# 3. DISCUSSION OF RESULTS AND CRITICISMS OF THE STANDARD MODEL.

The Coulomb and Ampere Maxwell laws in ECE theory are summarized in Table 1 for various metrics.

(Table 1 here).

In this section a discussion of these results is given with fundamental criticisms of standard model cosmologies. There are various well known exact solutions of the Einstein Hilbert (EH) field equation which are considered as follows. The class of vacuum solutions assume that there is no matter or non-gravitational fields present, this is typified by what is usually called the Schwarzschild metric, which in ECE self-consistently produces no charge density and no current density, i.e. a vacuum. The class of electro-vacuum solutions solves the source free Maxwell Heaviside (MH) field equations in the given curved Lorentzian manifold, the source of the gravitational field being the electromagnetic energy-momentum. In this class, as in all classes of solution of EH, there is no Cartan torsion present. The electro-vacuum class of solutions is typified by the Reissner Nordstrom (RN) metric, the Kerr metric, and variations thereof. Einstein did not accept the RN metric as a unified field theory, because it replaces the derivative of the MH theory by a covariant derivative and so this is not an objective procedure based on geometry, it is an ad hoc fix of the phenomenological MH theory, one which assumes the presence of an electromagnetic field that has no source, a logical contradiction present in MH electrodynamics. In ECE theory the electromagnetic field is due to the electromagnetic Cartan torsion, which is missing from all Riemannian theories such as EH. So to use RN or Kerr with ECE is a contradiction in fundamental concepts.

The third class of EH solutions is the null dust class which assumes that the source of the gravitational field is an incoherent electromagnetic field with no source. This again has

the weaknesses just discussed of the electro-vacuum class of EH solutions. The class of fluid solutions assumes that the canonical energy momentum density of EH comes from the stress-energy tensor of a fluid, and that this is the only source of the gravitational field. This class of solutions assumes isotropy and homogeneity, and the FLRW metric is an example. In ECE, the FLRW metric gives a finite charge and current density, and precisely the correct form of the Coulomb Law (se Table 1). In other words, ECE identifies the source of the Coulomb law as mass density, to which charge density is directly proportional. If there is mass density present anywhere in the universe, there is a source for the electromagnetic field. This cures the logical inconsistency in MH of having a field without a source. However, there are fundamental geometrical difficulties associated with this class of solutions, and these are discussed later in this Section. It seems that the rigorously correct Coulomb and Ampere Maxwell laws are given by a new class of solutions of EH deduced by Crothers { 15 }. This class also gives a finite charge density and current density given a finite mass density.

There are more exotic classes of exact EH solutions, for example the scalar field solutions in the field theory of meson beams and quintessence, the class of solutions due to a finite cosmological constant, the wormhole and superluminal metrics. The Kerr Newman NUT de Sitter class of exact solutions to EH uses a source-less electromagnetic field and positive vacuum energy. Finally the Godel dust solution of EH uses a pressure-less perfect fluid (dust) and a positive vacuum energy. From the point of view of ECE these are exotic, logically inconsistent and use adjustable parameters. None are true unified field theories because they are not based on the required logic of Cartan geometry.

Of these solutions the Crothers solution is the rigorously correct one, and produces a finite charge density and current density given a finite mass density. The Crothers solution also eliminates singularities, known as "Big Bang" and "black hole". ECE theory has been shown {2-9} to eliminate the wholly phenomenological concept of "dark matter" in

favor of the Cartan torsion, which is an intrinsic part of geometry. The latter is the objective foundation of general relativity. The most important property of the Crothers solution is that it is rigorously correct from a geometrical point of view, and it is further discussed later in this Section. The Crothers solutions are still Riemannian solutions, without consideration of torsion, but in Eq. ( 17 ), the right hand side term is considered in an approximation to derive from curvature. The effect of gravitational torsion can be included in further work by changing Eq. ( 17 ) to:

$$\partial_\mu F^{a\mu\nu} = -A^{(0)}\left(R^a{}_\mu{}^{\mu\nu} + \omega^a{}_{\mu b}T^{\mu\nu b}\right) \quad - (36)$$

where $\omega^a{}_{\mu b}$ is the gravitational spin connection and $T^{\mu\nu b}$ the gravitational torsion.

The rigorous self-consistency of ECE theory is proven from the fact that a vacuum solution, the usually named Schwarzschild metric, results in zero charge density and current density. This proves that the ECE theory is technically correct (see Appendices) and conceptually self consistent and objective. In ECE theory there is neither a gravitational nor an electromagnetic field without mass density acting as the source of that field. Indeed, the gravitational and electromagnetic fields become unified in the same field, and also unified with the weak, strong and fermionic and other matter fields {2-9}. In ECE, field theory is unified with quantum mechanics using the tetrad postulate.

It is to be noted that there are conceptual inconsistencies both in MH theory and in the class of vacuum solutions of EH, because in both cases, there is a field of force, but no source for the field. The concept of the field of force was introduced by Faraday. Maxwell considered the source to be the result of the field. The twentieth century view was that the field is produced by the source. ECE theory asserts that the field is geometry, and that the source of the gravitational field unified with the electromagnetic field is mass density.