Chapter 14

Spin connection resonance in counter gravitation

(Paper 68)
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Abstract

The equations for counter gravitation are developed in objective, or generally covariant, physics. The latter is represented by Einstein Cartan Evans (ECE) field theory and based on Cartan geometry (Riemann geometry extended with torsion). It is shown that the effect of counter gravitation can be greatly enhanced at spin connection resonance. The equation for resonance is solved numerically, and numerical results also obtained for counter gravitational resonance in the Newtonian force. The latter is greatly enhanced at resonance in a direction opposite to the force due to gravity, resulting in counter gravitation.

Keywords: Counter gravitation, spin connection resonance, Einstein Cartan Evans (ECE) unified field theory, objective physics, generally covariant unified field theory.

14.1 Introduction

It is well known that both the Newton and Coulomb inverse square laws hold to high precision in the laboratory, so the interaction between the two laws must be insignificant under normal laboratory conditions. If two interacting charged masses are considered, the interaction between them is the sum of the electrostatic interaction between charges (the dominant term by many orders of magnitude in the laboratory) and the gravitational interaction between the two masses. The interaction term is very small, and has never been measured in the laboratory. Nevertheless, a generally covariant unified field theory such as the Einstein Cartan Evans (ECE) theory [1]– [21] allows for the existence of interaction terms because in general the gravitational and electromagnetic fields may interact in ECE theory. Their interaction is controlled by the homogeneous current of ECE theory, which is defined in Section 14.2. In order to develop counter gravitational technology, the very small interaction term must be amplified by resonance. The equation controlling resonance is developed in Section 14.2, and solved numerically in Section 14.3 for the scalar potential of the electrostatic field and for the Newtonian force. At resonance, termed "spin connection resonance" (SCR) the electric field induced Newtonian force may be amplified by the necessary many orders of magnitude in a direction opposite to the force due to gravity. This must be the basis of practical counter gravitation. Without resonance, the electric field induced Newtonian force is far too small to be measured and far too small to be of any practical utility. This much is obvious from the precision of the Coulomb and Newton inverse square laws under laboratory conditions, but artifactual claims about counter gravitation continue to proliferate. In this paper we make a fresh start by developing resonant counter gravitational technology based on circuit designs governed by resonance equations. The gravitational field between two charged masses in the laboratory is very well known to be many orders of magnitude smaller than the electric field, so claims about large cross effects are obvious experimental artifacts.

14.2 Homogeneous current and resonance equation

The interaction of electromagnetism and gravitation in ECE theory [1]– [21] is described by the homogeneous current:

$$j^a = \frac{A^{(0)}}{\mu_0}(R^a{}_b \wedge q^b - \omega^a{}_b \wedge T^b) \tag{14.1}$$

and the geometrical condition for interaction of the two fields is therefore:

$$R^a{}_b \wedge q^b \neq \omega^a{}_b \wedge T^b \tag{14.2}$$

Here $R^a{}_b$ is the curvature form, q^b is the tetrad form, $\omega^a{}_b$ is the spin connection form and T^b is the torsion form. If condition (14.2) is fulfilled the electromagnetic field can affect the gravitational field on the classical level, and vice versa. An example is polarization effects due to light deflected by gravity [1]– [21]. The homogeneous current is governed by the homogeneous field equation of ECE theory:

$$d \wedge F^a = \mu_0 j^a \tag{14.3}$$

where

$$F^a = d \wedge A^a + \omega^a{}_b \wedge A^b \tag{14.4}$$

Here A^a is the electromagnetic potential form, defined by:

$$A^a = A^{(0)} q^a \tag{14.5}$$

and F^a is the electromagnetic field form, defined by:

$$F^a = A^{(0)} T^a \tag{14.6}$$

The factor $cA^{(0)}$ has the units of volts, where c is the speed of light, and $cA^{(0)}$ is the primordial voltage present in the universe. In Eq.(14.3) μ_0 is the vacuum permeability in S.I. units. The Hodge dual [1]– [21] of Eq.(14.3) is:

$$d \wedge \widetilde{F}^a = \mu_0 J^a = \mu_0 \widetilde{j}^a \tag{14.7}$$

and the objective or generally covariant Coulomb Law is part of Eq.(14.7), in which the Hodge dual current, the inhomogeneous current, is:

$$\widetilde{j}^a = \frac{A^{(0)}}{\mu_0} (\widetilde{R}^a{}_b \wedge q^b - \omega^a{}_b \wedge \widetilde{T}^b) \tag{14.8}$$

For a given initial driving voltage $cA^{(0)}$, the inhomogeneous current, and the quantity $\widetilde{R}^a{}_b \wedge q^b - \omega^a{}_b \wedge \widetilde{T}^b$ are greatly amplified at SCR. This means that the effect of the electromagnetic field on the gravitational field is greatly amplified, and for the Coulomb law, the effect of the electric field on the Newtonian force is greatly amplified. Such an effect does not exist in the standard model, because in the latter, the classical electromagnetic field is Lorentz covariant only, and not generally covariant as needed for objectivity in physics.

From Eqs.(14.3) and (14.4) the structure of the resonance equation is:

$$d \wedge (d \wedge A^a + \omega^a{}_b \wedge A^b) = \mu_0 j^a \tag{14.9}$$

and its Hodge dual gives another resonance equation. It has been shown [1]– [21] that the Newtonian force between two masses m_1 and m_2 is:

$$f^a = -m_1 m_2 G (R^a{}_b \wedge q^b - \omega^a{}_b \wedge T^b) \tag{14.10}$$

where G is the Newton constant. The Newtonian force is therefore:

$$f^a = -m_1 m_2 \frac{\mu_0 G}{A^{(0)}} j^a \tag{14.11}$$

When the electromagnetic and gravitational fields are independent:

$$R^a{}_b \wedge q^b = \omega^a{}_b \wedge T^b \tag{14.12}$$

the only contribution to $\widetilde{j}^a$ [1]– [21] is from the source mass, so:

$$\widetilde{j}^a = \frac{A^{(0)}}{\mu_0} (\widetilde{R}^a{}_b \wedge q^b)_{source} \tag{14.13}$$

Under this condition it has been shown [1]– [21] that the Coulomb law is:

$$\begin{gathered} \boldsymbol{\nabla} \cdot \boldsymbol{E}^a = -\phi^{(0)} R^a{}_i{}^{i0} \\ i = 1, 2, 3 \end{gathered} \tag{14.14}$$

where:

$$\phi^{(0)} = cA^{(0)} \tag{14.15}$$

The curvature elements appearing in Eq.(14.14) are those due to the source mass, the mass carrying the source charge. It has also been shown [1]– [21] that the electric field in ECE theory is in general a vector boson defined by:

$$a = 1, 2, 3 \tag{14.16}$$

so there are three equations of type (14.14):

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^1 = -\phi^{(0)} R^1{}_i{}^{i0} \tag{14.17}$$

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^2 = -\phi^{(0)} R^2{}_i{}^{i0} \tag{14.18}$$

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^3 = -\phi^{(0)} R^3{}_i{}^{i0} \tag{14.19}$$

Here, summation over repeated indices is implied, so:

$$R^1{}_i{}^{i0} = R^1{}_1{}^{10} + R^1{}_2{}^{20} + R^1{}_3{}^{30} \tag{14.20}$$

and so on. In Eqs.(14.17) to (14.20) the Riemann form elements are generated purely by the source mass, so:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^a = \mu_0 \widetilde{j}^a = -\phi^{(0)} R^a{}_i{}^{i0} \tag{14.21}$$

If the electric field induces a Newtonian force, the Coulomb law is changed to:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^a = \mu_0 \widetilde{j}^a = -\phi^{(0)} (R^a{}_i{}^{i0} + \omega^a{}_{ia} T^{bi0}) \tag{14.22}$$

The effect of the electric field on the elements $R^a{}_i{}^{i0}$ is given by $\omega^a{}_{ib} T^{bi0}$. Therefore the complete Coulomb Law becomes:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^a = \mu_0 (\widetilde{j}^a_{source} + \widetilde{j}^a_{int}) \tag{14.23}$$

where the interaction current is defined by:

$$\widetilde{j}^a_{int} = -\frac{\phi^{(0)}}{\mu_0} (R^a{}_i{}^{i0} + \omega^a{}_{ib} T^{bi0})_{int} \tag{14.24}$$

The interaction current in the absence of SCR is very tiny, and has never been measured experimentally. Claims to the contrary are clearly artifactual, because otherwise the Coulomb Law would not hold to very high precision in the laboratory, contrary to well known [22] and accurately reproducible and repeatable experimental data on the Coulomb Law.

