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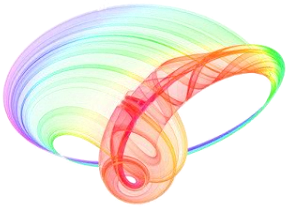

# PHOTONICA2017

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# Trajectory based interpretation of the laser light diffraction on a sharp edge

Milena D Davidović[1], Miloš D Davidović[2], Angel S Sanz[3], Mirjana Božić[4], Darko Vasiljević[4]

[1] *Faculty of Civil Engineering,University of Belgrade, Serbia*
[2]*Vinca Institute, University of Belgrade, Serbia*
[3]*Department of Optics, Universidad Complutense de Madrid, Spain*
[4] *Institute of Physics,University of Belgrade , Serbia*
e-mail:milena@grf.bg.ac.rs

Bohmian mechanics enables visualization and interpretation of quantum mechanical behavior of massive particles through trajectories connected to the probability current density [1]. Electromagnetic field also admits hydrodynamic formulation when the existence of suitably defined photon wave function is assumed [2]. This formulation gives possibility to interpret the optical phenomena in a picturesque way through photon trajectories which describe the evolution of the electromagnetic energy density behind an obstacle.

This approach, based on the trajectories, was used in the analysis of modified Young's double slit diffraction [3], in the context of the Arago-Fresnel laws [4], as well as in the analysis of the modes in the optical and microwave waveguides [5]. A group of scientists from the University of Toronto under the guidance of professor Steinberg, has been able to experimentally determine the mean paths of single photons in the Young's experiment [6]. The measured trajectories show good agreement with theoretically anticipated trajectories presented in [2, 3]. The achievement of Steinberg's group was selected by the Physics World as the top breakthrough in physics for the year 2011, as the discovery that is 'shifting the moral of quantum measurement' [7].

Theoretical solution for the diffraction of plane wave by the edge of the perfectly conducting plane was given by Sommerfeld in 1896 [8], and this solution became the starting point in solving the diffraction problems for various two dimensional obstacles [9, 10]. Diffraction of Gaussian beam by the edge was studied since the sixties of the last century [11] but more attention was given to the central part of the diffraction image, while the less pronounced side trails were analyzed much later [12]. In this paper we use photon trajectories approach to analyze the diffraction pattern obtained on the screen put behind the laser beam partially covered by a sharp edge, such as a razor blade.

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