FORTHCOMING PAPERS

A Note on Evaporation from Heated Spikes

M. Urbassek, P. Sigmund (Denmark)

We have investigated the effect of heat loss through evaporation on the surface temperature profile and the evaporation yield of an ion-induced spike. We derive a three-dimensional extension of a nonlinear integral equation first found by Mann and Wolf to describe the temperature profile in a semiinfinite medium in the presence of heat loss through the surface. The equation has been solved by perturbation expansion in powers of the evaporation rate. For heavy-ion induced, cylindrical elastic-collision spikes, noticeable but moderate corrections are found to evaporation yields estimated previously by neglecting heat loss due to evaporation. Comments are made on sputtering of insulators both by heavy keV ions and by ionizing particles. Expressions for an effective sputter time and sputter area are derived for cylindrical geometry; both quantities turn out independent of the initial spike temperature. The sputter radius is normally greater than the depth of the crater formed; we conclude that the influence of crater formation on the evaporation yield is normally negligible.

A Study of the Self-Injected Laser for Subnanosecond Pulse Generation

C. H. Brito Cruz, E. Palange, F. De Martini (Brasil)

We present a detailed analysis of the self-injected Nd: YAG laser which is capable of generating subnanosecond duration pulses with peak powers as high as 200 MW. The model predicts that pulses with durations much shorter than the electrical rise time of the electrooptical switcher driver can be obtained. Application of this technique to a conventionally Q-switched Nd: YAG laser allowed us to obtain 550 ps pulses with 120 mJ in a very stable and reliable way.

Multiphoton Absorption of Broad-Band CO_2 Laser Radiation by SF_6

S. S. Alimpiev, W. Fuß, K. L. Kompa, C. Schwab, Wan Chong-yi (F. R. Germany)

Increase of the emission bandwidth of a high-pressure CO_2 laser up to 1.5 cm^{-1} increases the multiphoton absorption cross-section of SF_6. Comparison with the previously found [9] increased absorption for shorter pulses suggests that this is also a bandwidth effect. Spectral structures as narrow as 1 cm^{-1} above the 10th absorption step are invoked to explain the observations. The temperature effect, which disappears in the broad-band case, confirms this view.

Observation of Superfluorescence and Stimulated Emission in Bi I after Nonresonant Two-Photon Pumping

C. Cremer, G. Gerber (F. R. Germany)

We report the observation of superfluorescence and of stimulated emission in the near-infrared at 965.69 nm in atomic Bi. The atoms are prepared in the $6p^2(^3P_0)7p_{3/2}$ upper state by nonresonant two-photon excitation. The cooperative character of the emission is demonstrated by the delay of the light pulses and their N^2 dependence upon the atomic density.

Continuous-Wave Frequency Mixing and UV Generation in Sodium Vapor

L. T. Bolotskikh, A. L. Vysotin, Im Tkhek-de, O. P. Podavalova, A. K. Popov (USSR)

Resonant nonlinear four-wave mixing processes have been studied in sodium vapor. The generation of cw uv radiation and the upconversion of $\lambda = 10.8\,\mu m$ light is reported. The coefficient $C = P_4/P_1P_2P_3$ obtained was on the order of $\sim 10^{-2}, W^{-2}$, the pump spectral width being 12 GHz. Resonant atomic nonlinearities are shown to be used for effective cw frequency conversion.

Computer Simulation of Multiphoton Excitation of SF_6 Molecules Cooled by Pulsed Supersonic Expansion

V. Toşa, I. Deac, P. Mercea, Zs. Gulácsi, V. Mercea (Romania)

The initial ground-state dependence of the multiphoton excitation of SF_6 is numerically estimated using two different approximations for the ν_3 vibration-rotation levels and for the laser line width. From this calculations we have identified and explained some features seen in recent experimental data.

