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Development of Spin Connection Resonance in the Coulomb Law

by

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Abstract

It is shown that the Coulomb law if developed in the context of a generally covariant unified field theory produces several classes of resonant phenomena due to the fact that the electromagnetic field is the Cartan torsion of Einstein Cartan Evans (ECE) field theory. The electromagnetic potential is always defined with the spin connection, so the possibility of resonance is always present, in the sense that the potential of the Coulomb law can be amplified by damped or undamped resonance. In suitable materials this resonance produces free electrons which may be used for power generation as first demonstrated by Tesla.

Keywords: ECE theory, spin connection resonance in the Coulomb law, new sources of electric power.

22.1 Introduction

Recently a generally covariant unified field theory has been developed based on standard Cartan geometry [1–8] - Einstein Cartan Evans (ECE) field theory. One of the many consequences of the ECE theory is that the fundamental laws of classical electrodynamics are augmented. The ECE theory reduces to these well known laws in well defined limits, but also gives more information based on the fact that the electromagnetic field tensor is the Cartan torsion within a proportionality $cA^{(0)}$ in volts. The electromagnetic potential is always defined as the Cartan tetrad, so that the electromagnetic field always contains the spin connection. In the absence of the spin connection the ECE theory reduces straightforwardly to the standard Maxwell Heaviside (MH) theory [9], because without a spin connection, space-time reduces to the flat Minkowski space-time of MH theory.

In Section 22.2 the most general ECE equation of the Coulomb law is developed to show that there exists a class of resonant solutions which can be demonstrated straightforwardly. The Coulomb limit is defined and conditions for damped and undamped resonance discussed. In Section 22.3, another novel class of resonant solutions is obtained by considering a heterodyne type driving force with a simple spin connection. There is freedom of choice of spin connection as long as the reduction to the Coulomb law is well defined. In the vast majority of cases the Coulomb law is observed to be very accurate, but Tesla [10] was the first to demonstrate experimentally that resonant power can be obtained form space-time. Therefore behind the Coulomb law is hidden a new world of possibilities for obtaining resonant electric power from space-time.

22.2 Simple Resonant Solutions

The basic spin connection resonance (SCR) equation of the Coulomb law [1–8] is written in terms of the radial coordinate as:

$$\frac{\partial^2 \phi}{\partial r^2} + \left(\frac{2}{r} + \omega_r\right)\frac{\partial \phi}{\partial_r} + \frac{\phi}{r^2}\left(2r\omega_r + r^2\frac{\partial \omega_r}{\partial r}\right) = -\frac{\rho}{\epsilon_0} \tag{22.1}$$

where ϕ is the potential of the Coulomb law, r is the radial coordinate, ω_r the spin connection, ρ the charge density and ϵ_0 the vacuum permittivity in S.I. units. Eq. (22.1) can be reduced straightforwardly to the basic structure of the damped resonator equation, which was discovered in the eighteenth century [11]:

$$\frac{d^2 x}{dr^2} + 2\beta\frac{dx}{dr} + \kappa_0^2 x = A\cos(\kappa r). \tag{22.2}$$

In Eq. (22.2) β takes the role of the friction coefficient, and κ_0 is a Hooke's law type wave-number. The right hand side term in Eq. (22.2) is a cosinal driving term with a characteristic wave-number κ, and A is a proportionality constant.

Eq. (22.1) reduces to Eq. (22.2) when:

$$\omega_r = 2\left(\beta - \frac{1}{r}\right), \tag{22.3}$$

$$\kappa_0^2 = \frac{4}{r}\left(\beta - \frac{1}{r}\right) + \frac{\partial \omega_r}{\partial r}. \tag{22.4}$$

Solving these equations defines the condition under which the spin connection gives the simple resonance equation (22.2):

$$\omega_r = \kappa_0^2 - 4\beta \log_e r - \frac{4}{r}. \tag{22.5}$$

Under this condition, Eq. (22.1) becomes:

$$\frac{\partial^2 \phi}{\partial r^2} + 2\beta \frac{\partial \phi}{\partial r} + \kappa_0^2 \phi = -\frac{\rho}{\epsilon_0}, \tag{22.6}$$

an equation which gives well known resonant solutions and their equivalent circuits, so that the circuits used for example by Tesla can be designed and etched on to foundry material.

