

II-G Application of Optical Vortices to Spectroscopy

II-G-1 Efficient Generation of Optical Vortices and the Application to Atom Manipulation

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Recently optical vortices have attracted considerable attentions because of the phase singularity and the characteristic intensity distribution. In particular, the dark region is very useful to trap and guide cold atoms provided by laser cooling.¹⁾ Several methods of generating the optical vortices have been reported so far, but their efficiencies are rather low.

We have demonstrated a simple and efficient generation of optical vortices using only glass plates and an astigmatic mode converter. A Gaussian beam successively passes N edges of thin glass plates, each of which imposes a π -phase difference to a part of the beam transmitting through the glass plate from the other part traveling in the air. The resultant beam has N nodal lines, and then is further led into a mode converter, which provides N appreciable optical vortices. The power efficiency is measured to be 72, 64, and 53% for $N = 1, 2,$ and $3,$ respectively.

Reference

- 1) T. Kuga, Y. Torii, N. Shiokawa, T. Hirano, Y. Shimizu and H. Sasada, *Phys. Rev. Lett.* **78**, 4713 (1997).