The interaction Coulomb Law can therefore be written as:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^a = -\boldsymbol{\omega}^a{}_{bint} \cdot \boldsymbol{E}^b \tag{14.25}$$

where:

$$\boldsymbol{\omega}^a{}_{bint} \cdot \boldsymbol{E}^b \sim 0 \tag{14.26}$$

Here $\omega^a{}_{bint}$ is the interaction spin connection. This is non-zero if and only if the electric field induces changes in the Newtonian force. Such changes do not exist in the standard model. For simplicity of argument only it is assumed that the indices a and b are the same, so Eq.(14.25) is simplified to:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E} = -\boldsymbol{\omega}_{int} \cdot \boldsymbol{E} \tag{14.27}$$

The electric field can be defined [1]– [21] as:

$$\boldsymbol{E} = -(\boldsymbol{\nabla} + \boldsymbol{\omega})\phi \tag{14.28}$$

where $\boldsymbol{\omega}$ is the spin connection in the absence of interaction between the electric field and Newtonian gravitation. A positive sign has been adopted for illustration only in Eq.(14.28) for $\boldsymbol{\omega}$, but in general [1]– [21]:

$$\omega_r = 0 \quad , \quad \pm\frac{1}{r} \tag{14.29}$$

in spherical polar coordinates. In the absence of interaction between the electric field and the Newtonian force [1]– [21]:

$$\frac{d^2\phi}{dr^2} + \frac{1}{r}\frac{d\phi}{dr} - \frac{1}{r^2}\phi = -\frac{\rho}{\epsilon_0} \tag{14.30}$$

but in the presence of interaction:

$$\frac{d^2\phi}{dr^2} + \frac{1}{r}\frac{d\phi}{dr} - \frac{1}{r^2}\phi - \omega_{int} \cdot (\boldsymbol{\nabla} + \boldsymbol{\omega})\phi = -\frac{\rho}{\epsilon_0} \tag{14.31}$$

i.e. there is an extra term due to the interaction spin connection $\boldsymbol{\omega}_{int}$. Eq.(14.31) is the resonance equation:

$$\frac{d^2\phi}{dr^2} + \left(\frac{1}{r} - \omega_{int}\right)\frac{d\phi}{dr} - \left(\frac{1}{r^2} + \frac{\omega_{int}}{r}\right)\phi = -\frac{\rho}{\epsilon_0} \tag{14.32}$$

and is solved numerically in Section 14.3 for various models of the interaction spin connection. Here ρ is the charge density and ϵ_0 is the vacuum permeability.

Resonant counter gravitation works by amplifying ϕ at resonance from Eq.(14.32). It is seen from Eq.(14.25) that the interaction term is amplified, meaning that the effect of the electric field on the Newtonian force is maximized in a direction opposite to the gravitational field of the Earth.

The basic structure of the interaction Coulomb Law is:

$$\boldsymbol{\nabla} \cdot \boldsymbol{E}^a = \frac{\rho^a}{\epsilon_0} - \boldsymbol{\omega}^a{}_{bint} \cdot \boldsymbol{E}^b \tag{14.33}$$

If it is assumed for the sake of simplicity of development that only the diagonal elements of the interaction spin connection exist:

$$(\boldsymbol{\nabla} + \boldsymbol{\omega}^1{}_1 int) \cdot \boldsymbol{E}^1 = \frac{\rho^1}{\epsilon_0} \qquad \text{etc.} \tag{14.34}$$

where the vector electric boson [1]– [21] is defined by:

$$\left.\begin{aligned} \boldsymbol{E}^1 &= -\boldsymbol{\nabla}\phi + \boldsymbol{\omega}\phi \\ \boldsymbol{E}^2 &= -\boldsymbol{\nabla}\phi \\ \boldsymbol{E}^3 &= -\boldsymbol{\nabla}\phi - \boldsymbol{\omega}\phi \end{aligned}\right\} \tag{14.35}$$

Therefore there are three resonance equations in general:

$$(\boldsymbol{\nabla} + \boldsymbol{\omega}^1{}_{1int}) \cdot (-\boldsymbol{\nabla}\phi + \boldsymbol{\omega}\phi) = \frac{\rho^1}{\epsilon_0} \tag{14.36}$$

$$(\boldsymbol{\nabla} + \boldsymbol{\omega}^2{}_{2int}) \cdot (-\boldsymbol{\nabla}\phi) = \frac{\rho^2}{\epsilon_0} \tag{14.37}$$

$$(\boldsymbol{\nabla} + \boldsymbol{\omega}^3{}_{3int}) \cdot (-\boldsymbol{\nabla}\phi - \boldsymbol{\omega}\phi) = \frac{\rho^3}{\epsilon_0} \tag{14.38}$$

The labels on the charge densities indicate that there are three different charge densities present in general. If it is assumed that:

$$\rho = \rho^1 = \rho^2 = \rho^3 \tag{14.39}$$

and that:

$$\boldsymbol{\omega}_{int} = \boldsymbol{\omega}^1{}_{1int} = \boldsymbol{\omega}^2{}_{2int} = \boldsymbol{\omega}^3{}_{3int} \tag{14.40}$$

the three resonance equations simplify to:

$$\nabla^2\phi + \boldsymbol{\omega}_{int} \cdot \boldsymbol{\nabla}\phi + \boldsymbol{\nabla} \cdot (\boldsymbol{\omega}\phi) - \boldsymbol{\omega}_{int} \cdot \boldsymbol{\omega}\phi = -\frac{\rho}{\epsilon_0} \tag{14.41}$$

$$\nabla^2\phi + \boldsymbol{\omega}_{int} \cdot \boldsymbol{\nabla}\phi = -\frac{\rho}{\epsilon_0} \tag{14.42}$$

$$\nabla^2\phi + \boldsymbol{\omega}_{int} \cdot \boldsymbol{\nabla}\phi + \boldsymbol{\nabla} \cdot (\boldsymbol{\omega}\phi) + \boldsymbol{\omega}_{int} \cdot \boldsymbol{\omega}\phi = -\frac{\rho}{\epsilon_0} \tag{14.43}$$

The resonance patterns from these three equations are obtained numerically and discussed in Section 14.3. The ability of the electric field to affect the Newtonian force is represented by the interaction spin connection $\boldsymbol{\omega}_{int}$. Off resonance this effect is very tiny, as argued, but at resonance its effect may be amplified enough to make counter gravitation feasible.

The effect of the electric field on the Newtonian force is conveniently demonstrated through the Hodge dual of Eq.(14.10):

$$\widetilde{f}^a = -m_1 m_2 G(\widetilde{R}^a{}_b \wedge q^b - \omega^a{}_b \wedge \widetilde{T}^{bi0}) \tag{14.44}$$

In the absence of any effect of the electric field on the Newtonian force:

$$\widetilde{f}^a = -m_1 m_2 G(R^0{}_1{}^{10} + R^0{}_2{}^{20} + R^0{}_3{}^{30}) \tag{14.45}$$

which is the ordinary Newtonian force between m_1 and m_2, the well known inverse square distance dependence being given by:

$$\frac{1}{r^2} = R^0{}_1{}^{10} + R^0{}_2{}^{20} + R^0{}_3{}^{30} \tag{14.46}$$

In the presence of interaction, the Newtonian force due to the electric field is:

$$\widetilde{f}^a = -m_1 m_2 G\omega^a{}_{ib} T^{bi0} \tag{14.47}$$

and simplifies to:

$$\widetilde{f} = -m_1 m_2 G\omega_{int} \cdot \boldsymbol{T} \tag{14.48}$$

where $\boldsymbol{T}$ is a torsion vector defined by:

$$\boldsymbol{E} = \phi \boldsymbol{T} = \nabla\phi \quad , \quad (\boldsymbol{\nabla} \pm \boldsymbol{\omega})\phi \tag{14.49}$$