Reduction to the Coulomb law occurs when

$$\beta = \frac{1}{r}. \tag{22.7}$$

It is seen from Eqns. (22.3) and (22.4) that under the condition (22.7):

$$\omega_r = 0,\ \kappa_0^2 = 0, \tag{22.8}$$

so that the Coulomb law is obtained:

$$\frac{\partial^2 \phi}{\partial r^2} + \frac{2}{r}\frac{\partial \phi}{\partial r} = -\frac{\rho}{\epsilon_0}. \tag{22.9}$$

In general however there is no reason to assume that condition (22.7) must always hold. The Coulomb law holds experimentally in the vast majority of applications, but in general relativity it is greatly enriched by the spin connection. The traditional structure (22.9) is regained if and only if the friction coefficient is defined by Eq. (22.7).

Reduction to the undamped resonator occurs when:

$$\beta = 0 \tag{22.10}$$

which implies:

$$\omega_r = -\frac{2}{r},\ \frac{\partial \omega_r}{\partial r} = \frac{2}{r^2},\ \kappa_0^2 = -\frac{2}{r}. \tag{22.11}$$

If there is dispersion [9] in the wave-number κ_0 it becomes complex valued:

$$\kappa_0 = \kappa_0' + i\kappa_0''. \tag{22.12}$$

The conjugate product is:

$$\kappa_0 \kappa_0^* = \kappa_0'^2 + \kappa_0''^2 \tag{22.13}$$

and is positive valued, but the square is :

$$\kappa_0^2 = \kappa_0'^2 - \kappa''^2_0 + 2i\kappa_0'\kappa''{}_0. \tag{22.14}$$

Therefore an undamped resonator equation of the type:

$$\frac{\partial^2 \phi}{\partial r^2} + \kappa_0 \kappa_0^* \phi = -\frac{\rho}{\epsilon_0} \tag{22.15}$$

can exist. At resonance it is well known that the solutions of the undamped resonator become infinite, signifying the release of free electrons into a power circuit from well chosen materials [1–8].

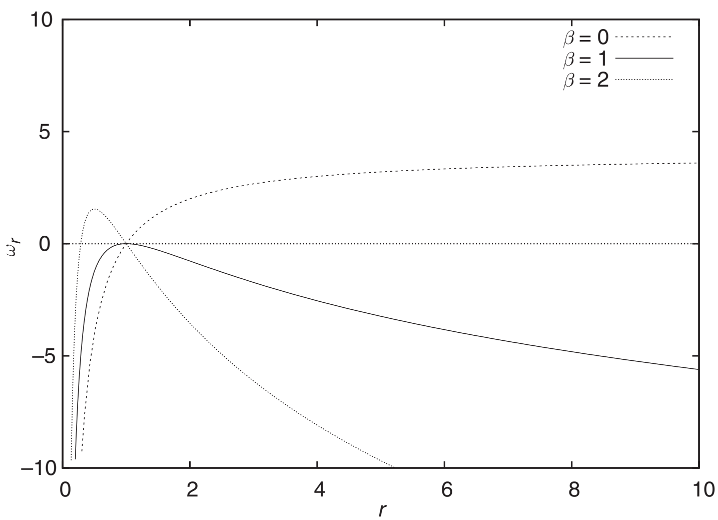

Fig. 22.1. Graph of $\omega_r(r)$ for $\kappa_0 = 2$ and three β values.

In Fig. 22.1 the function $\omega_r(r)$ (Eq. (22.5)) is plotted for three β values. For $\beta = 0, \omega_r$, takes a form of a shifted $\frac{1}{r}$ function. Because we chose $\kappa_0 = 2 =$ const., we get a shift compared to the theoretical result of Eq. (22.11) for ω_r. For all values of β there is a common radius value ($r = l$) at which omega is zero.

22.3 Direct Solution of the SCR Equation for the Coulomb Law

In [1–8] it was shown that the radial differential equation

$$\frac{\frac{d}{dr}\Phi}{r} - \frac{\Phi}{r^2} + \frac{d^2}{dr^2}\Phi = -\frac{\rho(r)}{\epsilon} \tag{22.16}$$

has to be solved in order to get resonances of the Coulomb law. $\Phi(r)$ denotes the radial dependence of the potential and $\rho(r)$ is a charge density serving as a "driving force". In Eq. (22.16) a special form of the spin connection has been assumed. According to the theory of ordinary differential equations, the most general solution consists of the general solution of the homogeneous equation ($\rho = 0$) to which one particular solution of the inhomogeneous equation has to be added. The solution of the homogeneous equation

