FORTHCOMING PAPERS

Origin of Laser-Output Noise of Cataphoretic $HeSe^+$ Lasers

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We investigated noise and fluctuations of the output power of cataphoretic $HeSe^+$-lasers in positive column plasmas. Direct coupling of laser output power noise and fluctuations of the local population inversion was found. An investigation of the positive column plasma showed moving striations being responsible for the gain fluctuations. Whereas the local plasma properties are dominated by high frequency striations in the 100 kHz range, integrated quantities such as laser gain per pass are most strongly influenced by low-frequency waves with a continuous noise spectrum below 200 kHz. External modulation of the discharge voltage or current at a frequency near the hf striations reduces laser noise and increases laser output power.

Delopment of an Optical Time Scale

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A time standard based on the use of an optical oscillation period of a frequency-stable He-Ne laser as a time scale is first described. We obtained highly frequency-stable oscillations in the SHF range that were locked to the oscillations of a He-Ne laser stabilized to an absorption resonance in methane at 3.39 μm. A direct comparison of frequency stabilities of a rubidium standard and He-Ne/Ch_4 laser has been made. The absolute measurement of the frequency of the He-Ne/CH_4 laser we performed gave a new value of frequency.

The Characterization of Multiple-Photon Absorption of SF_6 Molecules Cooled in Free-Jet Expansion from a Pulsed Supersonic Nozzle

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The multiple-photon absorption of pulsed TEA CO_2 laser radiation by SF_6 molecules cooled to $T_R \cong 40$ K and $T_V \cong 160$ K in, the free jet expansion from a pulsed supersonic nozzle has been investigated at energy fluences of 0.1 to 3.0 $J \cdot cm^{-2}$.
For practically all laser lines which coincide with the linear absorption spectrum of the ν_3 vibrational mode of SF_6 [P(12) ... P(28), 10.6μm], the dependence of the absorbed energy E_{ab} on the exiting energy fluence was found to be steeper than linear $E_{ab} \sim \phi^n$, where $n = (1.1 \ldots 1.8)$. Considerable increasing of the absorption cross sections with increasing energy fluence were observed. The fraction of the molecules interacting with the laser radiation is estimated.

Generation, Stabilization, and Amplification of Subpicosecond Pulses

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A sync-pumped cw dye laser system has been used to produce subpicosecond pulses. Pulses as short as 0.7 ps, assuming a single-sided exponential pulse shape, were observed. A set of experiments was performed to investigate the origin and effects of noise in the sync-pumped system. A digital and an analog feedback loop have been designed to optimize the pulse width. The noise has been lowered by 10 dB for frequencies up to 10 kHz; long-term drift is also controlled by this method. A four-stage dye laser amplifier, pumped by a Nd:YAG laser which operates at a 10-Hz repetition rate, is synchronized electronically to the dye-laser picosecond pulses. A gain of 3×10^6 has been achieved.

Apparent Transfer Function for Partially Coherent Optical Information Processing

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In this paper, the general formulations of the apparent transfer function for the partially coherent optical processor will be derived. Although these formulas show that the apparent transfer function is dependent upon the degree of spatial and temporal coherence, there is actually more variability in the spatial coherence. We note that the obtained formulas may also be used as a criterion in the selection of source size and spectral bandwidth of an incoherent light source. Thus a specific optical information processing operation can be carried out with an incoherent source.