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CVL-Pumped Dye Laser for Spectroscopic Application

G. Delacrétaz, L. Wöste (Switzerland)

A spectroscopic dye laser system — pumped by a Copper Vapor Laser (CVL) — has been built and optimized for different dye solutions operating in the spectral range from 530 to 890 nm. Conversion efficiencies up to 40% were reached in broad band operation, 24% with a prism expander grating cavity, and 20% in grazing incidence configuration, which operated at typical band widths of 3 GHz. Second harmonic generation (SHG) of the dye laser output produced tunable uv radiation between 260 and 408 nm at conversion efficiencies $\leqq 5\%$. Fundamental and SHG output were used for resonant ionization experiments in molecular beams.

Effects of a Lossy Thin Plasma-Film on Metal-Diffused $LiNbO_3$ Optical Waveguides

M. De Sario (Italy)

I intend to investigate the effects of different kinds of partially reflecting metal film (plasma layer) on the wave characteristics of a stratified titanium-diffused $LiNbO_3$ optical waveguide. The mode number, the equivalent indices, the extinction coefficients, the field distributions and the powers carried in each layer are given as a function of the free-space wavelength, of the diffusion parameters, and of the optic c-axis orientation. Of course, the power of TM-like hybrid waves flows in opposite directions in the plasma and the other regions.
For a c-axis varying in the transverse plane, the i^{th}-order hybrid mode is rather complicated in the guide with an aluminum layer. There, in fact, the field mapping can be seen as an overlap of a TE_i with a TM_{i+1} mode because of a sudden transformation of the TM_0 mode into by superficial plasma wave (SPW). On the contrary, with a silver layer, the hybrid field is a simple combination of a TE_i with a TM_i mode with no SPW growing.
The guide losses assume the lowest values (1 dB/cm) for an Ag layer which is the prime candidate for making electro-optical or acousto-optical devices. On the other hand, the nickel film causes the highest losses ($\geqq$ 66 dB/cm).

Laser FM Spectroscopy with Photochemical Modulation. A Sensitive, High Resolution Technique for Chemical Intermediates

E. A. Whittaker, H. R. Wendt, H. Hunziker, G. C. Bjorklund (USA)

We have combined the techniques of frequency-modulation spectroscopy (FMS) and photochemical-modulation spectroscopy to carry out high-resolution, high-sensitivity absorption measurements on the formyl and amino radicals. Using the $(0,9^0,0)$-$(0,0^1,0)$ band of the $A\,^2A'' - X\,^2A'$ transition of HCO at 614 nm, we obtained a sensitivity limit for absorption of 1.5×10^{-6}. Reconstructed spectra of several HCO lines are presented.

Anisotropic Selfdiffraction in $BaTiO_3$

N. V. Kukhtarev, E. Krätzig, H. C. Külich, R. A. Rupp, J. Albers (F. R. Germany)

Anisotropic selfdiffraction in $BaTiO_3$ crystals utilizing the large electro-optic coefficient r_{42} is described. In the absence of an external electric field the generated space charge field is determined by diffusion processes. The theory is in agreement with the experimental results. The angles between extraordinary and ordinary beams, the intensity and time dependence of transmitted and diffracted beams, and phase conjugation effects are measured and evaluated.

Improved Gain on the $Cl_2(D'\,^3\Pi_g - A'\,^3\Pi_u)$ Transition at 258 nm by Halogen Donor Mixing

W. Walter, H. Langhoff, R. Sauerbrey (F. R. Germany)

The temporal development of the small-signal gain on the $Cl_2(D'$-$A')$ transition at 258 nm has been investigated by means of an amplified spontaneous emission (ASE) technique. For electron-beam-pumped He/Cl_2 mixtures, the gain appears only at the end of the pumping pulse, whereas for $He/Cl_2/CCl_4$ mixtures the temporal gain profile coincides with the fluorescence pulse, and the maximum gain coefficient increases by about a factor of two. The observed effects are due to the mixing of both halogen donors and can be explained by considering the quenching of the D'-state by electrons.

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