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Robert Eisenberg* (bob.eisenberg@gmail.com). *Maxwell's Core Equations are Exact, Universal, and Scary.*

When Maxwell equations are written without dielectric constant, they are universal and exact, from atoms to stars. Dielectric and polarization phenomena are described by stress strain relations for charge, that show how charge redistributes when the electric field is changed. Conservation of total current (including ethereal displacement current $\epsilon_0 \partial E / \partial t$ is then as exact as the Maxwell equations and independent of matter. It is a consequence of Lorentz invariance of elementary charge, a property of locally inertial systems, described by the theory of relativity. Exact Conservation of Total Current allows redefinition of Kirchhoff's current law that is itself exact. In unbranched systems like ion channels or circuit components, conservation of total current becomes equality. Spatial dependence of total current disappears in that case. Hopping phenomena disappear. Spatial Brownian motion disappears. The infinite variation of a Brownian thermal noise becomes the zero spatial variation of total current. Maxwell's Core Equations become a perfect (spatial) low pass filter. An Exact and Universal theory of Electrodynamics is a scary challenge to scientists like me, trained to be skeptical of all sweeping claims to perfection. (Received August 30, 2021)