Ladan Arissian, J Phys Chem Biophys 2014, 4:5
http://dx.doi.org/10.4172/2161-0398.S1.006

OMICS Group Conferences
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2nd International Conference and Exhibition on
Lasers, Optics & Photonics
September 08-10, 2014 Hilton Philadelphia Airport, USA

Polarization evolution; a method to measure nonlinear interaction in light filaments

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The nonlinear interaction of ultrashort pulses in air results in confinement of optical beams (filaments) for distances larger than the Rayleigh range. The third order susceptibility of this interaction with isotropic air results in a polarization change of the beam. For example electronic Kerr effect results in rotation of the elliptical polarization as a function of light intensity and initial ellipticity.

We measure that the light ellipticity is strongly modified prior to the focus and starting the light filament. In the case of 5mJ light focused in air, our measurement shows that the ellipticity is modified such that the polarization at 40 and 50 degree of the QWP is more circular than the QWP at 45 degree (corresponding to circular polarization at weak field). This modification is not observed for the light prepared in vacuum. However the ellipse angle only 2 cm after the geometrical focus is rotated 20 degrees more for preparation in vacuum as focusing in air at 45 degrees of QWP. The enhancement in rotation for focusing in air is attributed to higher intensity (above clamping) and tighter spatial distribution.

We believe that by scanning the polarization and measuring its evolution in space we have a direct way to observe the nonlinear phase shifts on the optical pulses.

Biography

Ladan Arissian has completed her PhD in Optical science from University of New Mexico and postdoctoral studies from Texas A& M University working at National Research Council of Canada. She joined University of New Mexico as a research professor in 2010.

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