there is no charge density and no current density from Eq. (17) because there is no canonical energy momentum density used in deriving this Schwarzschild line element. Here M is mass, G the Newton constant, c the speed of light (S.I.units are used in Eq. (25)) and the spherical polar coordinate system (r , θ , ϕ) is used. Therefore in both of these line elements the Coulomb and Ampère Maxwell laws are:

$$\underline{\nabla} \cdot \underline{E} = 0, \qquad -(27)$$

$$\underline{\nabla} \times \underline{B} = \frac{1}{c^2} \frac{\partial \underline{E}}{\partial t}. \qquad -(28)$$

The Friedman Lemaitre Robertson Walker dynamical line element { 13 } is:

$$ds^2 = -c^2 dt^2 + a(t)^2 \left(\frac{dr^2}{1-kr^2} + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2 \right), \qquad -(29)$$

$$g_{00} = -1, \quad g_{11} = \frac{a^2(t)}{1-kr^2}, \quad g_{22} = a^2(t) r^2, \quad g_{33} = a^2(t) r^2 \sin^2\theta \qquad -(30)$$

where a is governed by the Friedman equations. This metric is the result of homogeneity and isotropy, as is well known { 14 }, and the Einstein Hilbert field equations are used to define the line element through the Friedman equations. Well known types of cosmologies are defined by this line element { 14 }. The line element (29) produces the Coulomb law:

$$\underline{\nabla} \cdot \underline{E} = -3\phi \frac{\ddot{a}}{a} = 4\pi \phi G(\rho + 3p) = \frac{\rho_e}{\epsilon_0}, \qquad -(31)$$

and the current density components:

$$J_r = -\frac{A^{(0)}}{\mu_0} \left(\frac{2}{a^4}(k + \ddot{a}^2)(kr^2 - 1) + \frac{\ddot{a}}{a^3}(kr^2 - 1) \right) \qquad -(32)$$

$$J_\theta = \frac{A^{(0)}}{\mu_0}\left(\frac{2}{a^4 r^2}\left(k + \ddot{a}^2\right) + \frac{\ddot{a}}{a^3 r^2}\right) \qquad -(33)$$

$$J_\phi = J_\theta / \sin^2\theta. \qquad -(34)$$

These depend on the type of universe, or cosmology, being considered { 11 }. The Coulomb law (31) depends directly on the Newton constant G and the mass density ρ , together with:

$$\rho = \frac{m}{V} \qquad -(35)$$

in the rest frame, where m is mass and V is volume. In the laboratory, Eq. (31) is the well tested Coulomb law of electrodynamics, one of the most precise laws of physics { 1 }. Eq. (31) is generally covariant and upon general coordinate transformation produces new physical effects. The generally covariant Ampere Maxwell law also produces new physical effects which can be looked for experimentally. Some are already known, notably the change in polarization of light deflected by gravitation {2-10}. Here, the scalar potential ϕ has the units of volts, G is the Newton constant with units of meters per kilogram, r is the radial vector of the spherical polar coordinate system (r, θ, ϕ), ρ_e is the electric charge density and ϵ_0 is the vacuum permittivity in S.I. units.