Electricity is Different

Bob Eisenberg
Rush University Chicago
November, 2016

Electricity is different from other force fields because it is universal. Electricity follows Maxwell's equations of electrodynamics exactly, in the nuclei of atoms and the nuclei of galaxies, from times much shorter than those of atomic motion (0.1 femtoseconds) to thousands of years. Electricity is different because it is so strong. One per cent charge imbalance (in an 80 kg object) produces a force enough to lift the earth. **Electrodynamics enforce the conservation of 'current'** when 'current' includes Maxwell's vacuum displacement term $\varepsilon_0 \partial \mathbf{E} / \partial t$. Analysis shows that the **time rate of change of the electric field can take on whatever value is needed to ensure conservation of this current no matter what are the properties of matter or its polarization.** Properties of matter rearrange themselves to satisfy conservation of this current. Theories of matter often treat electrodynamics cavalierly. Vacuum displacement current is usually ignored and so conservation of 'current' is not enforced. Kinetic models of chemistry and Markov treatments of atomic motion are ordinary differential equations in time and do not satisfy conservation of current unless amended significantly. Enforcing the laws of electrodynamics is necessary to understand the properties of oceans, animals, and the molecules of life, because all depend on electrically charged ions. All are complex fluids in which 'everything interacts with everything else' by the universal laws of electrodynamics. Amending theories of matter to include electrodynamics is likely to produce significant improvement in applications to the real worlds of technology, biology, and medicine. Proofs and discussion are at https://arxiv.org/abs/1609.09175 and references cited there.