SUB-NANOSECOND PULSE PARAMETRIC AMPLIFICATION SYSTEM IN THE VISIBLE SPECTRUM RANGE

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Optical parametric systems pumped by Q-switched microlasers operating at kHz repetition rates enable the generation of µJ–mJ level pulses and are characterized by structural simplicity, low cost, high peak power, and stable performance [1]. In recent years, sub-nanosecond parametric systems based on periodically poled crystals with quasi-phase-matching (QPM) structures, such as multi-grating or fan-out geometries, have been demonstrated [2]. These systems are being actively developed due to their potential for applications requiring widely tunable sources in both the infrared and visible spectral regions.

However, the realization of parametric systems in the visible spectral range remains more challenging due to lower laser-induced damage thresholds, limited capabilities of QPM structures, and secondary effects in periodically poled crystals, such as linear and nonlinear absorption and noncollinear interactions [3]. Consequently, tunable OPA sub-nanosecond systems operating in the visible spectral range remain insufficiently studied.

In this work, we present, to the best of our knowledge, the first subnanosecond OPA system efficiently tunable in the visible spectrum range. An optical parametric generation (OPG) signal is first generated by pumping a periodically poled lithium niobate (PPLN) crystal with a second harmonic radiation. By combining crystal temperature tuning with multiple grating periods, continuous tunability of the OPG signal is achieved over the 670-2200 nm spectral range. Consequently, this OPG signal is later employed as a seed in OPA stage, based on lithium triborate (LBO) crystal pumped by third harmonic radiation. As a result, tunable µJ pulse energy output radiation in the visible spectral range from 420 to 710 nm was achieved, with a conversion efficiency ranging from 10% to 30%.

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