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DEVELOPMENT AND INVESTIGATION OF SUBNANOSECOND PULSE COMBINED OPTICAL PARAMETRIC AMPLIFIER SYSTEM

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Nowadays lasers have become necessary optical devices used in many application areas. However, lasers have spectral limitations making wavelength of the lasers extremely hard to change. In order to change the wavelength of laser radiation, parametric light generators (OPGs) are used which have a distinctive flexibility allowing them to tune wavelength of radiation in a broad spectral range. Most of the parametric light generators are within ultrashort (less than 100 ps) and long (more than 1 ns) pulse durations, and, due to certain physical limitations, subnanosecond (300 ps – 1 ns) pulse parametric light generators are very scarce [1-3].

The goal of this research was to construct and investigate combined and optimized subnanosecond optical parametric amplifier system which uses a 15 mm lithium triborate (LBO) crystal as a nonlinear medium, generated signal wave in MgO:PPLM OPG as a seed radiation and 3rd harmonic of Nd:YAG MOPA laser (λ=355 nm) as pump.

In this work the spectral, energy and temporal characteristics of OPA system were investigated. During optical parametric generation MgO:PPLN optical crystal grating periods were from 27.58 μm to 31.59 μm and signal wavelength range was 1400 nm – 2150 nm. In LBO crystal we achieved signal wave generation via optical parametric amplification of the idler wave (the seed generated in MgO:PPLN OPG). The difference frequency wave (signal wave) range was from 425 nm to 475 nm, which was limited by the tuning limits of the seed radiation spectrum (1400 nm – 2150 nm). The maximum signal power at 475 nm was 24.1 mW which corresponded to maximum conversion efficiency of 37%. Saturation regime of the OPA was achieved with a pump power of 85 mW, which indicated that the device is optimized at current conditions. Furthermore, after the measuring signal pulse duration it was determined, that pulse durations were in the subnanosecond range: from 212 ps to 432 ps.

The results of this work will be used for further development of more effective subnanosecond OPG/OPA systems. This work has received funding from European Regional Development Fund (project No. 01.2.2-LMT-K-718-03-0004) under grant agreement with the Research Council of Lithuania (LMTLT).

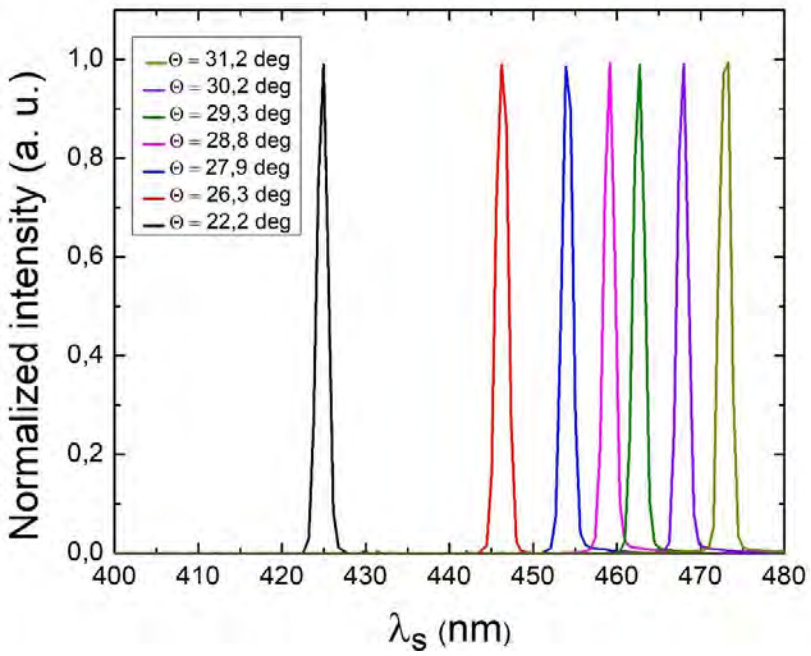

Fig. 1. Spectra of signal wave at different LBO crystal rotation angles.

[1] M. H. Dunn and M. Ebrahimzadeh, Parametric Generation of Tunable Light from Continuous-Wave to Femtosecond Pulses, Science 286, 1513–1518 (1999).
[2] A. Dubietis, Netiesinė optika, (Publisher Vilnius University, Vilnius 2011).
[3] R. W. Boyd, Nonlinear Optics ed. 3 (Academic press, New York 2008).