FORTHCOMING PAPERS

Infrared Emissions in the CO_2-Laser-Induced Photolysis of Trifluoromethane-d and the Mixtures of Trifluoromethane-d and -h

Y. Ishikawa, H. Yamazaki, Y. Hama, S. Arai (Japan)

Time-resolved infrared emission spectra in the wavelenght region of 2—5 μm were measured for the CO_2-laser-induced photolysis of trifluoromethane-d (CDF_3) and its mixtures with trifluoromethane-h (CHF_3). The reactant pressures were 0.1—20 Torr at room temperature; some collisions were expected to occur within the laser-pulse duration. The emissions due to vibrationally excited CDF_3^+ (C-D stretching mode and probably combination mode) and DF * were observed at the same time for the irradiation of pure CDF_3. DF * should be produced in the unimolecular decomposition of CDF_3^*. The dependence of the DF * emission on the experimental condition are explicable on the assumption the the collisional energy transfer followed by the decomposition of CDF_3 plays an important role in the present IRMPD, besides its direct multiple-photon decomposition. The mixtures of CDF_3 and CHF_3 showed the emissions due to HF * and CHF_3^* in addition to DF * and CDF_3^*. The ratio between the DF * and HF * emission intensities, I_{DF}/I_{HF}, was examined as a function of pressure. The pressure dependences were similar to those of the selectivity determined previously from the concentration changes of CDF_3 and CHF_3. The irradiation of mixtures with a long duration pulse (80 ns fwhm with a 2 μs) resulted in a marked decrease in I_{DF}/I_{HF}.

Laser Photoion Projector

V. S. Letokhov, S. V. Chekalin, V. S. Likhachev, V. G. Movshev (USSR)

A laser photodesorption microscope has been applied to obtain $4 \cdot 10^3$-fold images of rhodamine crystals on a tip with a diameter of 66 μm. Peculiarities of the formation of these images have been studied with different values of electric field strength on the tip and laser pulse intensities.

The Effect of Added Nitrogen on Multiphoton Absorption by Ammonia

I. M. Waller, D. K. Evans, R. D. McAlpine (Canada)

Multiphoton absorption (MPA) of the CO_2 laser 9 μm R(30) line (pulse width 60 ns, FWHM) by NH_3 and NH_3/N_2 mixtures was studied as a function of gas composition, pressure and laser fluence (Φ). MPA occurs for Φ smaller than those that have been used for optically pumped of NH_3/N_2 lasers; consequently a simple two-level absorption model will not adequately describe laser action in these systems. The photon energy deposited in NH_3/N_2 mixtures can be calculated from the MPA cross-section and the fluence dependence of the illumination geometry. An examination of the efficiency of conversion of this absorbed energy to the reported radiant energy of optically pumped NH_3/N_2 lasers shows an optimum value which depends on pressure, and gas composition.

Population Inversion in Thallium by Flashlamp-Photodissociation of TlI

G. Rinke (F. R. Germany)

A population inversion between the $6^2P_{3/2}$ and $6^2P_{1/2}$ state of thallium has been achieved for the first time by incoherent photodissociation of TlI. This is accomplished by using wall-ablating Flashlamps of short risetime and appropriate light filtering. The inversion lasts about 4μs and is terminated by quenching collisions.

Nonlinear Plasma Spectroscopy of the Hydrogen Balmer-αLine

E. W. Weber, R. Frankenberger, M. Schilling (F. R. Germany)

The plasma-line broadening of H_α fine-structure lines is investigated with Doppler-free saturation and polarization spectroscopy in He—H gas and arc discharges at plasma densities of $10^8\,cm^{-3} < N \lesssim 1.4 \times 10^{14}\,cm^{-3}$. With a single-mode laser, the shift and broadening of four resolfed H_α fs lines are measured in a low pressure discharge for $N < 10^{11}\,cm^{-3}$. With an intense, broadband multi-mode laser the plasma effects of H_α are investigated up to $N = 1.4 \times 10^{14}\,cm^{-3}$ in a hollow cathode arc. Calculations in the classical phase shift and impact approximations can explain the experimental data and peculiarities of the low-density plasma effects and show that the ions are the dominant perturbers. Ion dynamical effects, perturber mass and temperature dependence, are observed and interpreted. Applications of the nonlinear techniques to other H and D lines, other atoms, and for H and D plasma diagnostics are discussed.

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