Thus:

$$\left.\begin{aligned}(\boldsymbol{\nabla} + \omega)\phi = \boldsymbol{T}\phi,\\ \boldsymbol{\nabla}\phi = \boldsymbol{T}\phi\end{aligned}\right\} \tag{14.50}$$

and:

$$\left.\begin{aligned}\widetilde{f} =& - m_1 m_2 G \omega_{int} \cdot \frac{1}{\phi}(\boldsymbol{\nabla} + \omega)\phi\,,\\ &- m_1 m_2 G \omega_{int} \cdot \frac{1}{\phi}\boldsymbol{\nabla}\phi\end{aligned}\right\} \tag{14.51}$$

where:

$$\frac{d^2\phi}{dr^2} + \left(\frac{1}{r} - \omega_{int}\right)\frac{d\phi}{dr} - \left(\frac{1}{r^2} - \frac{\omega_{int}}{r}\right)\phi = -\frac{\rho}{\epsilon_0} \tag{14.52}$$

Therefore to maximize the effect of the electric field on the Newtonian force at SCR, the following term must be maximized:

$$\widetilde{f} = -m_1 m_2 G \omega_{int} \frac{\phi'}{\phi} \tag{14.53}$$

where

$$\phi' = \frac{d\phi}{dr} \tag{14.54}$$

and where:

$$\frac{d\phi'}{dr} + \left(\frac{1}{r} - \omega_{int}\right)\phi' - \left(\frac{1}{r^2} - \frac{\omega_{int}}{r}\right)\phi = -\frac{\rho}{\epsilon_0} \tag{14.55}$$

This is illustrated numerically and discussed in detail in Section 14.3.

14.3 Numerical results

The resonance equation

$$\frac{d^2\phi}{dr^2} + \left(\frac{1}{r} - \omega_{r,int}\right)\frac{d\phi}{dr} - \left(\frac{1}{r^2} + \frac{\omega_{r,int}}{r}\right)\phi = -\frac{\rho}{\epsilon_0} \tag{14.56}$$

has been solved numerically. This is the radial equation of the resonant Coulomb law of Chapter 9, Eq.(9.34) therein, enhanced by an additional spin connection term which describes the interaction of gravitation and electromagnetism (see Eq. (14.52) of Section 14.2). In order to study the solutions of this equation, we first consider the interaction-free case, $\omega_{r,int} = 0$, with no driving charge density ρ. Eq.(14.56) contains a singularity for $r = 0$. Therefore we integrate numerically from right to left. There are three types of solutions, depending on the initial or boundary conditions at the right-hand side. Starting at $r = 10$, we have chosen the three combinations

$$\phi(r = 10) = 0.11, \quad \frac{d\phi(r = 10)}{dr} = 0.01 \tag{14.57}$$

$$\phi(r = 10) = 0.10, \quad \frac{d\phi(r = 10)}{dr} = 0.01 \tag{14.58}$$

$$\phi(r=10) = 0.09, \quad \frac{d\phi(r=10)}{dr} = 0.01 \tag{14.59}$$

In Fig. 14.1 the three solutions are graphed. In the second case the initial conditions define a straight line which hits the coordinate origin. If the direction of this line does not point to the center, the solution $\phi(r)$ turns to plus or minus inifinity for $r \rightarrow 0$. In the following we choose the initial conditions in such a way that the ordinary Coulomb solution for a charge at $r = 0$ is obtained. Then the solution (setting $4\pi\epsilon_0$ to unity) is

$$\phi(r) = -\frac{1}{r} \tag{14.60}$$

$$\frac{d\phi}{dr} = \frac{1}{r^2} \tag{14.61}$$

For $r = 10$ we obtain $\phi(10) = -0.1$ and $d\phi/dr = 0.01$. Now we switch on the interacting spin connection. Its physical form is unknown, we only know that it is a function of r and possibly a fuctional of ϕ. In the limit $r \rightarrow \infty$ it should vanish. In the following we assume it to have the same form as for the resonant Coulomb law: $\omega_{r,int} = \pm 1/r$. Then we get the following result for the three possible values in vector boson notation (see Chapter 12):

$$\omega_{r,int[-1]} = -\frac{1}{r} \tag{14.62}$$

$$\omega_{r,int[0]} = 0 \tag{14.63}$$

$$\omega_{r,int[+1]} = \frac{1}{r} \tag{14.64}$$

Inserting this form into Eq.(14.56) with no stimulation of resonance ($\rho = 0$) leads in all cases (14.62–14.64) to nearly the same solutions. Differences are not visible in the graph (Fig. 14.2). This is in accordance with our finding in Chapter 7, Table 1, where the Coulomb spin connection did not lead to any remarkable deviations from the ordinary Coulomb law.

The situation changes as soon as we apply a driving term ρ which is dependent on a predefined wave number κ. In the simple case

$$\rho = A cos(\kappa r) \tag{14.65}$$

(depicted in Fig. 14.6) we get a clear dependence of ϕ from the wave number. Even the characteristic of the solution changes as can be seen from Fig. 14.3. In this diagram ϕ was plotted for four κ values $(0.25, 0.5, 1., 2.)$ and an interacting spin connection (Eq.(14.62)). Another interesting question is how the three spin connections (14.62–14.64) lead to different solutions ϕ if the wave number is the same. This result is presented in Figs. 14.4 and 14.5. Obviously the characteristic remains the same, but the $\omega_{r,int[-1]}$ leads to larger values of $|\phi|$ while $\omega_{r,int[+1]}$ effects a reduction.

Another interesting question is how the driving force in combination with the interacting spin connection creates resonances of ϕ. In contrast to the results described in Chapter 7 and Chapter 9, an oscillatory ρ does not lead to oscillatory resonances in ϕ. The main effect is the enhancement of the rate of increase or decrease for $r \rightarrow 0$. This behaviour is concentrated on the center

Type	Equation
1	$f_1(r) = A\cos(\kappa r)$
2	$f_2(r) = A\cos(\kappa r)e^{-0.25r}$
3	$f_3(r) = A(\sin(\kappa r) + \sin(\kappa 2r))^2$
4	$f_4(r) = A\cos(\kappa r)\cos(\cos(\kappa r))\cosh(\sin(\kappa r))+$ $\sin(2\kappa r)\sin(\cos(\kappa r))\sinh(\sin(\kappa r))$
5	$f_5(r) = \begin{cases} 0.5A & \text{if} \quad f_4(r) > -0.2A \\ -1.5A & \text{elsewhere} \end{cases}$

Table 14.1: Models for the driving force

of the charge, which is plausible since gravity comes from the central mass and interaction with electromagnetism is highest where both have their strongest values.

Before looking at the results in detail we list the models for the driving force used (Table 14.1). The first type is a pure cosine term which is folded by an exponentially decreasing function in the second case. Type 3 is a combination of two frequencies while type 4 is the driving force obtained for the equivalent circuit in Chapter 9(essentially a combination of three frequencies). Finally we have changed this model to a rectangular signal in type 5. The signal forms are shown in Figs. 14.6–14.10.

The resonance curves show some maximal amplitude of ϕ in dependence of κ. Since we do not have an oscillatory maximum difference as in Chapters 7 and 9, we have chosen the value of ϕ at a grid point near to the center ($r = 1/30$) as an indication of resonance. This value is plotted against κ in Figs. 14.11-14.15. The five diagrams correspond to the driving forces of Fig. 14.6–14.10. Resonance is not sharply structured but more oscillatory in nature. Figs. 14.11 and 14.12 show a harmonic form with maximum at $\kappa = 0$. This means that a constant ρ produces the highest resonance. Other wave forms (Figs. 14.13, 14.14) lead to anharmonic resonance curves. It is remarkable that the driving force of the Coulomb resonant circuit (Chapter 9) produces also a very high effect (compare the ordinate values of the diagrams). This may be a hint that both the Coulomb and gravito-electromagnetic interactional resonance are connected.

