Saturation of Resonant Frequency Conversion Processes in Cadmium Vapour

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We have investigated two-photon resonant up conversion of 375—159 nm coherent radiation using the four-frequency process $\omega_{159} = 2\omega_{375} + \omega_{1040}$ in cadmium vapour, where the ir component (1040 nm) is internally generated by the 375 nm pump tuned to the Cd two-photon transition $5s^2\,{}^1S_0 \rightarrow 5s6s\,{}^1S_0$. Scaling laws and tuning behaviour of both the 159 and 1040 nm output power were measured up to 1×10^8 Wcm^{-2} pump intensity and 2×10^{17} cm^{-3} Cd number density. The results are compared to numerical calculations based on semiclassical theory in a stationary perturbation approximation up to third order. Here, in accordance with experimental results, the ir component was assumed to originate from a superposition of stimulated emission and parametric generation. The observed saturation effects turned out to be mainly due to population changes of the atomic levels involved and are qualitatively reproduced by calculations. Discrepancies with respect to absolute output levels are discussed in terms of the approximations in the theoretical formalism.

Intense Laser Generation from an Atomic-Fluorine Laser

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An intensive generation of radiation from a discharge-pumped atomic-fluorine gas laser is reported. A peak power exceeding 330 kW and a total energy of more than 2 mJ is obtained for a number of lines in the red, using a NF_3:He (1:100) gas mixture at total pressure of 500 Torr. The circuitry optimization is described and the conditions for effective operation of the atomic-fluorine laser are discussed. The temporal and the spectral characteristics of the laser emission are also presented.

Detection of Free NH_2 (X^2B_1) Radicals by CARS Spectroscopy

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CARS spectra of NH_3 and the free NH_2-radical in the NH stretch region at 3334 and 3220 cm^{-1} have been obtained, respectively. The NH_2 radicals were generated by laser photolysis of 0.5 mbar NH_3 at 193 nm with an ArF-exciplex laser and detected by time resolved CARS spectroscopy.

Applications of Two-Photon Absorption for Detection of CO in Combustion Gases

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Laser-induced fluorescence has been used for detection of CO in different environments. The fluorescence light was obtained by using a two-photon transition between the $X\,{}^1\Sigma^+$ and the $B\,{}^1\Sigma^+$ electronical states around 230 nm. Cell measurements indicate a detection limit lower than 0.1 ppm. Measurements in a CH_4/air flame and in a low pressure dc discharge were realized with a diode-array detector, which was used in an imaging mode, permitting single-shot CO distributions to be captured.

Picosecond Gain Dynamics of KrF*

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We describe the generation of excimer-laser pulses of <10 ps pulse width and up to 40 mJ pulse energy at 248.5 nm and their use in the measurement of ps gain dynamics in a KrF amplifier. Small-signal gain of $>2 \times 10^4$, saturation energy density of 2.0 mJ/cm^2, and gain recovery time of 4 ns were measured. In contrast to XeCl* no short-gain recovery time was found in KrF* and the stored inversion could be fully depleted by a single ps pulse.

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