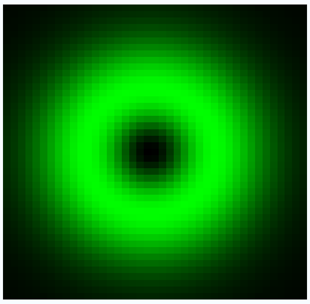
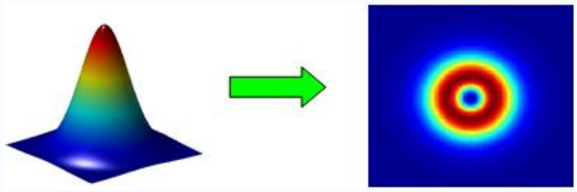
HOLO/OR A VISION OF EXCELLENCE

30 YEARS A VISION OF EXCELLENCE



Vortex Lens

The Vortex lens DOE converts a Gaussian input profile into a donut-shaped energy ring.



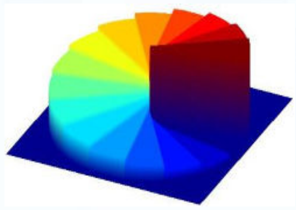
FEATURES

- High power threshold
- High efficiency
- Low back reflection
- Wavelengths from UV to IR
- Optional AR/AR coating

APPLICATIONS

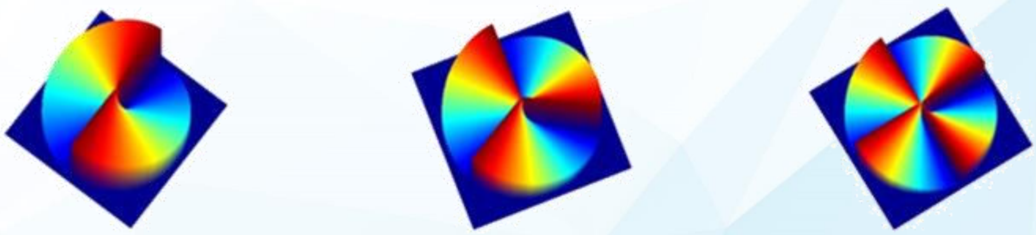
- Solar coronagraphs
- Astronomy
- High-resolution microscopy
- Laser Welding
- Optical tweezers for particle trapping & manipulation
- Quantum optics

The Vortex lens is a unique optic, its structure composed entirely of spiral or helical phase steps, whose purpose is to control the phase of the transmitted beam.



The topological charge, denoted in the literature as m, refers to the number of 2π cycles (i.e. "staircases") etched around 360° turn of diffractive surface. In Fig.1 below, the surface profiles are illustrated for vortex lenses with m=2, m=3 and m=4.

Figure 1 Surface profiles for Vortex lenses with m=2, m=3 and m=4



One main effect of a higher topological charge is an increase in the angular momentum of the vortex beam by a factor of m. Another effect is the dimensions magnification of the ring intensity pattern, by a factor of m.

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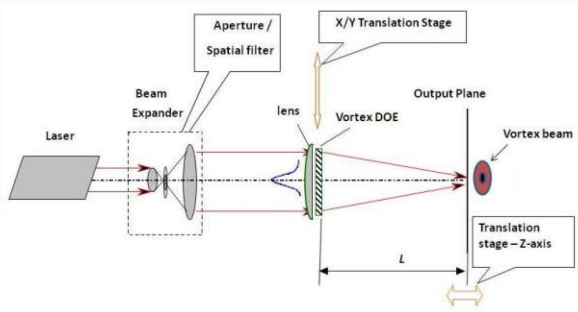
DESIGN CONSIDERATIONS

The Vortex lens requires a collimated Single Mode (TEM_{00}) Gaussian input beam, which it converts to a TEM_{01^*} axially symmetric mode (*Laguerre mode). For small divergence angles (<3º), only the working distance is affected, not the output quality. The added spatial filter/aperture acts to reduce parasitic modes, and the beam expander to increase the incident beam diameter.

There are two main advantages for working with a larger input beam:

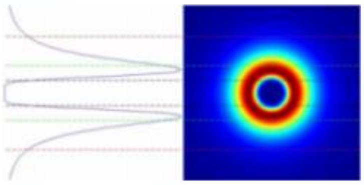
1. It reduces the sensitivity of the output to DOE alignment tolerances.
2. Enables smaller vortex spot.

Figure 2 Typical Set-up for Vortex beam system



The two translation stages in fig.2 above are meant to provide the user precise control of elements' locations, to reduce tolerance effects.

Spot size in the image plane of the vortex of charge m will be **Spot Size = (m+1) x DL** , where the formula for the Diffraction-Limited spot diameter at $1/e^2$ follows:



$$\frac{4\times L\times\lambda}{\pi\times D}\times M^2 = D.L.spotsize$$

L = Working Distance, **λ** = Wavelength, **D** = Input Beam Size, **M^2** = quality of input laser beam

SPECIFICATION RANGE

Materials	Fused Silica, ZnSe, Plastics
Wavelength range	193nm to10.6um
Topological number	M=1, 2, 3, 4, 5, 6
DOE design DOE	Binary, 8-level, 16-level
Diffraction efficiency	75%-98%
Element size	5mm to 38.1mm
Coating (optional)	AR/AR
Custom Design	Ring thickness, Square donut

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