$$\frac{\frac{d}{dr}\Phi}{r} - \frac{\Phi}{r^2} + \frac{d^2}{dr^2}\Phi = 0 \tag{22.17}$$

is

$$\Phi = k_2 r - \frac{k_1}{2r} \tag{22.18}$$

with arbitrary constants k_1 and k_2. By choosing $k_1 = \frac{q}{(2\pi\epsilon_0)}, k_2 = 0$ we obtain the solution

$$\Phi_C = -\frac{q}{4\pi\epsilon_0 r} \tag{22.19}$$

which is exactly the Coulomb potential of a point charge q. Thus Eq. (22.17) is fully compatible to the Poisson equation for a vanishing driving force.

The particular solution of the full equation (22.16) is given by

$$\Phi_p = \frac{\int r^2\rho(r)dr - r^2\int\rho(r)dr}{2\epsilon_0 r} \tag{22.20}$$

(we used the computer algebra system Maxima [12] to obtain this). From this solution it can be seen that the key for the occurrence of resonances are the two integrals. If an oscillating function is inserted for $\rho(r)$, at least one of the integrals has to go to inifity for certain parameters contained in $\rho(r)$. In the following we will investigate this behaviour for several predefined functions $\rho(r)$. Our first choice is

$$\rho(r) := A\cos(\kappa r) \tag{22.21}$$

which is oscillating with an amplitude A and spatial frequency κ. The first integral of (22.21) then results to

$$\int r^2 \cos(\kappa r) dr A = \frac{((\kappa^2 r^2 - 2)\sin(\kappa r) + 2\kappa r\cos(\kappa r))A}{\kappa^3} \tag{22.22}$$

and the second to

$$r^2 \int \cos(\kappa r) dr A = \frac{r^2 \sin(\kappa r) A}{\kappa}. \tag{22.23}$$

Combining the terms of (22.21) leads to the particular solution

$$\Phi_{p1} = -\frac{(\sin(\kappa r) - \kappa r\cos(\kappa r))A}{\epsilon_0 \kappa^3 r} \tag{22.24}$$

This is an oscillating function without resonances (all parameters set to unity), see Fig. 22.2.

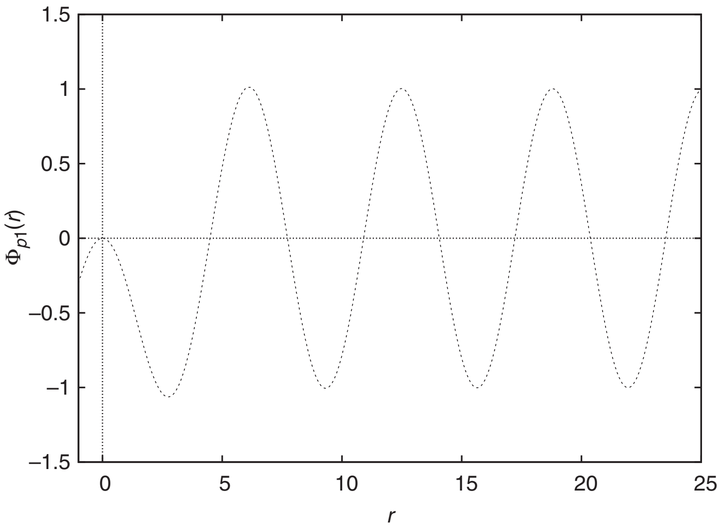

Fig. 22.2. Particular solution $\Phi_{p1}(r)$.

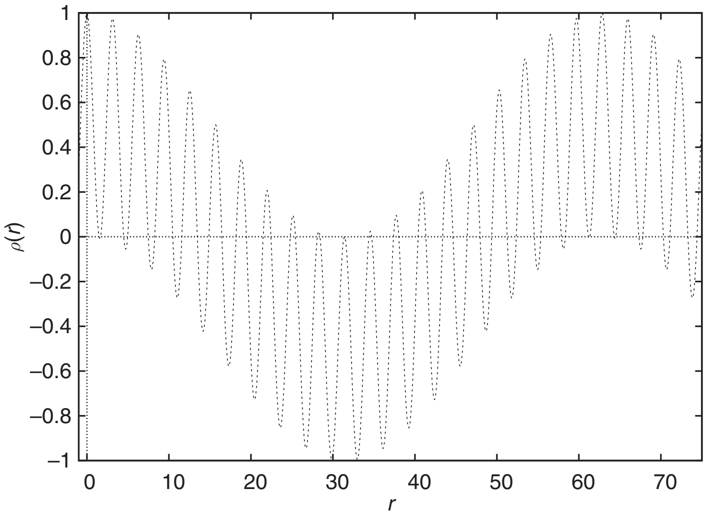

Fig. 22.3. Heterodyne function (interference of two near-by frequencies).

