DIFFRACTION OF THE SINGULAR BEAM ON AN OPAQUE SCREEN AND REGENERATION OF AN OPTICAL VORTEX

V.N. Gorshkov, A.N. Khoroshun[1]*, M.S. Soskin*

Institute of Physics, Nat. Acad. Sci. of Ukraine
(*46, Nauky Prosp., Kyiv 03650, Ukraine*),
[1]East Ukrainian National University
(*20a, Molodezhny block, Lugansk 91034, Ukraine*)

S u m m a r y

We have developed the theory of diffraction of the singular light beam with axial optical vortex on a half-plane screen which cuts off the vortex zero-amplitude center ("severe screening"). It is shown that such diffraction features differ strongly from the well-known diffraction of a light beam with smooth wave front. It is found that the singular properties of the beam are restored at some distance behind the screen due to the influence of long-wave transversal perturbations. This is happened through the complicated space dynamics due to the generation of secondary short-living "diffractive" vortices. The diffraction is considered for one and many charged singular beams. We have established the duration, possibility, and quality of the regeneration of the helicoidal structure of the wave front basing on the developed mathematical model and the analysis of the distributions of amplitude, phase, and orbital angular momentum (OAM).