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WOP
WORKSHOP OF PHOTONICS

Higher Order S-Waveplate

converts linear polarization to higher-order polarization patterns.

WHY CHOOSE AN S-WAVEPLATE?

- Best choice for converting:
  - linear polarization to radial or azimuthal polarization;
  - circular polarization to an optical vortex.
- 94% transmission @ 1030 nm (no AR coating).
- Stand-alone – no additional optical elements needed.
- Suitable for high LIDT applications and high-power lasers.
- Reliable and resistant surface – the structure is inside the bulk.

Higher-order S-waveplate

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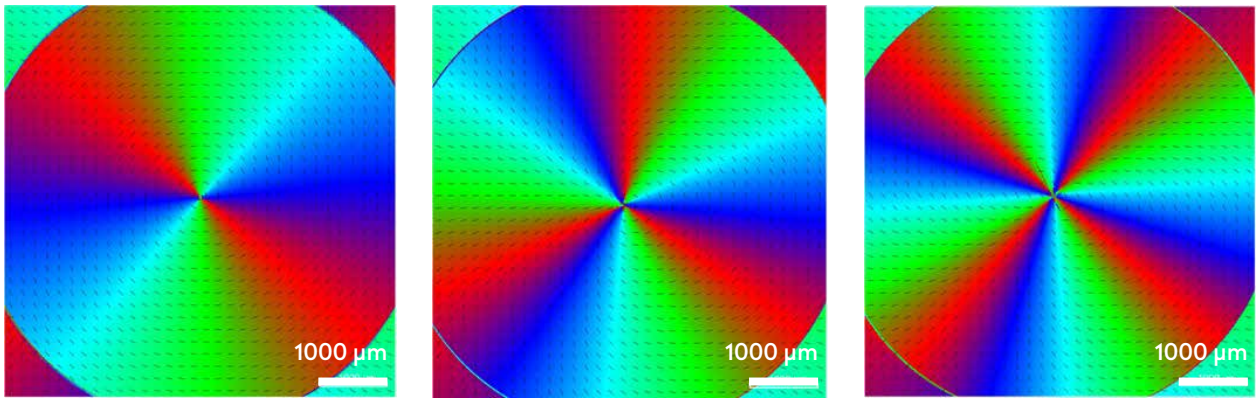
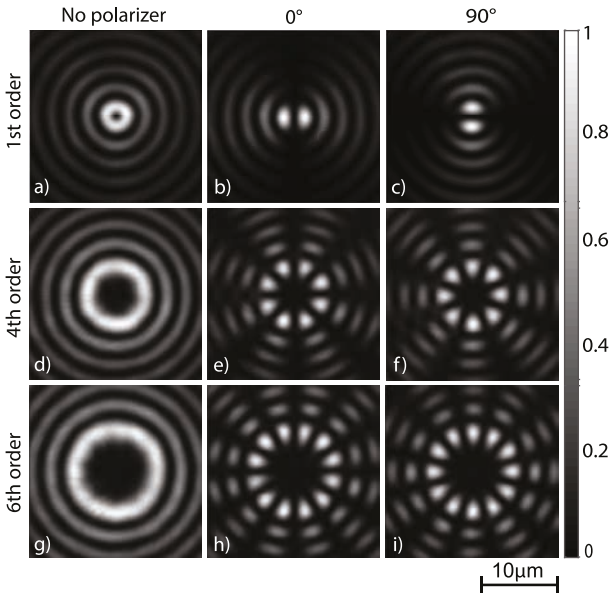
Higher-order S-waveplate converts linear polarization to higher-order polarization patterns.

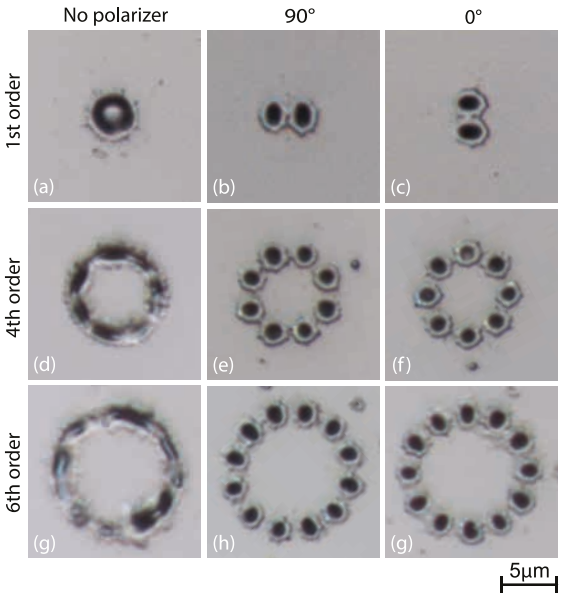


Examples of fast axis patterns for 2nd (left), 3rd (center) and 4th (right) order S-Waveplates (measured with Hinds Instruments Exicor MicroImager).