Next we use the driving force

$$\rho(r) := A\cos((\kappa+\delta)r)\cos((\kappa-\delta)r) \tag{22.25}$$

This is a heterodyne beat which is an interference of two near frequencies $\kappa+\delta$ an $\kappa-\delta$. The graph of this function is shown in Fig. 22.3 for $\frac{\delta}{\kappa}=0.05$. Calculating the solution in the same way as in Eqs.(22.21, 22.22) above leads to the result after some simplifications:

$$\Phi_{p2} = -\frac{\sin(2\kappa r)A}{16\epsilon_0\kappa^3 r} + \frac{\cos(2\kappa r)A}{8\epsilon_0\kappa^2} - \frac{\sin(2\delta r)A}{16\delta^3\epsilon_0 r} + \frac{\cos(2\delta r)A}{8\delta^2\epsilon_0} \tag{22.26}$$

This shows the following behaviour as graphed in Fig. 22.4. Obviously the curve follows the heterodyne form of $\rho(r)$, cf. Fig. 22.3. We are interested in the behaviour $\delta \to 0$, i.e. whether there is a resonance behaviour for this case. The third and fourth term of Eq. (22.26) are of the form

$$-\frac{\sin(ax)}{x^3} + \frac{\cos(ax)}{x^2}$$

with a constant a. Both terms diverge for $\delta \to 0$ but cancel each other in part so that the limit remains finite:

$$\Phi_{p2} \to -\frac{(3\sin(2\kappa r) - 6\kappa r\cos(2\kappa r) + 8\kappa^3 r^3)A}{48\epsilon_0\kappa^3 r} \tag{22.27}$$

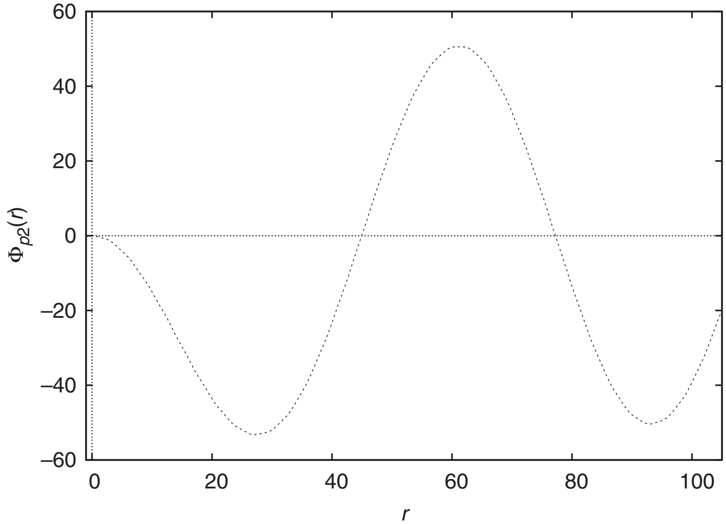

Fig. 22.4. Particular solution $\Phi_{p2}(r)$.

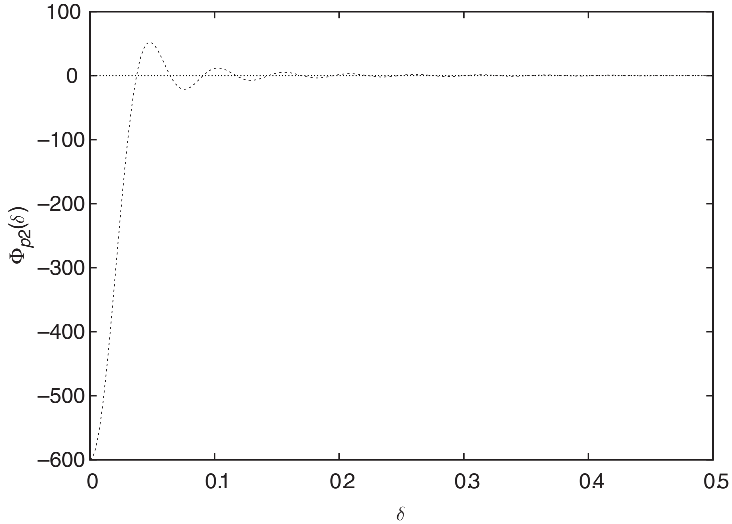

Fig. 22.5. Particular solution $\Phi_{p2}(\delta)$ for a constant radius $r = 60$.

