Simulation of the vortex beams formation while diffraction on square contour-like and spiral apertures

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Aperture

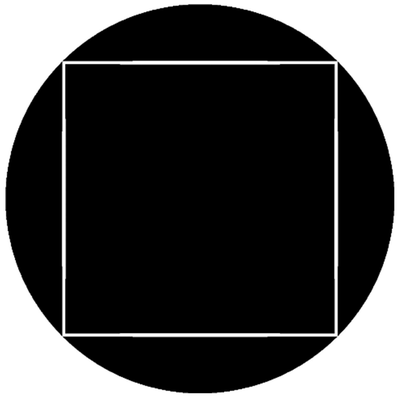

Fig. 1 Cross section of the slit in the form of a square contour (r_0 = 10 mm, d^1 = 0.1 mm, a = 7 mm)

Fig. 2 Cross section of the slit in the form of a square spiral (r_0 = 10 mm, d^1 = 0.1 mm, a = 7 mm, b^2 = 0.2 mm)

[1] – the thickness of a spiral

[2] – the spiral pitch

References

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[2] A. V. Volyar, Ya. E. Akimova, "Transformations of structurally stable states of spiral beams subjected to sector perturbations", Computer Optics, vol. 45, no. 6, pp. 789-799, November 2021.

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Square contour with SPP

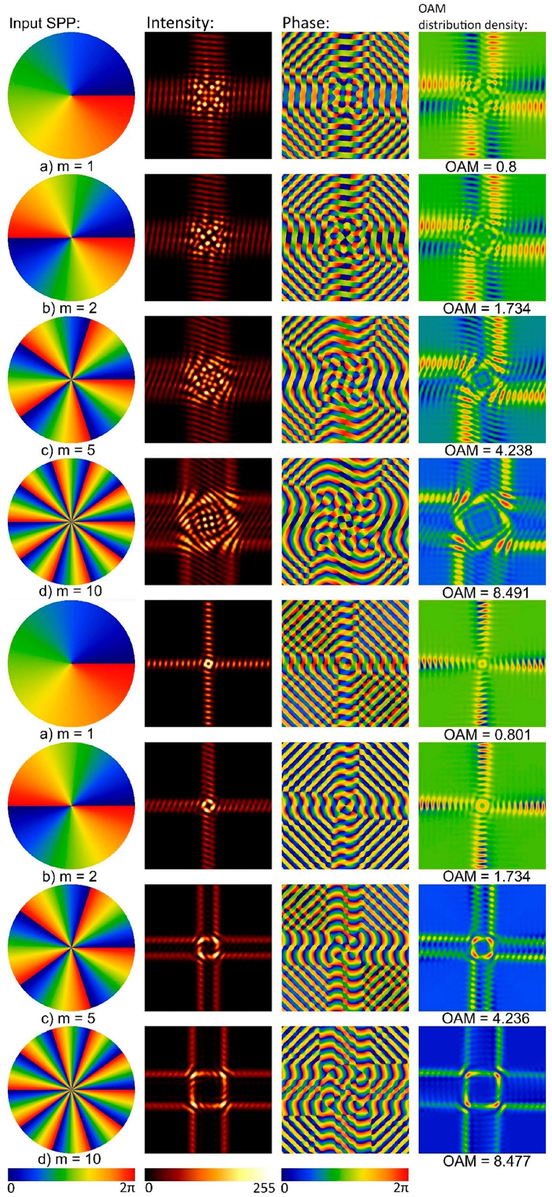

Fig. 3 The intensity, phase and OAM distribution density of the beams formed with SPP for the square contour shown in Fig. 1 at a distance of 10 meters (top) and 50 meters (bottom)

