Fractional vortex generation from a vortex pumped parametric oscillator Chiba Univ.¹, Hokkaido Univ.², JST-CREST³ °T. Yusufu^{1,3}, A. Abulikemu¹, K. Yamane^{2,3}, K. Miyamoto¹, and T. Omatsu^{1,3} E-mail: omatsu@faculty.chiba-u.jp

Fractional optical vortex with a non-integer topological charge, *m*, exhibits a unique fractional radial opening low-intensity gap on its intensity profile, and it has been investigated in many fields such as optical manipulation of microscopic particles and quantum entanglement of photon. In recent years, we have demonstrated a 2 μ m fractional vortex output from a 1 μ m vortex-pumped KTiOPO₄ (KTP) optical parametric oscillator (OPO)[1]. However, the large spatial displacement of the phase singularity in the idler output, owing to the walk-off effects, then prevented the direct observation of the topological charge of the idler output. In this presentation, we investigate the 1 μ m fractional vortex generation from a 0.5- μ m vortex pumped non-critical phase-matching LiB₃O₅ (NCPM-LBO) optical parametric oscillator.

Figure 1 shows an experimental setup for the system. A frequency-doubled Q-switched Nd:YAG laser was used as a pump source, and its output was converted into a first-order vortex with a topological charge, *m* of, 1 by utilizing a spiral phase plate. The vortex pump beam was collimated to be a 750 μ m spot onto the LBO crystals (30 × 3 × 3 mm³, 20 × 3 × 3 mm³, θ =90°, φ =0°) inside the OPO with a plane-parallel cavity configuration. The signal and idler outputs were spatially separated by using a dichroic mirror, and they were observed by a conventional CCD camera.

The spatial profiles of the signal and idler outputs are shown in Fig. 2. Both signal and the idler outputs showed a radial opening (intensity gap) in their spatial profiles, indicating that a topological charge of the pump beam was shared between the signal and the idler outputs.



[1] K. Miyamoto, S. Miyagi, M. Yamada, K. Furuki, N. Aoki, M. Okida, T. Omatsu, Opt. Express, 19, 12220 (2011).

[2] T. Yusufu, Y. Tokizane, K. Miyamoto, T. Omatsu, Opt. Express, 21, 23604 (2013).