XIII. ELECTRODYNAMICS OF MOVING MEDIA

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RESEARCH OBJECTIVES

We are developing the fundamental equations of electrodynamics (for both electromagnetism and dynamics) of moving and deforming polarizable and magnetizable material. Our ultimate goal is the determination of the macroscopic force acting on a continuum, and the distribution of that force as a function of space and time. The fundamental equations must be consistent with (a) the special theory of relativity; (b) electromagnetism of free space; (c) electromagnetism of stationary bodies; (d) relativistic continuum mechanics of solids or fluids without electromagnetic fields; (e) thermodynamic measurements of the various kinds of power flow; and (f) nonlinear material properties.

Thus far we have obtained equations for conservative media that, in general, are nonlinear and/or time dispersive. Work proceeds on the extension to space dispersive matter and irreversible phenomena in the presence of heat flow. Some of the results are applicable to the theory of Brillouin scattering in solids and liquids. The potentiality of the Brillouin scattering experiment to provide an experimental test of the theoretical force terms is under investigation.

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