

Tunable 1 μ m optical vortex parametric oscillator

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Optical vortex has an annular intensity profile and orbital angular momentum owing to its helical wavefront, and it has been receiving attention in various fields, for instance, optical manipulation [1], materials processing [2,3], super-resolution microscopy. Tunable optical vortex sources with wavelength versatility, allowing the absorption band of target materials to be matched, are intensely desired for the above-mentioned applications.

In this presentation, we demonstrate a widely tunable near-infrared vortex laser based on a singly resonant optical parametric oscillator formed from non-critical phase-matching LiB₃O₅ (NCPM-LBO) crystals. Figure 1 shows a schematic diagram of a LBO-OPO with a singly resonant cavity for the idler output. The output from the OPO exhibits an annular spatial form and a pair of Y-shaped fringes measured by utilizing the shearing interferometric technique, evidencing that it was optical vortex mode.

In contrast, the signal output shows a Gaussian profile without any phase singularity, indicating that the topological charge of the pump beam selectively transfers to the idler output. The lasing wavelength of the idler output was tuned within a wavelength range of 1130-1301nm. Maximum idler vortex pulse energy of 0.18mJ was achieved at pump energy of 9 mJ.

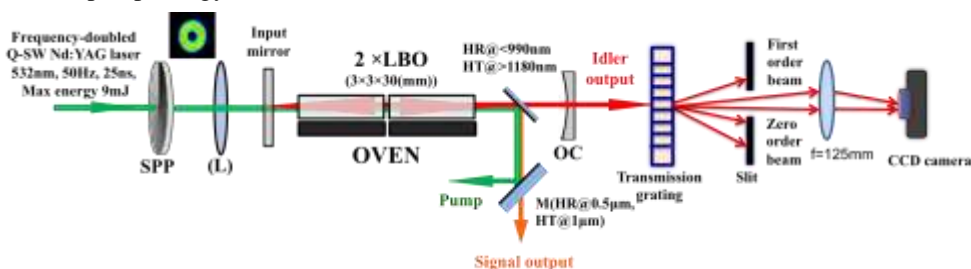


Fig. 1 Experimental setup of an optical vortex pumped singly resonant NCPM-LBO optical parametric oscillator.

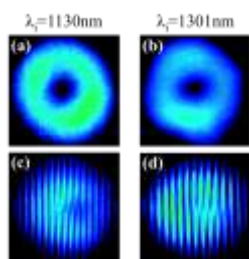


Fig. 2 (a),(b) Spatial form, and (c),(d) self-referenced fringes of idler output.

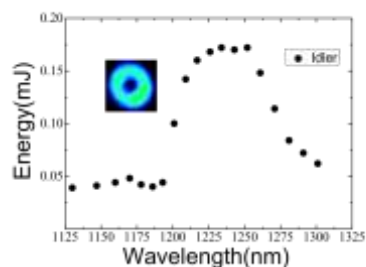


Fig. 3 Experimental tunability of idler output.

References

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