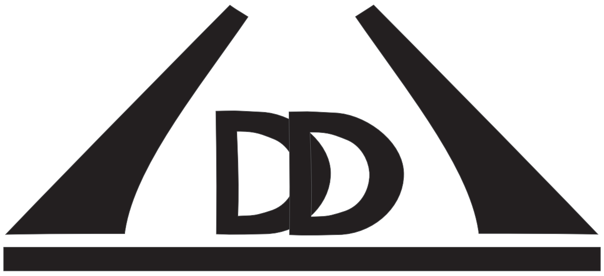
INTERNATIONAL CONFERENCE

DAYS ON DIFFRACTION 2015

ABSTRACTS



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wavefunction in this region, only the leading order term proportional to $h^{1/4}$ is considered and the wavefunction is expressed in terms of the Pearcey function. It turns out that, at the length scales that are relevant in physics, this approximation does not give very good results. Furthermore, it is unable to fully capture the effect of the Berry phase, since it predicts that $|\Psi|^2$ is independent of the Berry phase. I will show that a much better description can be obtained by employing the uniform approximation, which also includes the terms of order $h^{1/2}$ and $h^{3/4}$, and expresses the wavefunction not only in terms of the Pearcey function, but also in terms of its derivatives. Using this approximation, we find that the Berry phase can have a significant effect on the maximal intensity at the focus. The accuracy of both approximations will be illustrated by comparing them to numerical results.

This work was done in collaboration with D. S. Minenkov, M. I. Katsnelson and S. Yu. Dobrokhotov.

Algorithm for reconstruction of inhomogeneous permittivity in optical fibers using propagation constant measurements

Repina A.I.[1], Spiridonov A.O.[1], Karchevskii E.M.[1], Beilina L.[2]
[1]Kazan Federal University, Russia
[2]Chalmers University of Technology and University of Gothenburg, Sweden
e-mails: `airepinas@gmail.com, sasha_ens@mail.ru, ekarchev@yandex.ru, larisa.beilina@chalmers.se`

Optical fibers are regular dielectric rods having various cross-sectional shapes where generally the permittivity may vary in the waveguide's cross section. The eigenvalue problem for natural modes of inhomogeneous optical waveguides in the weakly guiding approximation is formulated as the problem for Helmholtz equation with partial radiation conditions at infinity in the cross-sectional plane. The original problem is reduced to a nonlinear spectral problem with compact integral operator. The problems of existence, localization, and dependence on parameters of the spectrum are investigated. We prove that for each positive frequency there exists exactly one fundamental mode. First, we approximate the integral operator by a spline-collocation method. Then we present new numerical method for reconstruction of inhomogeneous permittivity using measurements of propagation constants of the fundamental mode for different frequencies. To solve our inverse eigenvalue problem, we are not requiring the information about specific values of eigenfunctions. In our algorithm, it is enough only to know that the fundamental mode is excited and then to measure its propagation constant for several frequencies. This approach satisfies to the practice of physical experiments because usually in real-life applications the fundamental mode is excited in waveguides. Moreover, the fundamental mode can be excited only for enough wide range of frequencies. The convergence and quality of the numerical method are confirmed by numerical experiments. Main applications of our algorithm are, for example, in detection of defects in metamaterials and in nanoelectronics, as well as in microwave imaging technology in remote sensing.

Longitudinal and transverse solitons in a dynamical trap

N.N. Rosanov[1,2,3], N.V. Vysotina[1], L.A. Nesterov[1,2], N.A. Veretenov[1,2], S.V. Fedorov[1,2], A.N. Shatsev[1]
[1]Vavilov State Optical Institute, Kadetskaya liniya 5/2, 199053 Saint-Petersburg, Russia
[2]ITMO University, Kronverkskii prospect 49, 197101 Saint-Petersburg, Russia
[3]Ioffe Physical Technical Institute, Politekhnicheskaya ul. 26, 194021 Saint-Petersburg, Russia
e-mail: `nnrosanov@mail.ru`

We consider dynamics of solitons of Bose–Einstein condensate in a trap with harmonically oscillating walls. For the transverse solitons — structures localized along the trap axis — approximate