The last example (Fig. 14.15) of this group shows the result of a rectangular signal (Fig. 14.10). The signal amplitudes have been adjusted to Fig. 14.9. The rectangular form obviously enhances the first minimum at $\kappa = 0.2$. According to the examples considered here, this is a very effective form of the driving force to evoke resonance effects. For an exact comparison the driving forces would have to be normalized precisely, which was not the case in this calculation.

We have changed the spin connection form of Eq.(14.62–14.64) from $1/r$ to $1/r^3$ type. This gives extremely high values in the resonance diagram Fig. 14.16. For $r \to 0$ the numerical solution becomes unstable so we have left out some grid points near to 0. The effects of the vector bosons [0] and [1] are nearly identical on this scale, the boson [−1] produces a giant resonance. This last example shows that the form of the spin connection is most important for the size of the resonance effect, while the form of the driving force determines its shape. According to Eq.(14.53) the Hodge dual of the Newtonian gravitational force is proportional to

$$\widetilde{f} \sim -\omega_{r,int}\frac{\phi'}{\phi} \tag{14.66}$$

For comparison with measurements we would have to take the Hodge dual once more to obtain the force itself, but this would require knowledge of the metric. Therefore we restrict to the form (14.66) to give a qualitative impression of the effects. The expression ϕ'/ϕ is shown in Fig. 14.17 for type 5, $\kappa = 0.25$. Due to zeros in ϕ there are poles in ϕ'/ϕ at certain radii. These poles cannot occur in an off-resonant Coulomb potential since this remains always positive or negative, depending of the sign of the central charge. So the poles are an effect of resonance. Their position can mainly be influenced by the form of the driving force and the boundary conditions of the potential. For $r \to 0$ we have $\phi \to \pm\infty$ as was shown earlier. For both asymptotes the sign of ϕ' is different from that of ϕ so that the ratio of both is always negative as is the case in Fig. 14.17.

The last graph (Fig. 14.18) shows the full force term (14.66) where the ratio ϕ'/ϕ has been multiplied by the interacting spin connection. Since $\omega_{r,int[0]}$ is zero, the force for this vector boson type always disappears. The other two differ in sign and result to an attractive and a repulsive force near to the center when gravitation is impacted by an electrical potential. The zeros of ϕ at certain radii lead to sharp peaks. For practical applicability of counter gravitation this means that one would get a gravitational instability at these radii. It would be advisable to avoid these effects by design and utilize the smooth range near to the center. How the different modes of the vector boson can be evoked is not clear yet. The numerical results show that the driving term and the boundary conditions of the potential are most important for designing counter-gravitation devices. It should be possible to design an equivalent circuit for Eq.(14.56). The form of the interacting spin connection is not known but seems not to change the results qualitatively.

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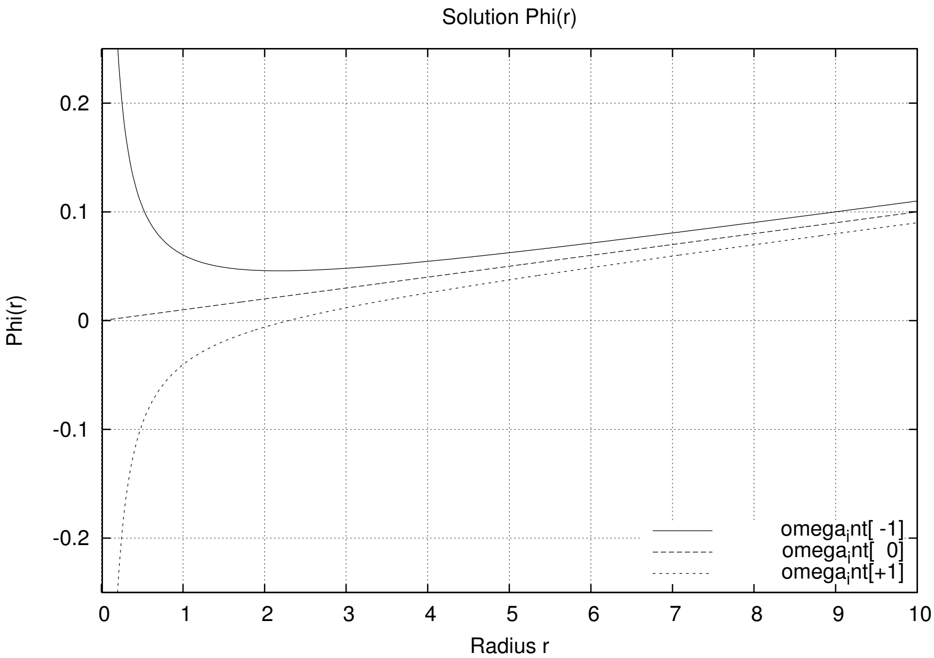

Figure 14.1: Solution types for Eq.(14.56 for $\omega_{r,int} = 0$, no driving force, dependent on initial conditions at the right ($d\phi/dr(10) = 0.01$)

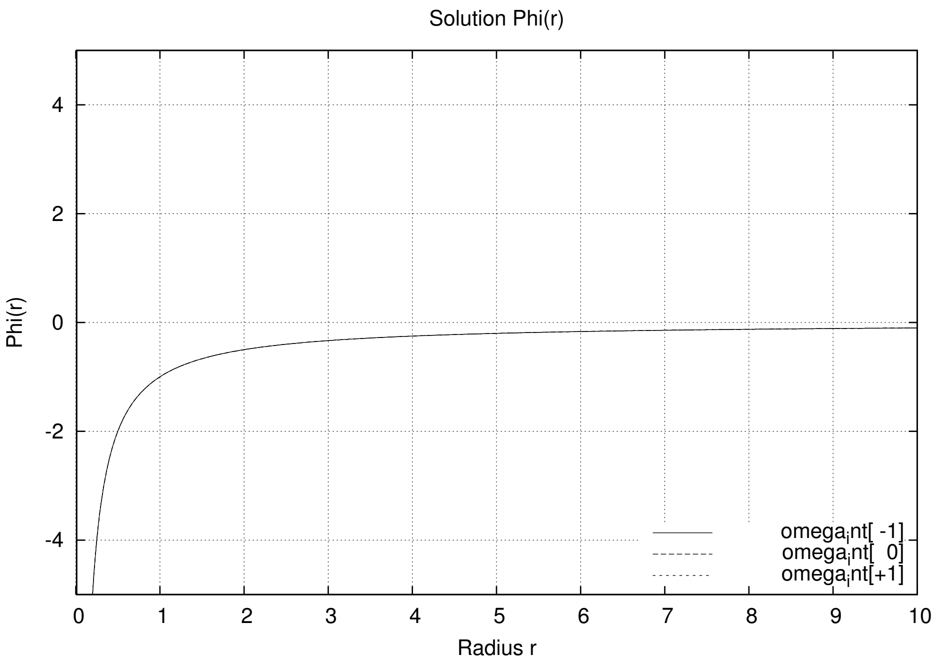

Figure 14.2: Solution for $\omega_{r,int} = \omega_{r,Coul}$, no driving force

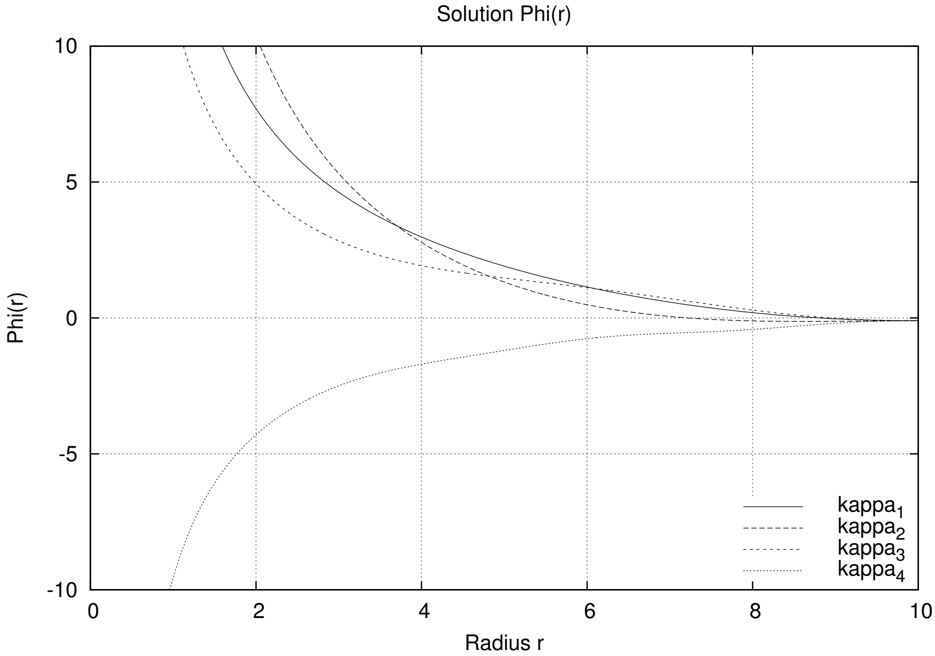

Figure 14.3: κ-dependence for ϕ for type=1,$\omega_{r,int[-1]}, \kappa = 0.25, 0.5, 1.0, 2.0$

