XII. ELECTRODYNAMICS OF MEDIA*

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RESEARCH OBJECTIVES

The research on interaction of electromagnetic fields with media is pursued (a) to obtain self-consistent formulations of electrodynamics in the presence of moving and deforming media, and (b) to study nonlinear interactions of electromagnetic fields and optical frequencies both theoretically and experimentally.

1. Force on Media in Electromagnetic Fields

The methods developed for the determination of the force distribution in polarizable and magnetizable media are being applied to media with dispersion and quadrupolar media. The work is relevant to an understanding of electroacoustic interactions both at microwave and optical frequencies. It has been found that the energy momentum tensor of media that are dispersive may be asymmetric. The asymmetry has been interpreted.

Also under study are quantum descriptions of electromagnetic fields in dispersive and/or moving media. Quantum effects are important in particular in determining the noise of optical devices.

L. J. Chu, P. Penfield, Jr., H. A. Haus, J. A. Kong

2. Nonlinear Interactions at Optical Frequencies

One major objective of this study is to produce short powerful pulses of radiation in the infrared. Pulses have been produced using a low-pressure CO_2 laser oscillator with a cavity-dumping scheme, and amplification of the pulse has achieved gain and shortening. The high-pressure transverse discharge-excited CO_2 laser will be employed for the same purpose. The eventual aim is to combine mode locking and cavity dumping and nonlinear pulse shaping in an amplifying medium to obtain a pulse as short and as powerful as possible.

For a better understanding of saturation of CO_2 lasers studies are conducted experimentally and theoretically on cross-relaxation phenomena in low-pressure and high-pressure discharges.

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