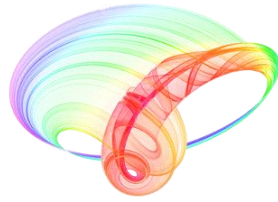


Book of abstracts



PHOTONICA2021

VIII International School and Conference on Photonics

& HEMMAGINERO workshop

23 - 27 August 2021,

Belgrade, Serbia

Editors

Mihailo Rabasović, Marina Lekić and Aleksandar Krmpot

Institute of Physics Belgrade, Serbia

Belgrade, 2021

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Narrowing of laser beam propagating through biological suspension

A. Kovacevic¹, T. Pajic², D. Pavlovic¹, M. Stanic³, M. Lekic¹, S. Nikolic¹, B. Jelenkovic¹

¹ Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

² Faculty of Biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia

³ Institute for Multidisciplinary Research, University of Belgrade, Bulevar Despota Stefana 142, 11060 Belgrade, Serbia

e-mail: aleksander.kovacevic@ipb.ac.rs

Recent demonstration of nonlinear self-action of laser beams in suspension of biological materials, like marine bacteria and red blood cells, has been reported [1-3]. In this work, we demonstrate nonlinear optical effects of laser beam propagation through the freshwater green microalga *Chlorella sorokiniana*, cultivated in Bold basal medium with 3-fold nitrogen and vitamins (3N-BBM+V).

Chlorella sorokiniana is a species of single-celled freshwater green microalga in the division *Chlorophyta*. Its spherical or ellipsoidal cells (3 x 2 μm in small cells to 4.5 x 3.5 μm in large cells, sometimes >5 μm) divide rapidly to produce four new cells every 17 to 24 hours [4]. The non-pathogenic species has been chosen as a model organism due to its small cell dimension, rapid growth, non-mobility and non-toxicity. The algae were kept in the light chamber and the temperature was maintained at 22°C. Mid-exponential growth phase of algal culture was used for the experiments.

In the experiments, the 532 nm CW laser beam is directed to the glass cuvette that is filled either with the medium or with algae suspended in the medium. We have monitored the laser beam diameter at the entrance and exit of the cuvette, and its axial profile through entire cell length. The concentration has been determined by optical microscopy and optical density and has been varied between 10^6 and 10^8 cm^{-3} .

The concentration of the algae and the laser beam power affect the beam radius. Our preliminary results have shown the effect of light self-trapping, i.e., the decrease of laser diameter when the algae concentration exceeds 10^6 cm^{-3} while laser power is above 1 W. The difference of the refractive indexes of the algae and the medium can induce optical trapping of algae, which subsequently changes the concentration of the algae within the laser beam. This in turn can explain different behavior of the beam in the medium with and without algae.

We discuss the mechanisms which led to narrowing of the beam including nonlinear effects as well as potential applications in waveguiding, medical imaging and optimal propagation of laser beam in biological suspensions.

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