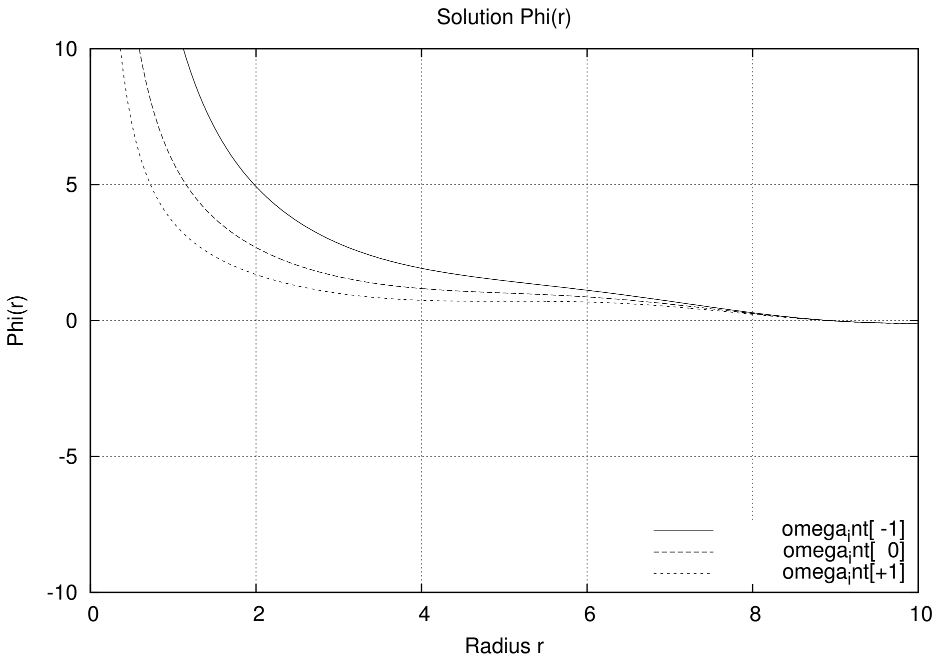

Figure 14.4: κ-dependence for ϕ for type=1,$\omega_{r,int[-1]}, \kappa = 0.25, 0.5, 1.0, 2.0$

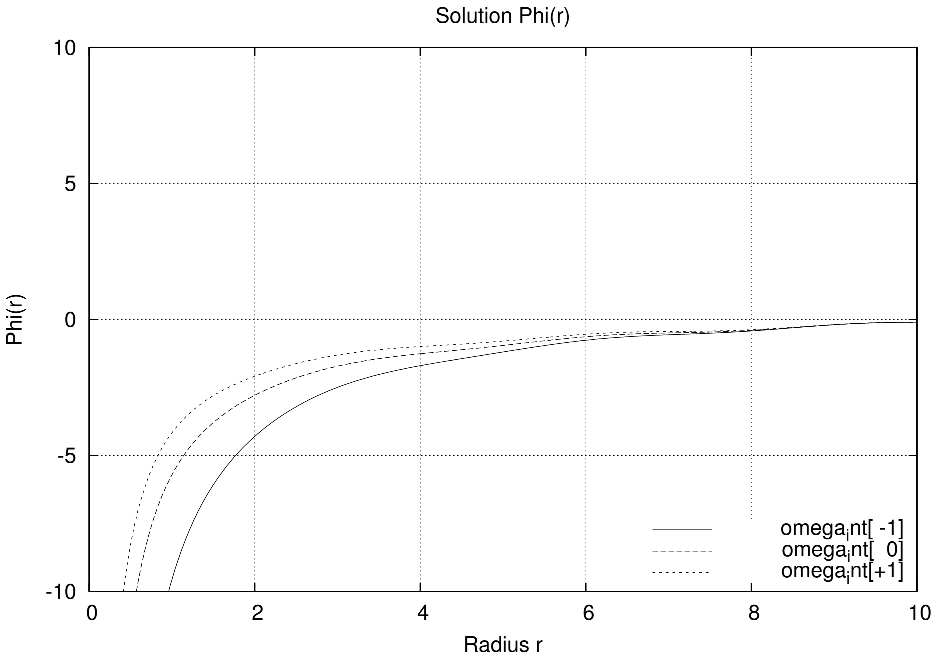

Figure 14.5: $\omega_{r,int}$-dependence of ϕ for type=1, $\kappa = 2$.

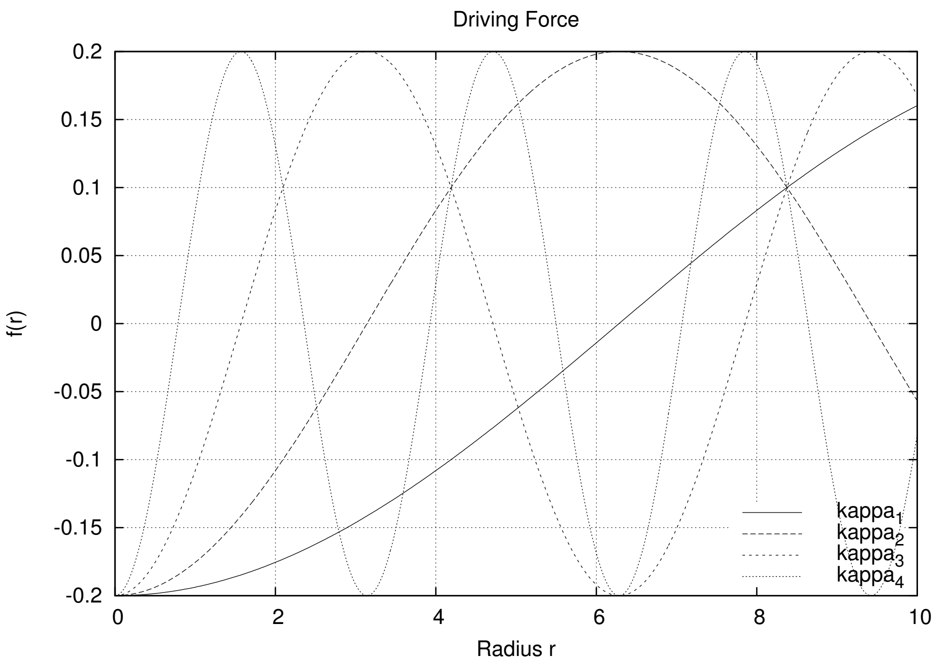

Figure 14.6: Driving force, type 1, for four κ values: $\kappa = 0.25, 0.5, 1.0, 2.0$

