FJ4 Diode pumped *Q*-switched single frequency Nd:YAG ring laser

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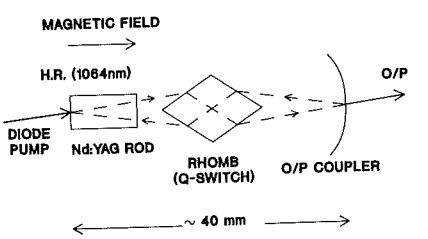
The requirement for diffraction-limited single frequency sources has led to the development of a number of compact diode pumped solid state lasers. In particular, unidirectional operation of a monolithic Nd:YAG ring resonator[1,2] in which spatial hole burning is suppressed has led to reliable single-longitudinal-mode operation. By virtue of their monolithic construction such lasers have so far been confined to low power or gain-switched operation. However, there are many applications for which higher power pulsed operation is required. To meet this need we constructed a compact diode pumped *Q*-switched Nd:YAG ring laser, consisting of only three optical components (Fig. 1). This laser differs from its conventional standing-wave counterpart through the inclusion of a rhombic prism, which serves both to define the ring path geometry and by virtue of its Brewster angled surfaces to act as a polarizer.

Unidirectional and hence single frequency operation is achieved via the nonreciprocal polarization rotation in the laser medium resulting from an applied magnetic field (Faraday effect) and the reciprocal rotation arising from a slightly out of plane ring geometry.[3] The different polarization rotations combined with the polarization discrimination at the surfaces of the rhombic prism results in a differential loss for counterpropagating beams and hence unidirectional operation.

Q-switching is achieved by means of a Pockels cell, which in this case is the rhombic prism itself, made from lithium niobate and with electrodes on its top and bottom surfaces. Preliminary results indicate that for a 10- × 10- × 5-mm crystal the hold-off voltage is typically 500–600 V when using a 500-mW laser diode array pump. For an arrangement which is not optimized, we have so far obtained pulse energies of 11 μJ and 30-ns duration at repetition rates up to 1 kHz.

These results suggest that for generation of high energy (10–100-mJ) *Q*-switched single frequency pulses, use of this miniature *Q*-switched laser followed by a double pass amplifier could provide an attractive alternative to injection seeding a slave oscillator. **(12 mln)**

1. T. J. Kane and R. L. Byer, Opt. Lett. **10,** 65 (1985).
2. W. R. Trutna, D. K. Donald, and M. Nazarathy, Opt. Lett. **12,** 248 (1987).
3. A. C. Nilsson, E. K. Gustafson, and R. L. Byer. "Eigenpolarization Theory of Monolithic Nonplanar Ring Oscillators," IEEE J. Quantum Electron. (to be published).



FJ4 Fig. 1. Diode pumped *Q*-switched single frequency Nd:YAG ring laser.