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# Polarization singularities in a superposition of counter-propagating vector beams

IMRAM, Tohoku Univ., °Sunil Vyas, Yuichi Kozawa, Shunichi Sato

E-mail: sunil@tagen.tohoku.ac.jp

Vector beams are formed by the non-separable combination of spatial and polarization modes [1]. Polarization singularities, which are the vector analog of the phase singularities present in a scalar field, can be used to describe vector fields. Intrinsic inhomogenous polarization distribution of cylindrical vector beams is much more complicated and less investigated area in the vector optical fields. Objective of the present work is to understand inhomogeneity of polarization in the vector beams as well as the natural extension of our previous study on the polarization singular properties of vector beams [2]. In this paper, we have presented detailed analysis of the polarization singularities in the propagation dependent inhomogenous elliptic field generated by a superposition of two counter-propagating vector Laguerre-Gaussian beams. Intensity and polarization properties of the resultant field obtained from the co-propagating and counter-propagating vector beams are compared and analyzed in detail. Intensity and polarization properties have some distinct features in the above two cases. We found that a variety of intensity and polarization patterns can be generated by combining two vector beams of different azimuthal indices and polarization distribution types. Azimuthal polarization gradients are observed in the resultant field, which can be used to explain the creation and annihilation of the singular points. Stokes field vortices have been used to study the dynamics of polarization singular points during the propagation of the field [3]. The present study may be useful in understanding the mechanism of appearance of different kinds of polarization singularity in the vector optical field.

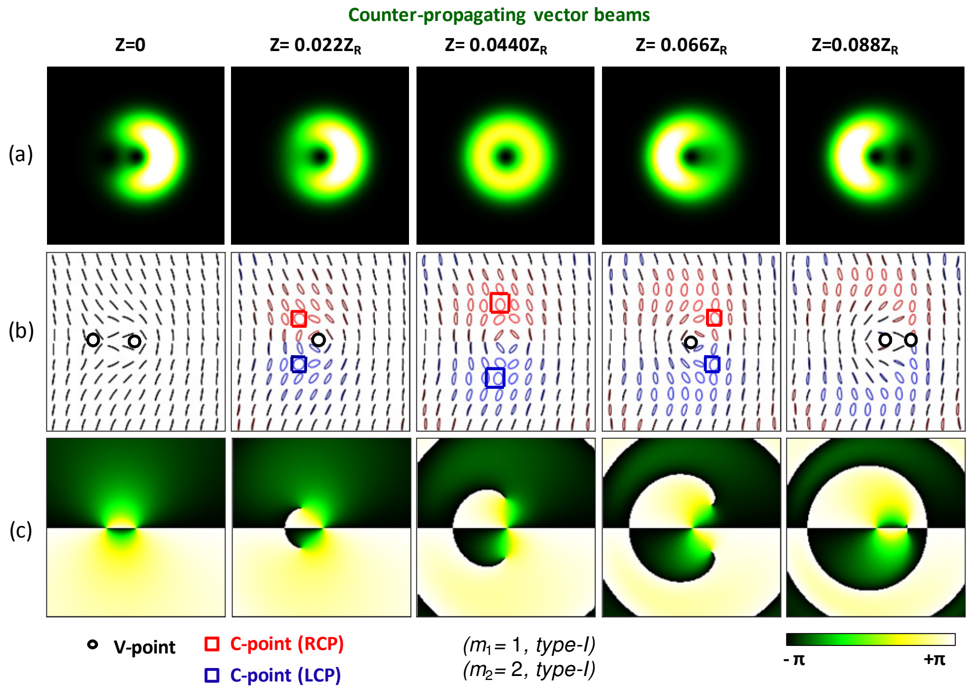


**Fig.1.** Calculated field distributions for two counterpropagating vector LG beams (a) intensity distribution, (b) polarization distribution, (c) stokes phase map. ($\lambda$ = 632.8nm, $w_0$ = 3mm).

**References:**

[1] D. L. Andrews and M. Babikar, "The angular momentum of light" Cambridge University press 2013.

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[3] I. Freund, "Poincare vortices," Opt. Lett. **26**, 1996-1998 (2001).