

Abstract Submitted
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Application of axiomatic formal theory to the Abraham–Minkowski controversy MICHAEL CRENSHAW, USArmy AMRDEC — Continuum electrodynamics is an axiomatic formal theory whose axioms are the macroscopic Maxwell equations. We demonstrate that valid theorems of the formal theory are inconsistent with conservation laws and with special relativity because continuum electrodynamics allows transformations of the Maxwell equations that constitute an improper tensor transformation that changes the conservation properties, the relativity properties, and the space-time embedding of the coupled equations of motion. The inconsistencies are resolved by a reformulation of physical principles in a flat non-Minkowski material spacetime in which the timelike coordinate corresponds to ct/n . Applying Lagrangian field theory, we derive equations of motion for the macroscopic electric and magnetic fields in a simple dielectric medium. We construct a new formal theory of continuum electrodynamics and we derive a tensor energy-momentum continuity theorem that trivially resolves the century-old Abraham–Minkowski momentum controversy. We derive the theory of special relativity in a dielectric, including the material Lorentz factor and the material Lorentz transformation. We derive the momentum of a polariton in the context of material special relativity to confirm the resolution of the Abraham-Minkowski debate.

Michael Crenshaw
USArmy AMRDEC

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