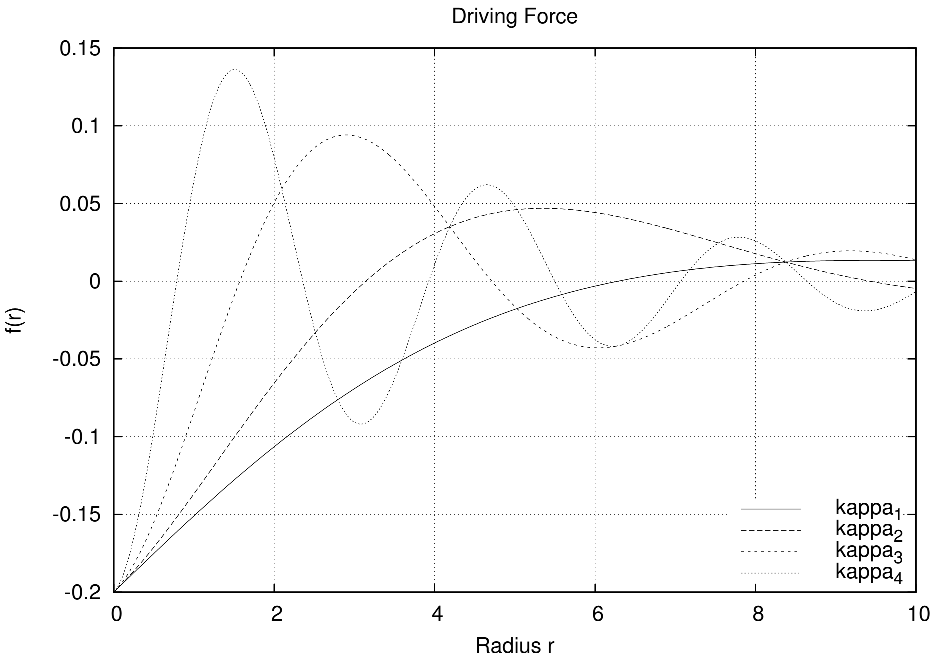

Figure 14.7: Driving force, type 2, for four κ values: $\kappa = 0.25, 0.5, 1.0, 2.0$

