

future work will be extended to a 1024 x 1024-pixel device now under development.

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EVERY GOOD VIRTUE YOU EVER WANTED IN A Q-SWITCHED SOLID-STATE LASER AND MORE—MONOLITHIC, DIODE-PUMPED, SELF-Q-SWITCHED, HIGHLY REPRODUCIBLE, DIFFRACTION-LIMITED Nd:YAG LASER. Y. C. Chen¹ and K. K. Lee², ¹Physics Department, Hunter College of CUNY, New York NY 10021, USA, ²Electrical and Computer Engineering Department, University of Colorado, Colorado Springs CO 80933-7150, USA.

The applications of Q-switched lasers are well known, for example, laser radar, laser remote sensing, satellite orbit determination, Moon orbit and "moonquake" determination, satellite laser communication, and many nonlinear optics experiments. Most of the applications require additional properties of the Q-switched lasers, such as single-axial and/or single-transverse mode, high repetition rate, stable pulse shape and pulse width, or ultracompact and rugged oscillators with some or all of the above properties. Furthermore, spacebased and airborne lasers for lidar and laser communication applications require efficient, compact, lightweight, long-lived, stable-pulsed laser sources. Diode-pumped solid-state lasers (DPSSL) have recently shown the potential of satisfying all these requirements.

We will report the operating characteristics of a diode-pumped monolithic self-Q-switched Cr,Nd:YAG laser where the chromium ions act as a saturable absorber for the laser emission at 1064 nm [1]. The pulse duration is 3.5 ns and the output is highly polarized with an extinction ratio of 700:1 [1]. It is further shown that the output is single-longitudinal-mode with transform-limited spectral line width without pulse-to-pulse mode competition [2]. Consequently, the pulse-to-pulse intensity fluctuation is less than the instrument resolution of 0.25% [2]. This self-stabilization mechanism is because the lasing mode bleaches the distributed absorber and establishes a gain-loss grating [3,4] similar to that used in the distributed feedback semiconductor lasers. Repetition rate above 5 KHz has also been demonstrated [3]. Figure 1 shows how compact, simple, and rugged this laser oscillator is. For higher power, this laser can be used for injection seeding an amplifier (or amplifier chain) or injection locking of a power oscillator pumped by diode lasers. We will discuss some research directions on the master oscillator for higher output energy per pulse as well as how to scale the output power of the diode-pumped amplifier (s) to multikilowatt average power.

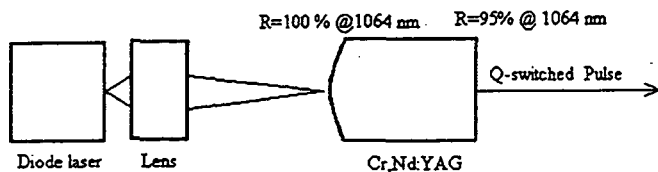


Fig. 1.

References: [1] Li S.-Q. et al. (1993) *Opt. Lett.*, 18, 203. [2] Li S.-Q. et al. (1993) *Opt. Lett.*, 18, April 1 issue. [3] Chen Y. C. et al. (1993) *Opt. Lett.*, 18, in press. [4] Li S.-Q., *Appl. Phys. Lett.*, submitted.

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PLANETARY AND SATELLITE X-RAY SPECTROSCOPY: A NEW WINDOW ON SOLID-BODY COMPOSITION BY REMOTE SENSING. D. L. Chenette¹, R. W. Wolcott¹, and R. S. Selesnick², ¹Lockheed R&D Division, Palo Alto CA 94304, USA, ²Downs Laboratory, California Institute of Technology, Pasadena CA 91125, USA.

The rings and most of the satellites of the outer planets orbit within the radiation belts of their parent bodies, an environment with intense fluxes of energetic electrons. As a result these objects are strong emitters of X-rays. The characteristic X-ray lines from these bodies depend on atomic composition, but they are not sensitive to how the material is arranged in compounds or mixtures. X-ray fluorescence spectral analysis has demonstrated its unique value in the laboratory as a qualitative and quantitative analysis tool. This technique has yet to be fully exploited in a planetary instrument for remote sensing. The characteristic X-ray emissions provide atomic relative abundances. These results are complementary to the molecular composition information obtained from IR, visible, and UV emission spectra. The atomic relative abundances are crucial to understanding the formation and evolution of these bodies. They are also crucial to the proper interpretation of the molecular composition results from the other sensors. The intensities of the characteristic X-ray emissions are sufficiently strong to be measured with an instrument of modest size. Recent developments in X-ray detector technologies and electronic miniaturization have made possible space-flight X-ray imaging and nonimaging spectrometers of high sensitivity and excellent energy resolution that are rugged enough to survive long-duration space missions. Depending on the application, such instruments are capable of resolving elemental abundances of elements from carbon through iron. At the same time, by measuring the bremsstrahlung intensity and energy spectrum, the characteristics of the source electron flux can be determined. We will discuss these concepts, including estimated source strengths, and will describe a small instrument capable of providing this unique channel of information for future planetary missions. We propose to build this instrument using innovative electronics packaging methods to minimize size and weight.

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POLARIMETRIC MULTISPECTRAL IMAGING TECHNOLOGY. L.-J. Cheng, T.-H. Chao, M. Dowdy, C. Mahoney, and G. Reyes, Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109, USA.

The Jet Propulsion Laboratory is developing a remote sensing technology on which a new generation of compact, lightweight, high-resolution, low-power, reliable, versatile, programmable scientific polarimetric multispectral imaging instruments can be built to meet the challenge of future planetary exploration missions.

The instrument is based on the fast programmable acousto-optic tunable filter (AOTF) of tellurium dioxide (TeO₂) that operates in

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