

FORTHCOMING PAPERS

Large-Signal Results for Degenerate Four-Wave Mixing and Phase Conjugate Resonators

Yao Jian-quan, Zhou Guosheng (P. R. China), A. E. Siegman (USA)

A numerical calculation procedure and various large-signal numerical solutions are presented for degenerate four-wave mixing in optical Kerr media, and for phase conjugate resonators using degenerate four-wave mixing. The solutions presented take full account of nonlinear refractive index changes, pump depletion, signal saturation, distributed losses, and possible external mirrors with laser gain. We find that including the nonlinear index change generally causes little change in the reflectivity or power output of degenerate four-wave mixing devices, at least with symmetric pumping. The optimum power output from a phase conjugate resonator with and without a laser gain medium is calculated. The results provide some theoretical guidance for designing phase conjugate resonators.

Pressure Effects in the Kinetics of cw Laser Induced Reactions

R. N. Zitter, D. F. Koster, A. Ringwelski, A. Cantoni (USA)

Rate constants k and translational temperatures T have been determined for the decompositions of ethyl acetate and perfluorocyclobutane at various pressures induced by a continuous cw CO₂ laser. Arrhenius plots give activation energies in good agreement with those reported for thermal rate constants k_t . The ratios k/k_t become progressively larger than unity with decreasing reactant pressure, indicative of laser induced non-thermalization, but the values of k/k_t appear to reach limiting values at low pressures, similar to effects reported elsewhere for CH₃CE₂Cl. Analysis of the data suggests important general features of vibrational-translational energy transfer in polyatomic compounds.

Optical Properties Determination at 10.6 μ m of Thin Semiconducting Layers

C. Falco, J. Botineau, A. Azema, M. de Micheli, D. B. Ostrowsky (France)

An optical characterization of thin semiconducting multilayers in the infrared range, using a combination of m-lines and reflection spectroscopy techniques is exposed. Such a method, non-destructive, allows to determine the thickness and the refractive index of each component of a multilayer multimodal planar waveguide.

Spatial Frequency Response and Resolution in Holography

M. Segal, J. Politch (Israel)

Measurements were taken in order to compare "spatial frequency response" (SFR) and resolution properties of several types of holographic methods. The best SFR was obtained for the "Fourier holographic method"; good resolution and SFR were also found for the "image plane hologram" (IPH) reconstructed with a laser light.

The Bi-Directional Amplifier in the Constant Intensity Approximation and its Application to KrF Lasers

M. J. Shaw (UK)

Bi-directional and folded laser amplifiers are analysed in the constant intensity approximation. Simple analytical expressions are developed for gain, output intensity and extraction efficiency. The analysis is applied to electron-beam pumped KrF lasers and expressions for saturation intensity, small-signal gain coefficient and intrinsic efficiency in terms of gas composition and pump power per unit volume are given. The problem of fluorine burn-up in KrF lasers is discussed. Under certain conditions the analysis is shown to be equally applicable to oscillators and comparison is made with previous experimental results and computer code predictions.

Coherence Requirement for Partially Coherent Correlation Detection

F. T. S. Yu, Y. W. Zhang, S. L. Zhuang (USA)

The coherence requirement for correlation detection is determined using the theory of partially coherent light. It is shown that the requirement for temporal coherence strongly depends on the spatial frequency and the spatial extension of the target (i.e., space bandwidth product). However, the spatial coherence requirement depends only on the extension of the target. Some numerical results are also presented.

Ion Implantation Techniques

Lectures given at the Ion Implantation School in Connection with the Fourth International Conference on Ion Implantation: Equipment and Techniques

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Invited Paper

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Volume 7

Laser Spectroscopy III

Proceedings of the Third International Conference, Jackson Lake Lodge, Wyoming, USA, July 4-8, 1977

Editors: J.L. Hall, J.L. Carlsten

1977. 296 figures. XI, 468 pages
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Volume 21

Laser Spectroscopy IV

Proceedings of the Fourth International Conference Rottach-Egern, Federal Republic of Germany, June 11-15, 1979

Editors: H. Walther, K. W. Rothe

1979. 411 figures, 19 tables. XIII, 652 pages
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Contents: Introduction. - Fundamental Physical Applications of Laser Spectroscopy. - Two and Three Level Atoms/High Resolution Spectroscopy. - Rydberg States. - Multiphoton Dissociation, Multiphoton Excitation. - Nonlinear Processes, Laser Induced Collisions, Multiphoton Ionization. - Coherent Transients, Time Domain Spectroscopy. - Optical Bistability, Superradiance. - Laser Spectroscopic Applications. - Laser Sources. - Postdeadline Papers. - Index of Contributors.