The graph for $\Phi_{p2}(\delta)$ for a constant radius $r = 60$ (Fig. 22.5) shows that Φ_{p2} neverveless grows significantly for $\delta \to 0$:

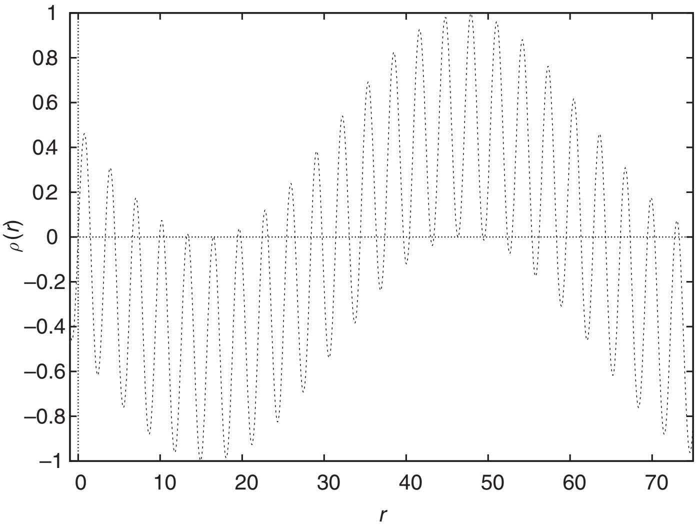

Fig. 22.6. Heterodyne function of Eq. (22.28).

As a third example we modify the driving force by using the sine instead of the cosine function in the second factor:

$$\rho(r) := A\cos((\kappa+\delta)r)\sin((\kappa-\delta)r) \tag{22.28}$$

The r-dependence of this $\rho(r)$ is shown in Fig. 22.6. Compared with Fig. 22.2, this is only a phase shift.

The particular solution of this driving force is

$$\Phi_{p3} = \frac{\sin(2\kappa r)A}{8\epsilon_0\kappa^2} + \frac{\cos(2\kappa r)A}{16\epsilon_0\kappa^3 r} - \frac{\sin(2\delta r)A}{8\delta^2\epsilon_0} - \frac{\cos(2\delta r)A}{16\delta^3\epsilon_0 r} \tag{22.29}$$

which at a first glance looks similar to Φ_{p2} (Eq. 22.26) of the second example. From the graph Φ_{p3} (Fig. 22.7) we can see, however, that the function diverges for $r \to 0$.

In addition we obtain resonances for any r if delta approaches zero. This can be seen from Fig. 22.8, which was calculated for $r = 45$ and has to be compared to Fig. 22.5. The reason for the unbound resonance is that the two diverging terms in Eq. (22.29) have the same sign. Compared to Eq. (22.26), no compensation is present.

We have to state that there is an unsteady transition in the limit $\delta \to 0$. Then Eq. (22.28) transforms to

$$\rho(r) := A\cos(\kappa r)\sin(\kappa r) = \frac{\sin(2\kappa r)A}{2} \tag{22.30}$$

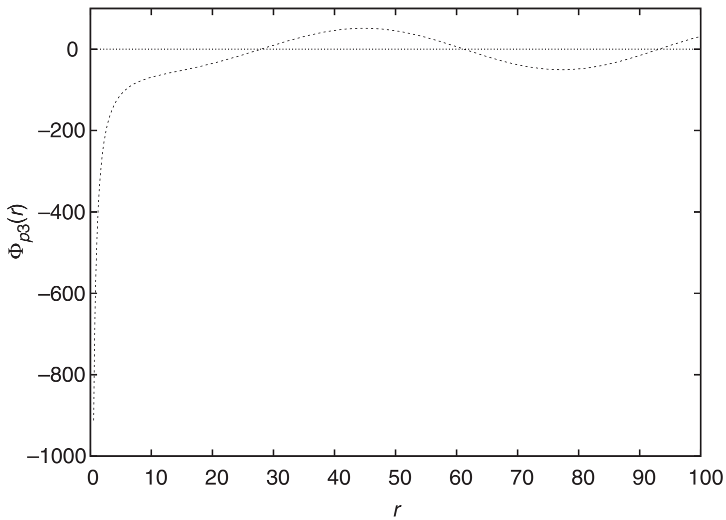

Fig. 22.7. Particular solution $\Phi_{p3}(r)$.