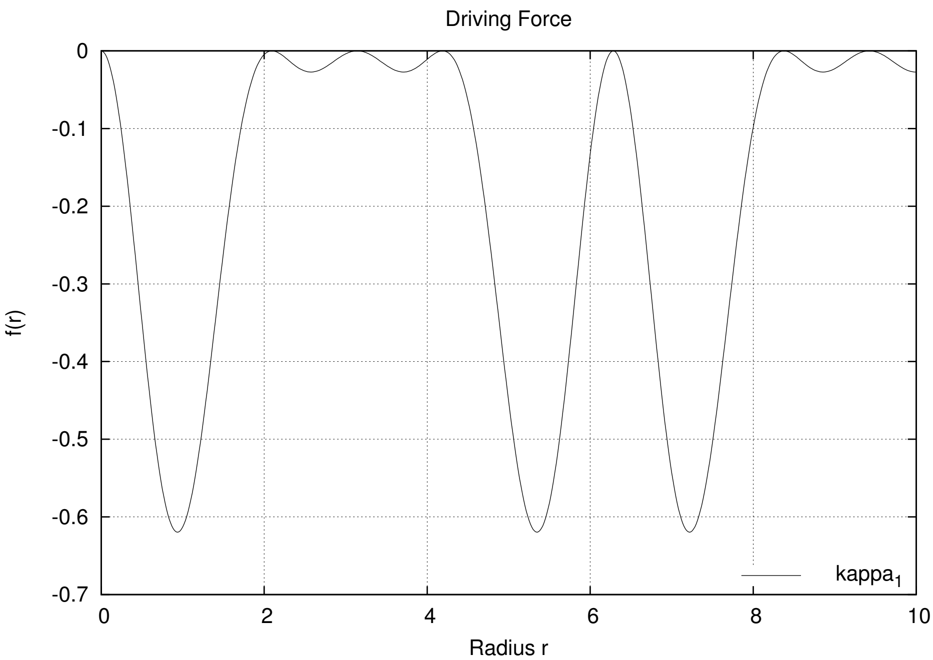

Figure 14.8: Driving force, type 3, $\kappa = 1.0$

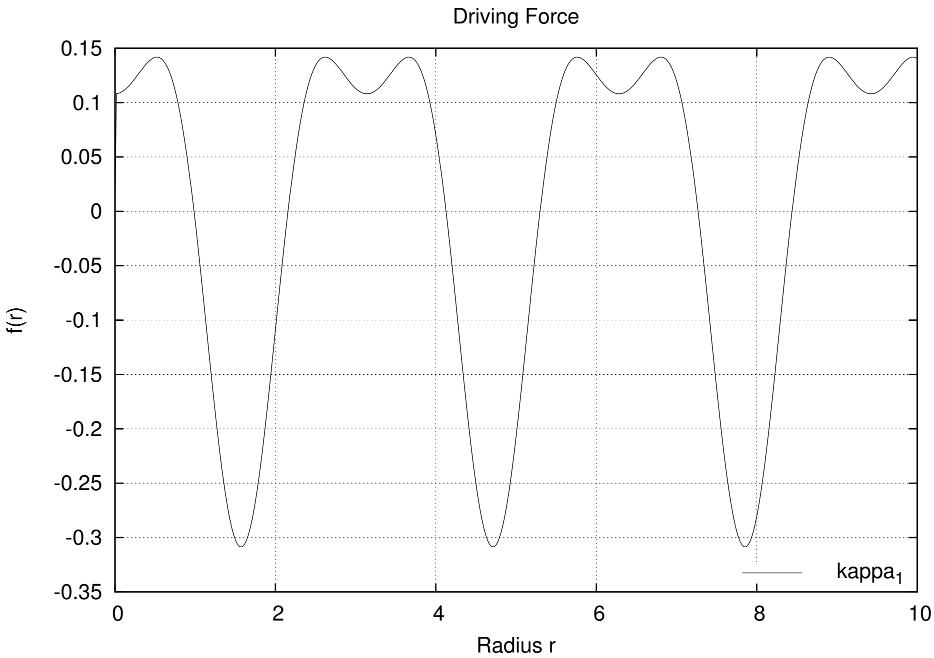

Figure 14.9: Driving force, type 4, $\kappa = 1.0$

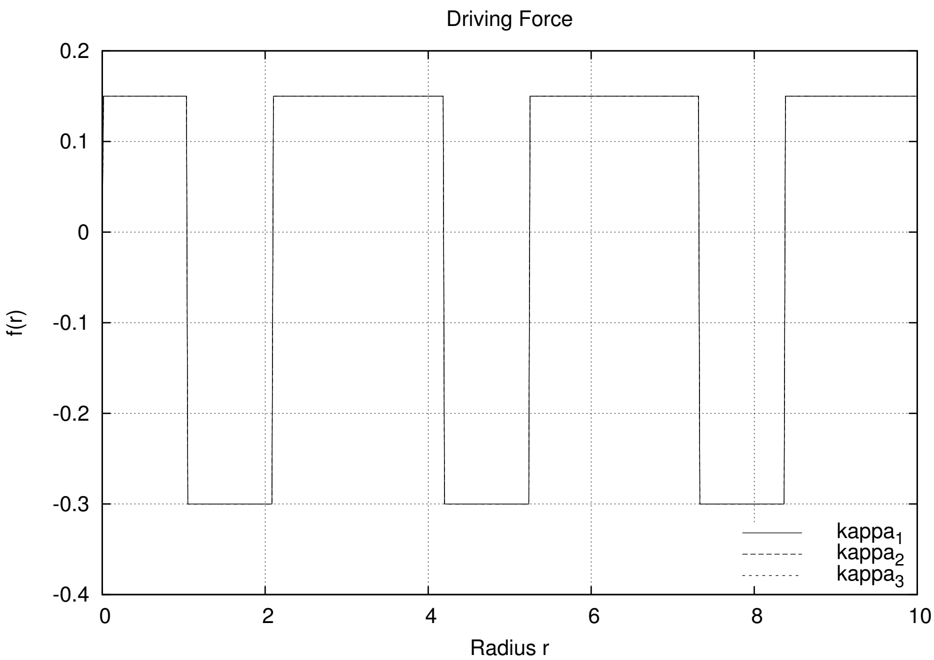

Figure 14.10: Driving force, type 5, $\kappa = 1.0$

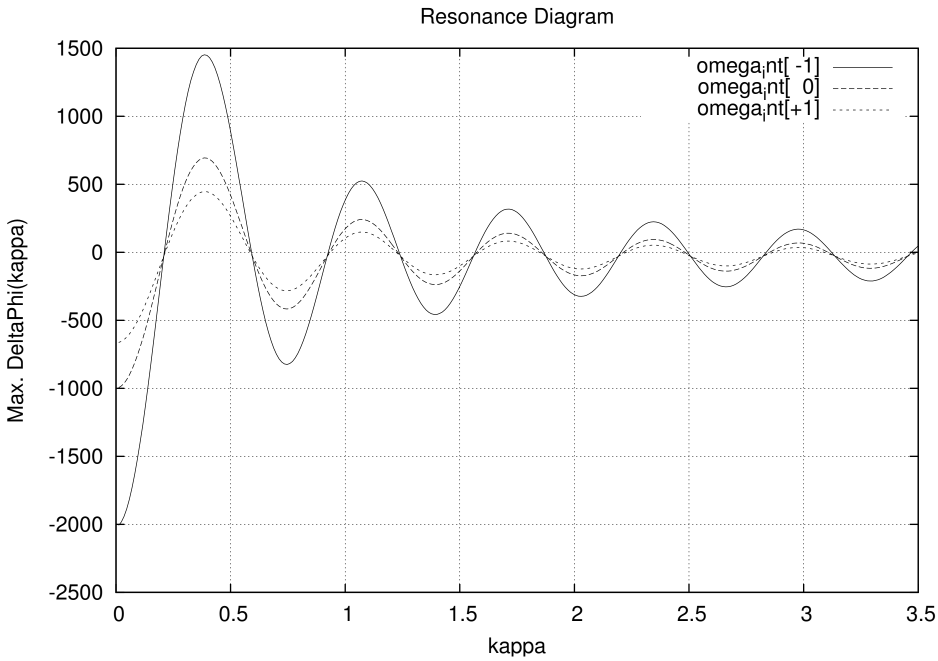

Figure 14.11: Resonance diagram, type 1

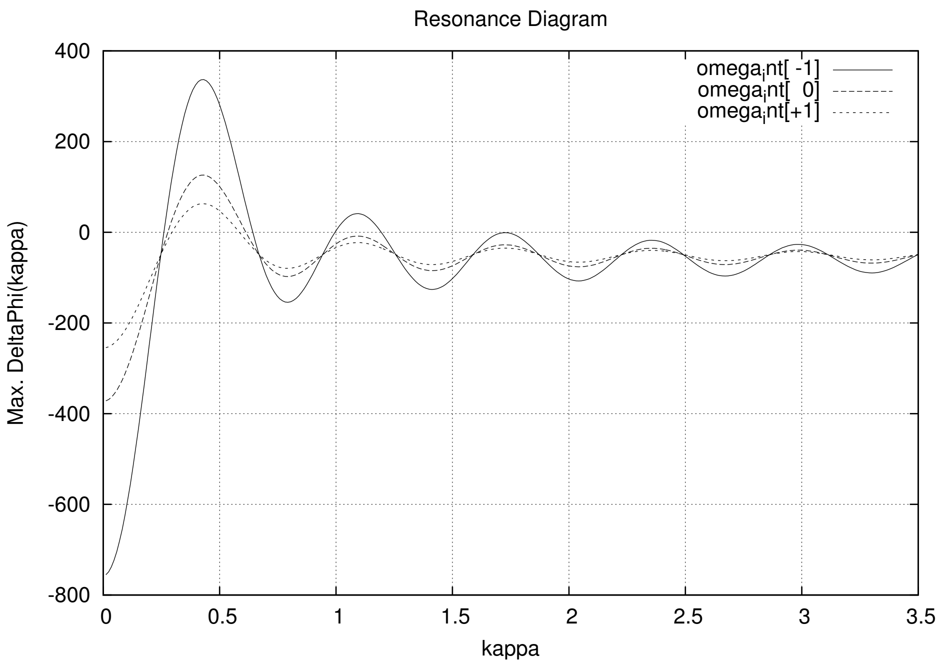

Figure 14.12: Resonance diagram, type 2

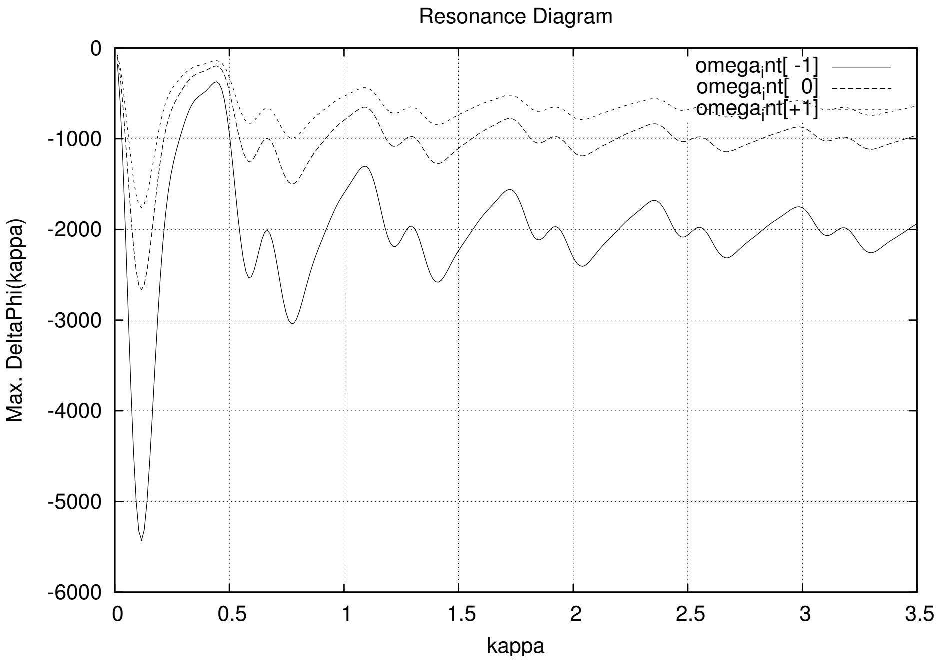

Figure 14.13: Resonance diagram, type 3

