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THEORY OF APM LASER USING SECOND ORDER NONLINEARITY IN AN EXTERNAL CAVITY

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ABSTRACT

The additive-pulse mode-locked lasers have been recognized as one of the most versatile tool of modern optics holding out an attractive prospect of easy-to use all-solid state source of short pulses. While short pulses have already been demonstrated in various fibre-based lasers, the potential of such devices can be further enhanced if their output characteristics and operating wavelengths can be easily and accurately adjusted.

The purpose of this Report is to present the theory of completely passive mode-locking of the solid-state laser with long-lived upper level and having $\chi^{(2)}$-grating in an external cavity, and to demostrate how such laser can be upgraded into an optical parametric oscillator. The master equation for the complex amplitude of laser pulses is derived, and the solution describing generation of a spectral-limited pulse is analyzed beyond the assumption of a small nonlinear phase shift at the one pass through the external cavity. Such output charcteristics as a full-width at half-maximum, time-bandwidth product, gain, and total phase shift are obtained.