Square spiral with SPP

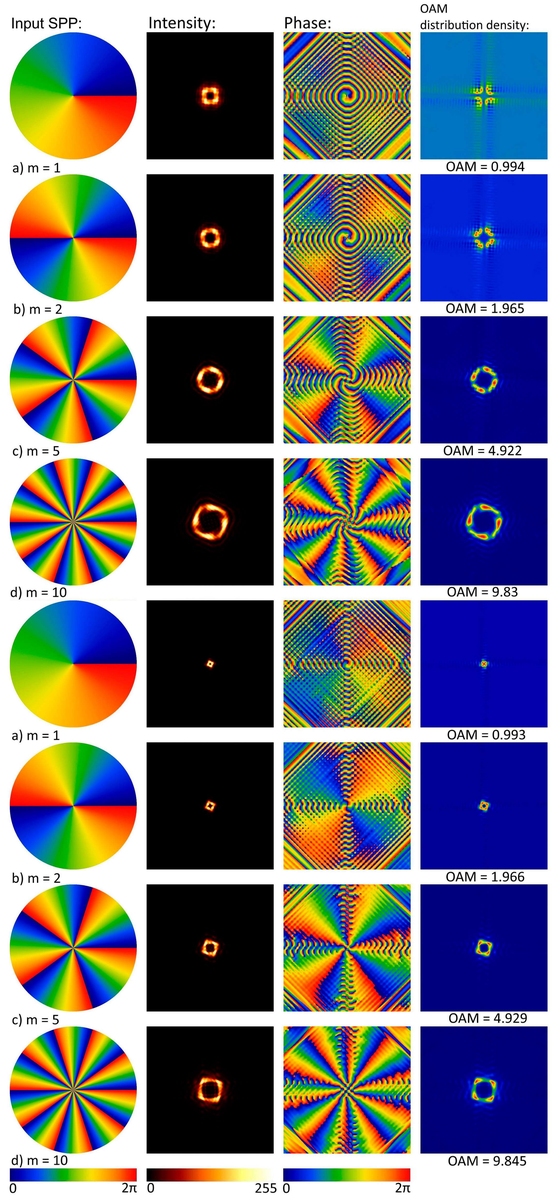

Fig. 4 The intensity, phase and OAM distribution density of the beams formed with SPP for the square spiral shown in Fig. 2 at a distance of 10 meters (top) and 50 meters (bottom)

Both without SPP

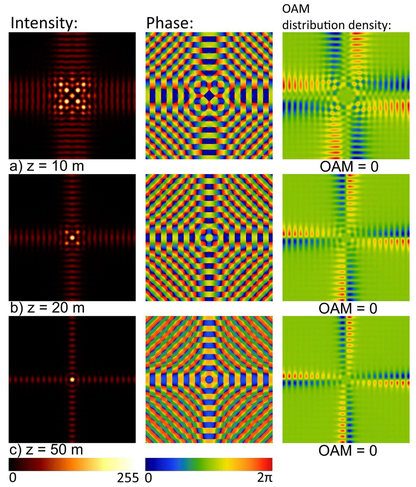

Fig. 5 The intensity, phase and OAM distribution density of the beams formed without SPP for the square contour shown in Fig. 1 at distances from 10 to 50 meters

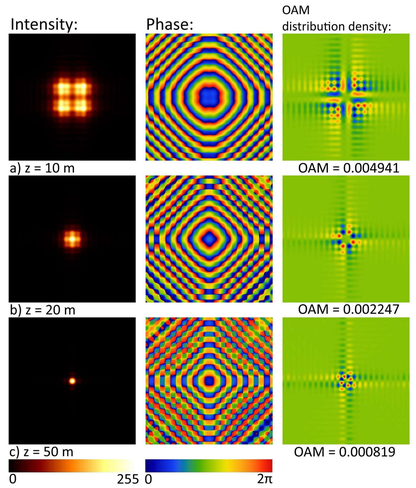

Fig. 6 The intensity, phase and OAM distribution density of the beams formed without SPP for the square spiral shown in Fig. 2 at distances from 10 to 50 meters

Conclusion

It is numerically shown that a beam formed by a square contour without SPP does not have an OAM, but formed by a square spiral has an OAM, and also that a square contour in the presence of the SPP at the input reduces the OAM of the formed beam by 15-20%, while the influence of the square contour does not depend on the distance and weakly depends on the topological order of the SPP. The results obtained can be applied for solving optical capture and manipulation tasks.

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