

AD-A243 864



LASER FREQUENCY MULTIPLICATION  
REPORT FOR NOVEMBER 1991  
Contract No. 00014-91-C-2279

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During this month, a high quality mode-locked pulse train was obtained at 9.55  $\mu\text{m}$ , the  $\text{CO}_2$  wavelength chosen for frequency doubling into the atmospheric window at 4.8  $\mu\text{m}$ . The pulse train consists of a 3  $\mu\text{sec}$  burst of 1.5 nsec pulses separated by 40 nsec, in a  $\text{TEM}_{00}$  mode and with a total energy of 100 mJ. The pulse intensity without focussing is about 3  $\text{MW cm}^{-2}$ , already quite close to the target intensity of 10  $\text{MW cm}^{-2}$  for frequency doubling in a  $\text{AgGaSe}_2$  crystal.

The mode-locked train is obtained by intracavity modulation at 12.5 MHz using a germanium crystal driven with a power of about 30 Watts. Line selection is achieved firstly by the use of a 0.92 mm thick  $\text{CaF}_2$  plate at the Brewster angle within the cavity, which completely suppresses 10.6  $\mu\text{m}$  band radiation. Secondly, a particular rotational line, the P20 at 9.55  $\mu\text{m}$ , is selected by the injection of a continuous laser tuned to this wavelength. The continuous beam is mode-matched to the pulsed laser cavity using a long focal length lens, and for best line-locking it is necessary to fine tune the length of the pulsed laser resonator. Injection causes substantial depression of the gain switched "spike."

In the near future, it is planned to amplify the 100 mJ pulse train to the 1 J level by passage through a 120 cm  $\text{CO}_2$  gain length. Frequency doubling experiments are scheduled to begin in late December, with the arrival of a type I doubling crystal. As an alternate method of line selection, which should be more robust, it is intended to experiment with a grating blazed at 9.5  $\mu\text{m}$ , which is expected to be delivered in late December. The use of a grating does not give suppression of the gain "spike" and could degrade the quality of mode-locking by introducing significant intracavity round trip time dispersion, so its effect on second harmonic generation will be interesting.

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per telecon NRL 1/6/92

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Justification

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