Volume 30

Laser Spectroscopy V

Proceedings of the Fifth International Conference Jasper Park Lodge, Alberta, Canada, June 29-July 3, 1981

Editors: A. R. W. McKellar, T. Oka

1981. 309 figures. XI, 494 pages
Cloth DM 70,-; approx. US \$ 29.20
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Contents: Introduction: Progress and Perspectives in Laser Spectroscopy. - Fundamental Applications of Laser Spectroscopy. - Laser Spectroscopic Applications. - Double Resonance. - Collision-Induced Phenomena. - Nonlinear Processes. - Rydberg States (Panel Discussion). - Methods of Studying Unstable Species. - Cooling, Trapping and Control of Ions, Atoms, and Molecules. - Surface and Solid State. - Vacuum Ultraviolet. - Progress in New Laser Sources. - List of Contributors.

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FORTHCOMING PAPERS (CONT'D)

Laser Action in a Gallium Hollow Cathode Discharge

Liu Jian-bang (F. R. Germany)

CW laser action was observed for the 6335 and 7199 Å transitions of Ga II in a hollow cathode discharge. Charge exchange and radiative cascade processes are suggested to be responsible for the population of the upper laser levels.

Diagnostics of Pulsed Molecular Beams and Free Jets with Pyroelectric Detectors and TEA Co₂ Lasers

V. M. Apatin, L. M. Dorozhkin, G. N. Makarov, G. M. Pleshkov (USSR)

A pyroelectric detector with a time resolution of 3 to 5 ns and a TEA-CO₂ laser have been used in diagnostics of a pulsed molecular beam (a free jet). The kinetic energy distribution of molecules was determined by using time-of-flight measurements both with a laser and without it. A combination of the laser with the pyroelectric detector makes it possible to determine the kinetic energy distribution of molecules in a selected internal state and to measure the energy absorbed by the molecules of the beam from a laser pulse. The results obtained for pure SF₆ and the SF₆ seeded in He have been presented and analyzed. The advantages and the disadvantages of the method are being discussed in comparison with other available methods of diagnostics of molecular beams and free jets.

Further Study of Continuous-Wave CO Flame Chemical Laser of the CS₂/O₂/N₂O Type

M. Trtica, Z. Babarogić (Yugoslavia)

This report describes an experimental examination of the output characteristics of the continuous-wave (cw) carbon monoxide flame chemical laser (FCL) of the CS₂/O₂/N₂O type in case of small CS₂/O₂ reactants ratios (typically CS₂/O₂ ≤ 1/10). A linear burner which gives a homogeneous and stable flame was used during the experimental study. The measurements of temperature distribution in CS₂/O₂ as well as CS₂/O₂/N₂O flames show maximum temperatures of 1040 and 890 K, respectively. The addition of nitrous oxide (N₂O) leads to dramatically enhanced output laser power caused primarily by V-V transfer processes. A chemical efficiency, based on the reaction O + CS → CO* + S, of 3% was achieved. The spectral composition of the CO FCL of the CS₂/O₂/N₂O type shows lasing in the region from 5.130 to 5.586 μm. Experimental results were obtained with a nondispersive optical cavity.

Diode-Laser Radiation Absorption of CF₂Cl₂ Around 921 cm⁻¹ in a Supersonic Jet

G. Baldacchini, S. Marchetti, V. Montelatici (Italy)

With a diode laser we have studied the spectral region around 921 cm⁻¹ of the CF₂Cl₂ molecule cooled in a free jet. Accurate studies of the intensity of two vibro-rotational bands have enabled us to determine their assignment. In addition, the rotational structure has been partially resolved, and approximate fitting parameters have been deduced. The simultaneous use of a diode laser and a free jet has proved to be useful in correctly identifying the origin of the absorption bands.

Harmonic Detection with Tunable Diode Lasers — Two-Tone Modulation

D. T. Cassidy, J. Reid (Canada)

The minimum absorption detectable by a tunable diode laser spectrometer utilizing harmonic techniques is often limited by interference fringes generated by scattered light. The sensitivity of the spectrometer to absorption can be increased by applying a jitter modulation. In this paper, the theory of harmonic response for single and two-tone modulation over optical fringes and Lorentzian absorption lines is developed and compared to experimental measurements. A simple analytic expression for the two-tone harmonic lineshape is derived. This expression provides a physical understanding of the effects of the second modulation, and a means to unravel the effects of the second modulation on the linewidth and line shape. For a specific choice of the jitter frequency and phase, it is possible to simultaneously minimize the fringe signal and increase the harmonic absorption signal. The results of this investigation are applicable to trace gas detection using tunable diode lasers, and to other areas of spectroscopy and magnetic resonance where harmonic techniques are used.

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