GENERATION AND DETECTION OF TUNABLE ULTRASHORT INFRARED AND FAR-INFRARED RADIATION PULSES OF HIGH INTENSITY

P. T. Lang, W. J. Knott, I. Leipold, K. F. Renk, A. D. Semenov, and G. N. Gol'tsman

1Institut für Angewandte Physik
Universität Regensburg
W-8400 Regensburg, Germany

2Physics Department
State Pedagogical University
Moscow 119435, USSR

Received August 1, 1991

Abstract

We report on generation and detection of intense pulsed radiation with frequency tunability in the infrared and far-infrared spectral regions. Infrared radiation is generated with a transversally electrically excited high pressure CO2 laser. A laser pulse of a total duration of about 300 ns consisted, due to self mode locking, of a series of single pulses, some with pulse durations of less than 450 ps and peak powers larger than 20 MW. Using these pulses for optical pumping of a Raman D2O laser, trains of short far-infrared pulses with durations less than 400 ps were obtained. For detection a new ultrafast superconducting detector was used.

Key words: High pressure CO2 laser, mode locking, stimulated Raman scattering, detection of radiation
Cooperative Target Detection, Tracking, Ranging and Scanning. Several mm waves and Microwave Radar systems are investigated to obtain detection at optimal ranges and preliminary tracking performances\(^{7,8}\).

Fig.1: Synoptic picture of a dual mode LADAR/RADAR system for detection and tracking of cooperative targets

**Limitations of LADAR Ranging**

It has been shown earlier\(^3\) that for retroreflective LADARS of ranges above 1(km) the atmospheric scattering effects can be neglected. Hence the problem consists mainly of clutter limited ranging. In order to estimate clutter effects, we consider the following equations for the Signal/Clutter ratio:

\[
S_c = \frac{P_{re}}{P_{cl} + P_n}
\]

where \(P_{re}\) is the retroreflected power from the target, \(P_{cl}\) is the clutter signal, and \(P_n\) is the system extra noise that can generally be neglected in comparison to \(P_{cl}\). Hence the following explicit Signal/Noise Ratio\(^{3,6}\) is obtained for this case:

\[
S_c = \frac{\pi^2 \cdot K_{10} \cdot D^4 \cdot \rho_{(1,0 \ ret)}}{4 \cdot \lambda^2 \cdot K_2 \cdot \rho_{(0,1 \ diff)} \cdot \theta^2 \cdot R^2 \cdot 10^6}
\]

where \(K_{10}, D, \rho_{(1,0 \ ret)}, \lambda, K_2, \rho_{(0,1 \ diff)}, \theta, R\) are respectively: the target atmospheric correction factor, cooperative aperture diameter, attenuation factor of the cooperative target, LADAR wavelength, retrofactor for circular cross section, equivalent reflection factor, LADAR transmitter angular beamwidth, and range.