FORTHCOMING PAPERS

Image Transfer by Modulation of Short Light Pulses

M. B. Danailov, I. P. Christov, N. I. Michailov (Bulgaria)

This paper shows that the Fourier-processing based modulation of short laser pulses can be successfully used for all-optical image transfer. The system under consideration consists of a transmitter, where the transferred image modulates the frequency profile of a carrier pulse, and a receiver, where after the reverse processing an original image is restored. The main limitations are discussed and the information capacity of a single pulse is obtained. The results from preliminary experiments using a CPM-ring dye laser as a source of carrier pulses are presented.

Quantum-Limited FM-Spectroscopy with a Lead-Salt Diode Laser. A Comparison of Theoretical and Experimental Data

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Ultrasensitive absorption spectroscopy of NO_2 was performed with a tunable lead-salt diode laser (TDL) using a single-tone high-frequency modulation (FM) technique. With a detection bandwidth of 200 kHz, an optical density of 2.7×10^{-5} was detectable at SNR of 1. The detectable optical density could be further improved by reducing the detection bandwidth in agreement with the $\sqrt{\Delta f}$ relationship, reaching 2.5×10^{-6} at a detection bandwidth of 1.56 kHz. Normalized to 1 Hz bandwidth, the demonstrated performance would then correspond to a detectable optical density of 5.9×10^{-8}. This detection limit agrees well with the calculated „quantum limited" performance based on the measured laser power, modulation index, noise figure of the electronic components, and other parameters of the apparatus. These measurements and calculations show that by implementation of the Fm technique, the sensitivity of the present TDL absorption spectrometers (TDLAS) can be improved by at least a factor of 10 and possibly even of 100. Such a sensitivity improvement would greatly extend the applicability of TDLAS for trace gas analysis, especially in atmospheric monitoring.

Selectivity Enhancement in Tritium Isotope Separation by Multiple Frequency Multiple Photon Dissociation of CTF_3/CHF_3 System

R. S. Karve, A. K. Nayak, S. K. Sarkar, K. V. S. Rama Rao, J. P. Mittal (India)

Isotope separation of tritium by multiple photon dissociation process in multiple frequency fields of a TEA-CO_2 laser is reported for the first time. A tenfold improvement in the bulk selectivity was obtained in 8.5 Torr CTF_3/CHF_3 in the presence of buffer gas at room temperature using 9R(8) to 9R(14) CO_2 laser lines compared to single frequency excitation. Investigations of various process parameters such as exciting laser frequencies, pulse energy, sample and buffer gas pressure indicate that is a promising technique for the separation of tritium.

830 nm Emission in Sodium Vapor

W. T. Luh, Yan Lee, J. Huennekens (USA)

We demonstrate that the intriguing 830 nm coherent emission, which is observed when sodium vapor is pumped with a high-power pulsed laser tuned near the $3S \rightarrow 4D$ two-photon transition, ist due to an axially phase-matched six-wave mixing process. This conclusion is based upon the observation of emission near 584 nm, which is coupled to the 830 nm emission in the six-wave mixing process: $\omega_1 + \omega_2 = 2\omega_L - \omega_{4D\rightarrow 4P} - \omega_{4P\rightarrow 3D}$. In addition, we have observed coherent emission near 1.16 m, which is due to an analogous process involving cascade through the 4*S* (as opposed to the 3*D*) state. We calculate the wavelengths of all photons involved in these processes using the standard formulas of parametric wave-mixing theory, and show that they can be predicted to within experimental uncertainties. Finally we report observations of significant blue shifts of the 830 nm and 1.16 µm emissions in a mixed sodium-potassium vapor. These shifts can be readily understood by considering the effect of the potassium on the frequency-dependent refractive index of the vapor. Due to these results, other recent interpretations of the 830 nm emission as stimulated excimer emission on the $Na_2 1^3\Sigma_g^+ \rightarrow 1^3\Sigma_u^+$ band must now be rejected.

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