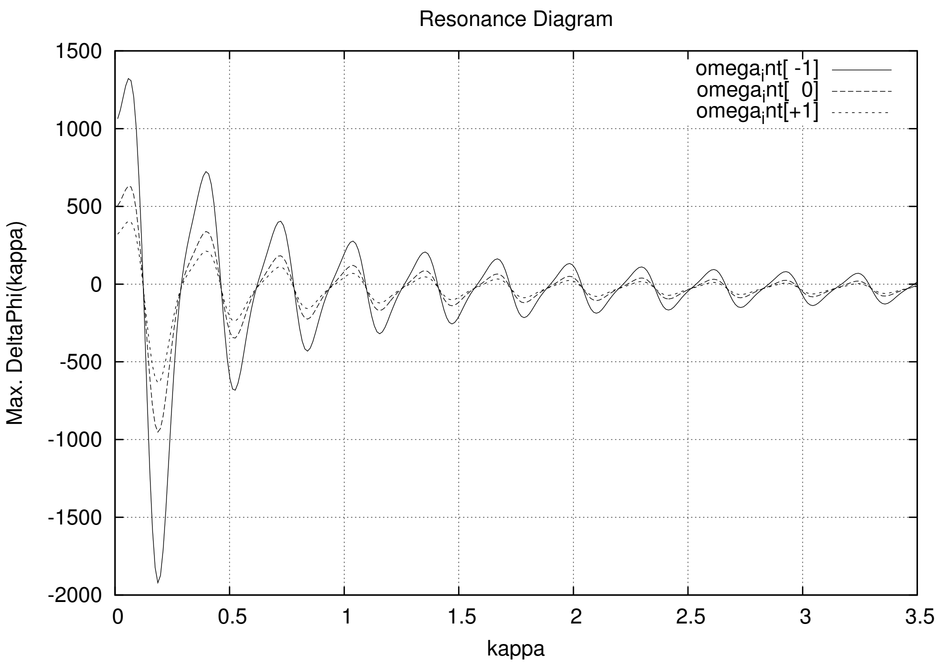

Figure 14.14: Resonance diagram, type 4

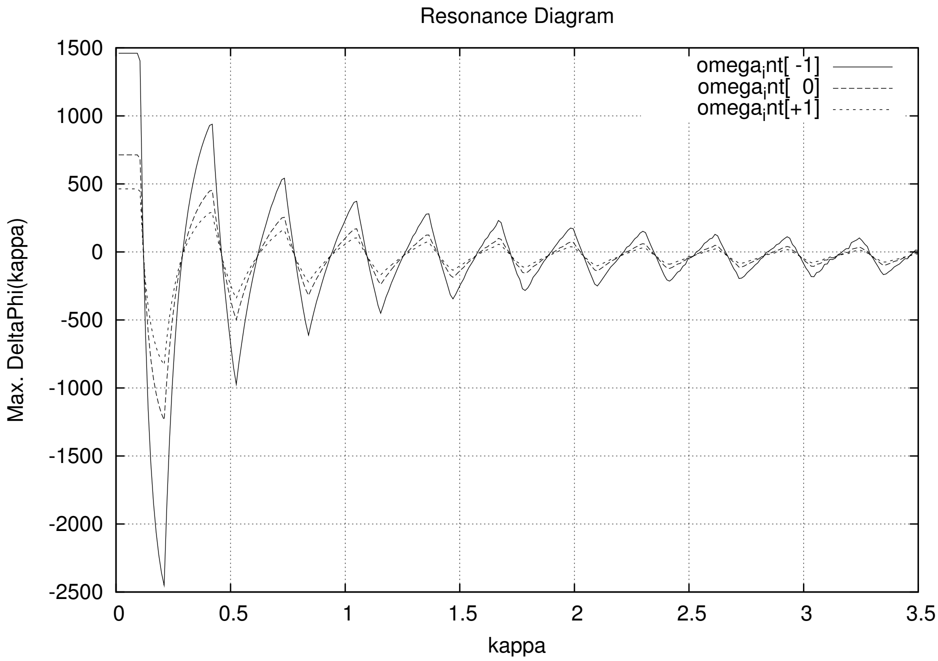

Figure 14.15: Resonance diagram, type 5

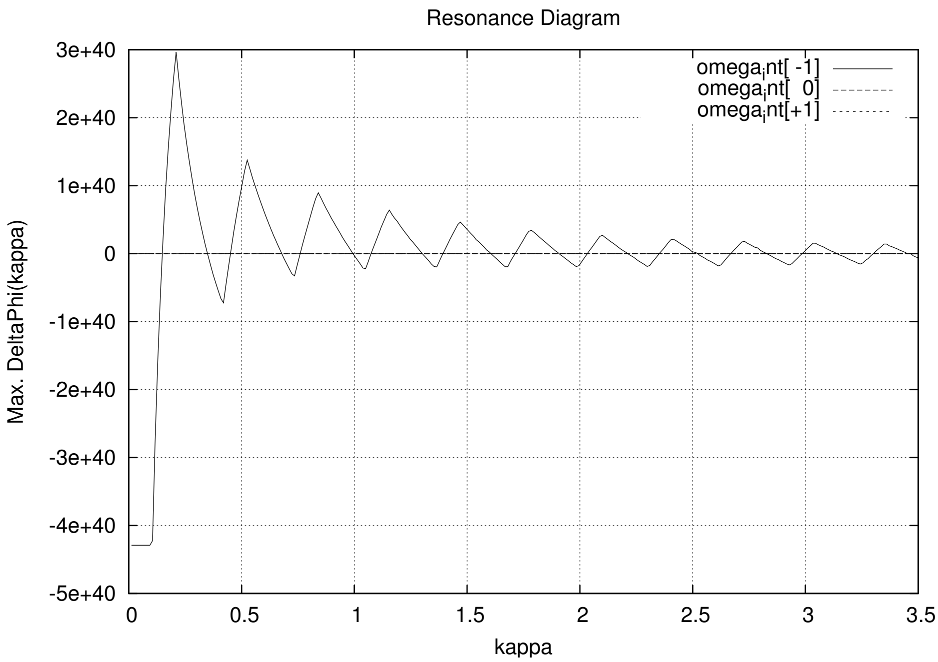

Figure 14.16: Resonance diagram for interacting spin connection $1/r^3$, type 5

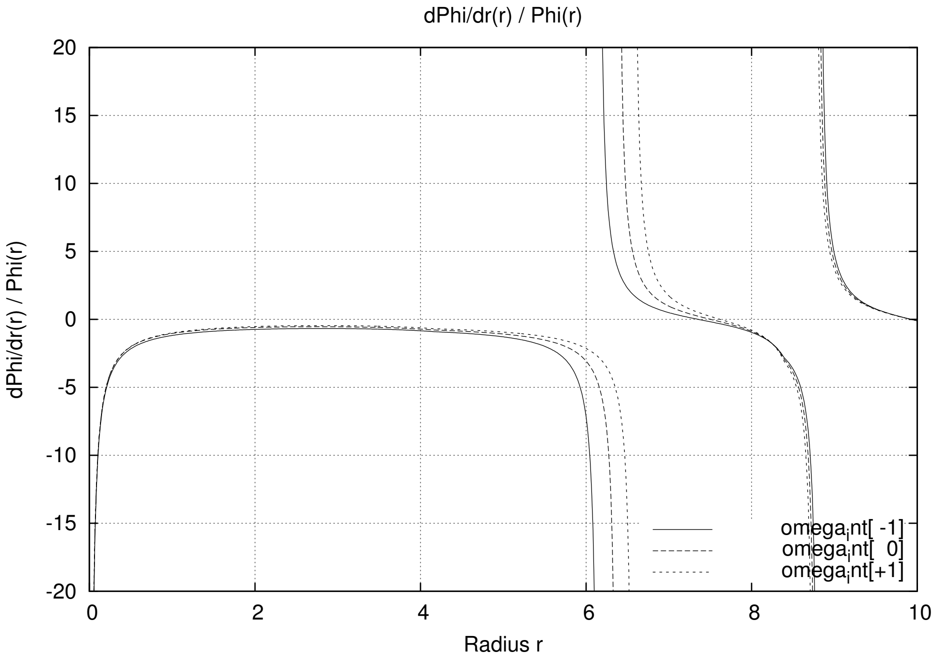

Figure 14.17: $(d\phi/dr)/\phi$ for type=5,$\kappa = 0.25$

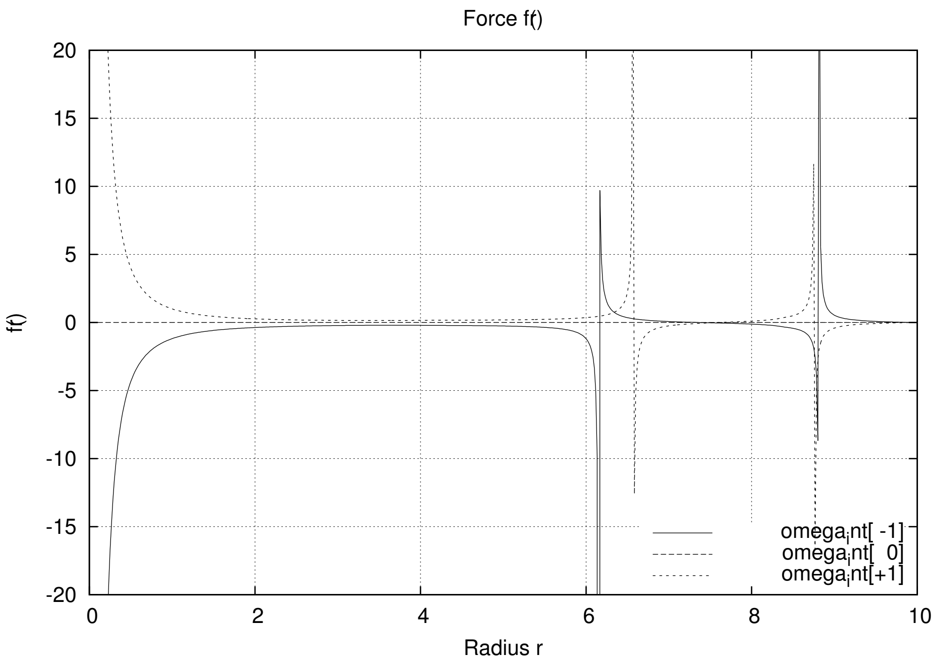

Figure 14.18: Force term $f\ (r)$ for type=5, $\kappa = 0.25$