Combining HOS with an axicon enables vector Bessel beams (VBBs) to be obtained that can be used for the efficient drilling of transparent materials.



Beam spatial intensity profiles of the 1'st, 4'th and 6'th order vector Bessel-Gauss beams (a, d, g) and their single polarization component spatial intensity distribution when polarizer was rotated at two different angles. When the polarizer was parallel to incoming polarization (0 deg) beam intensity profiles are depicted in second column and when polarizer was perpendicular (90 deg) beams are depicted in third column. [3]



Transparent material modification on the D263t glass sample surface with higher order VBB's and their transverse polarization components. 1'st, 4'th and 6'th order VBB damages are depicted in a, d, and g respectively. The single polarization component of the appropriate VBB are depicted in second and third column. [3]

[3] Justas Baltrukonis, Orestas Ulcinas, Pavel Gotovski, Sergej Orlov, Vytautas Jukna, "Realization of higher order vector Bessel beams for transparent material processing applications," Proc. SPIE 11268, Laser-based Micro- and Nanoprocessing XIV, 112681D (2 March 2020); doi: 10.1117/12.2545093

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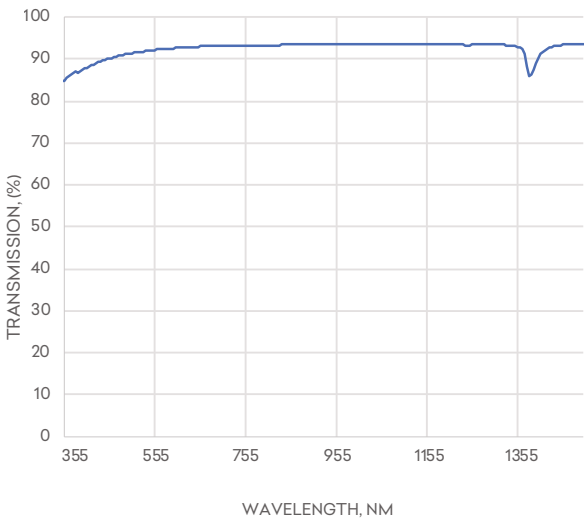
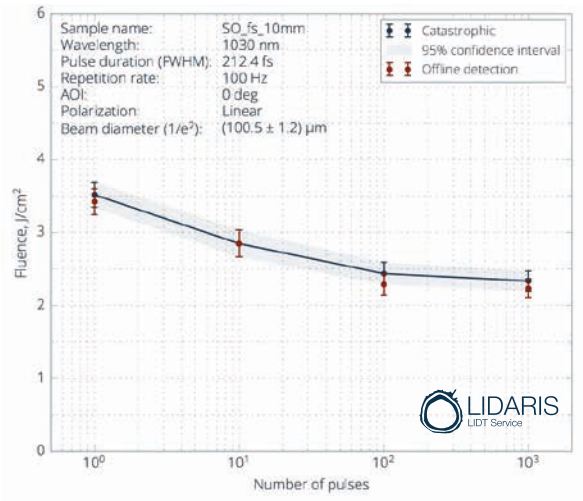
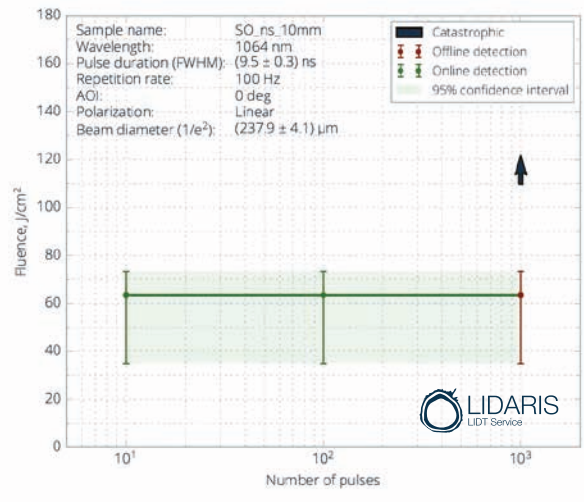


Transmission of uncoated s-waveplate



LIDT at femtosecond regime



LIDT at nanosecond regime

Technical features

- LIDT | High damage threshold:

  63,4 J/cm² @ 1064 nm, 10 ns
  2,2 J/cm² @ 1030 nm, 212 fs

- High transmission (no AR coating):

  94% @ 1030 nm, 92% @ 515 nm,
  85% @ 343 nm of most SS lasers

- Large aperture possible - up to 15 mm

Application examples

- STED microscopy
- Micromachining
- Micro drilling high-aspect-ratio channels
- Generate any cylindrical vector vortex
- Multiple particle trapping
- Micro-mill is driven by optical tweezers
- Use as an intracavity polarization-controlling element in cladding-pumped ytterbium-doped fiber laser for radially polarized output beam generation

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