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Interaction of Photon Vortex Beams with Atomic Matter MARIA SOLYANIK, ANDREI AFANASEV, Department of Physics, The George Washington University, Washington, DC 20052, USA, CARL E. CARLSON, Department of Physics, The College of William and Mary in Virginia, Williamsburg, Virginia 23187, USA — In our work we consider helical Bessel beams' (BB's) propagation and interaction with isotropic matter. Dynamical properties of the beams with non-zero orbital angular momentum (OAM), which are determined by spatial degrees of freedom and polarization, modify the fundamental processes in light-matter interactions. Circular dichroism of BBs propagating in hydrogen gas was considered within the frame of studying the vortex beams' attenuation due to photoabsorption in hydrogen gas. In this case, the phenomenon is due to the topology of the wave front, contrary to the zero OAM case, when the change in polarization state is due to matter inhomogeneity. The effect of circular dichroism has been predicted by calculating the beam ellipticity evolution when traversing an isotropic target. According to our results, the BBs' transverse ellipticity profile has a structure of concentric circular maxima which correspond to minima of the intensity. The characteristic polarization singularity arises on the beam axis as the result of interaction with matter. It is shown, that even for the case of the paraxial approximation the effect of circular dichroism takes place. These signatures can be used for theoretical and experimental analysis of the interactions of optical vortices with atomic matter.

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