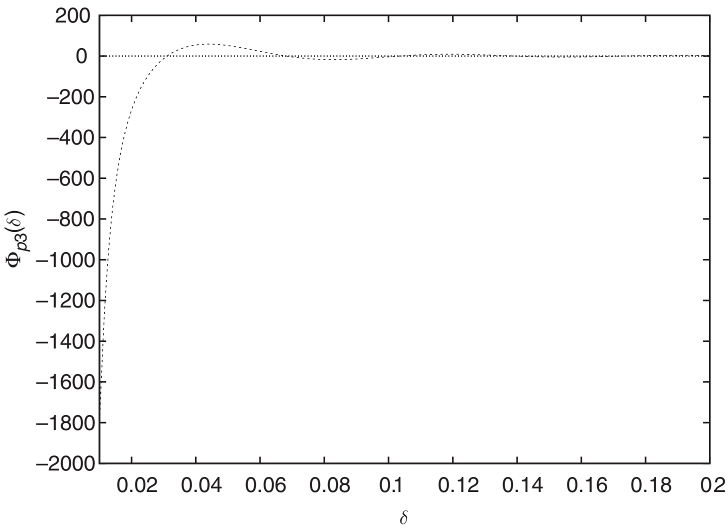

Fig. 22.8. Particular solution $\Phi_{p3}(\delta)$ for a fixed value of $r = 45$.

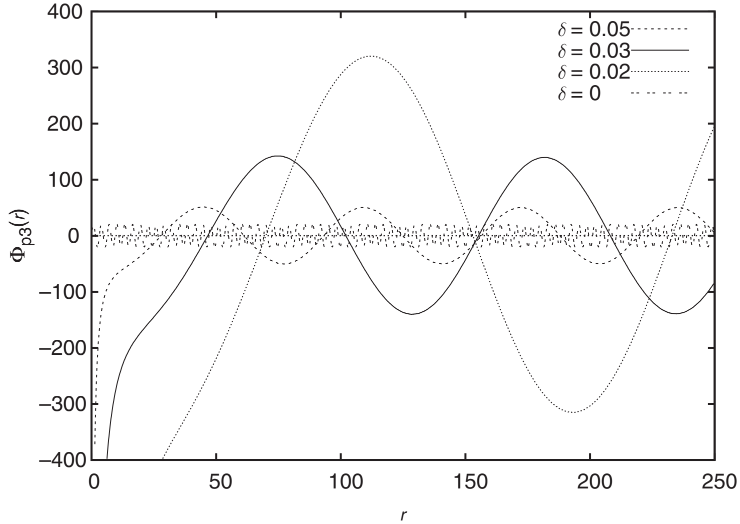

Fig. 22.9. Particular solution $\Phi_{p3}(r)$ for several δ values.

i.e. the driving force is a pure sinoidal function with a high frequency, compared to the ocsillating δ terms of Eq. (22.29). For decreasing δ the amplitude grows by the same factor over the whole range of r, see Fig. 22.9. At the same time the wavelength increases correspondingly. This behaviour collapses for $\delta = 0$.

Interpreting this physically, driving heterodyne beats evoke an electrical SCR potential which exhibits very strong fluctuations from and to the spacetime background. The amplitude of the oscillations does not go to zero for large radii in contrast to the Coulomb potential. This is a completely different behaviour.

There are now two methods to construct circuits from Eq. (22.16). Either one uses Eq. (22.16) directly as shown in this paper or the equation is transformed by the Euler method so that the circuit can be constructed simply as a LC resonance circuit. The Euler transformation changes the driving force so that the transformed force has to be implemented in that case. This was the method described in [1–8]. The current method could have the advantage of being applicable more directly. However, the conversion of Eq. (22.16) to a circuit is not straightforward. As a third independent method for evoking spacetime resonances, so-called vacuum fluctuations experienced in the Lamb shift [1–8] have been identified.

Acknowledgments

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