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Widely tunable optical vortex parametric laser

Chiba Univ.[1], JST-CREST[2] ○A. Abulikemu[1], T. Yusufu[1,2], K. Miyamoto[1], and T. Omatsu[1,2]

E-mail: omatsu@faculty.chiba-u.jp

Tunable optical vortex laser [1-3], showing a spiral wavefront with phase singularity characterized by topological charge, has been potentially applied in various fields, including optical trapping, and chiral nanostructures fabrication [4,5]. Recently, we and our co-workers have studied a tunable fractional vortex output with a non-integer topological charge from a 532-nm optical vortex pumped non-critical LiB_3O_5 (LBO) optical parametric oscillator.

In this presentation, we perform a widely tunable near-infrared vortex laser formed of a non-critical LBO crystal. With this system, a milli-joule level signal vortex output was obtained in the wavelength range of 850-990nm.

Figure 1 shows a schematic diagram of a LBO optical parametric oscillator with a singly resonant cavity for the signal output. The pump laser used was a frequency-doubled conventional Q-switched Nd:YAG laser. The cavity for the signal output was formed of a flat input mirror with HT for 532nm and HR for 980nm, a folding mirror with HR for 980nm (signal) and HT for 1180nm (idler), and 80% reflective output coupler for 980nm. The spatial form and self-interference fringes of the output were then observed by a conventional digital CCD camera.

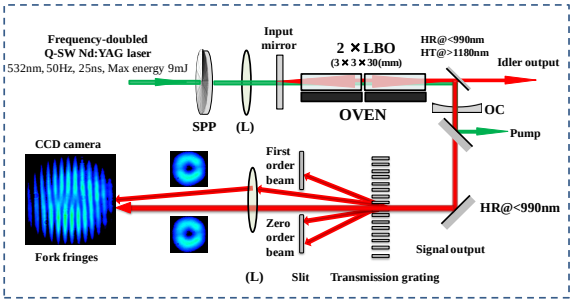

Fig. 1 Experimental setup of an optical vortex pumped singly resonant NCPM-LBO optical parametric oscillator.

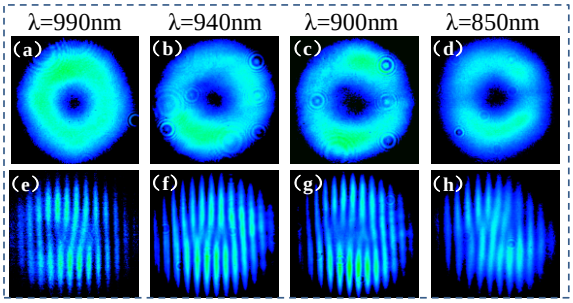

Fig. 2 (a)-(d) Spatial forms of the signal output generated from the singly resonant OPO. (e)-(h) Self-referenced fringes of the signal output.

As shown in Fig. 2 (a)-(d), the signal output exhibits an annular intensity spatial form owing to the phase singularity, evidencing that the signal output is the first-order optical vortex. The lasing wavelength of the signal output was tuned in the wavelength range of 850-990nm. In contrast, the idler output shows a Gaussian profile without any phase singularity. This system enables us to transfer selectively a topological charge of the pump beam to the signal output.

References:

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