega_0 = 8.5 \pm 1.0$ ps^{-1}, $\sigma = 5 \pm 1$ ps^{-1}.

Table 2. Fit Parameters for SOS model of $n_{2,el}$ and α_2 of CS_2

State	Energy (eV)	HWHM (eV)	μ (D)
e	6.00 ± 0.01	0.17 ± 0.01	$\mu_{ge} = 4.8 \pm 0.3$
e'	5.93 ± 0.05	0.42 ± 0.05	$\mu_{ee'} = 6.2 \pm 0.7$

Funding. Air Force Office of Scientific Research (AFOSR) (FA9550-10-1-0558); National Science Foundation (NSF) (ECCS-1202471, ECCS-1229563).

REFERENCES

1. M. Reichert, H. Hu, M. R. Ferdinandus, M. Seidel, P. Zhao, T. R. Ensley, D. Peceli, J. M. Reed, D. A. Fishman, S. Webster, D. J. Hagan, and E. W. Van Stryland, "Temporal, spectral, and polarization dependence of the nonlinear optical response of carbon disulfide," Optica **1**, 436–445 (2014).
2. D. Milam, "Review and assessment of measured values of the nonlinear refractive-index coefficient of fused silica," Appl. Opt. **37**, 546–550 (1998).
3. T. R. Ensley, H. Hu, M. Reichert, M. R. Ferdinandus, D. Peceli, J. M. Hales, J. W. Perry, Z. Li, S.-H. Jang, A. K.-Y. Jen, S. R. Marder, D. J. Hagan, and E. W. Van Stryland, "Quasi-three-level model applied to measured spectra of nonlinear absorption and refraction in organic molecules," J. Opt. Soc. Am. B **33**, 780–796 (2016).