Einstein – Cartan – Evans Physics of the 21st Century

Horst Eckardt

Munich

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- General relativity
- Geometry of spacetime: curvature and torsion
- Cartan geometry and ECE theory
  - Field equations and wave equation
  - Electromagnetic sector
  - Mechanical sector
  - Quantum theory and unification of natural forces
  - Cosmology
  - Resonance Applications

History of Modern Natural Philosophy

- Classical mechanics
  - Galilei 1638: acceleration
  - Newton 1666: gravitation
  - Newton 1687: equations of motion
- Electrodynamics
  - Maxwell‘s equations: 1864
- Special Relativity
  - Einstein 1905: relativity principle
- General Relativity
  - Einstein 1915: Geometrical description of gravitation
- Quantum Physics
  - Bohr 1913: model of electron orbits in atoms
- Unified Field Theory
  - Kaluza-Klein 1919: 5D model, Basis of string theory
  - Evans 2003: Geometrical description of gravitation and electromagnetism

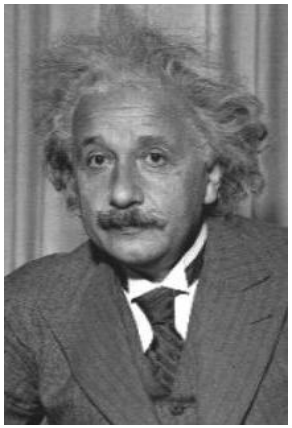
What‘s the problem with contemporary theoretical physics?

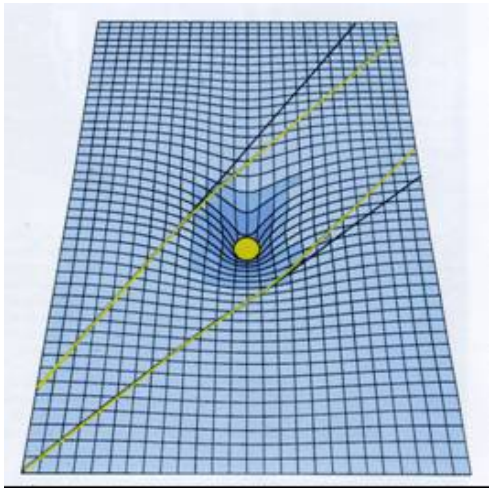
- Einstein‘s Equivalence principle and general covariance principle is only applicable to mechanics
- Quantum mechanics of Heisenberg/Schrödinger is non-relativistic
- Dirac equation is compatible with special relativity only
- Quantum electrodynamics and other advanced quantum theories not reconcilable with general relativity
- String theory cannot be tested and cannot be applied to any practical problem („pre-Baconian“, medieval philosophy)

Description of Laws of Nature

- Newton‘s mechanics
  - All laws of nature act in unchangeable Euclidian space as a „stage“
- Electromagnetism and quantum physics
  - Superimposed to Euclidian space
  - Compatible with Einstein‘s Special Relativity
- Geometrical description
  - Einstein: gravitation is curvature
- New
  - Evans: gravitation is curvature, electromagnetism is torsion
  - Based on Cartan: general mathematical concept of curvature/torsion, described by differential geometry

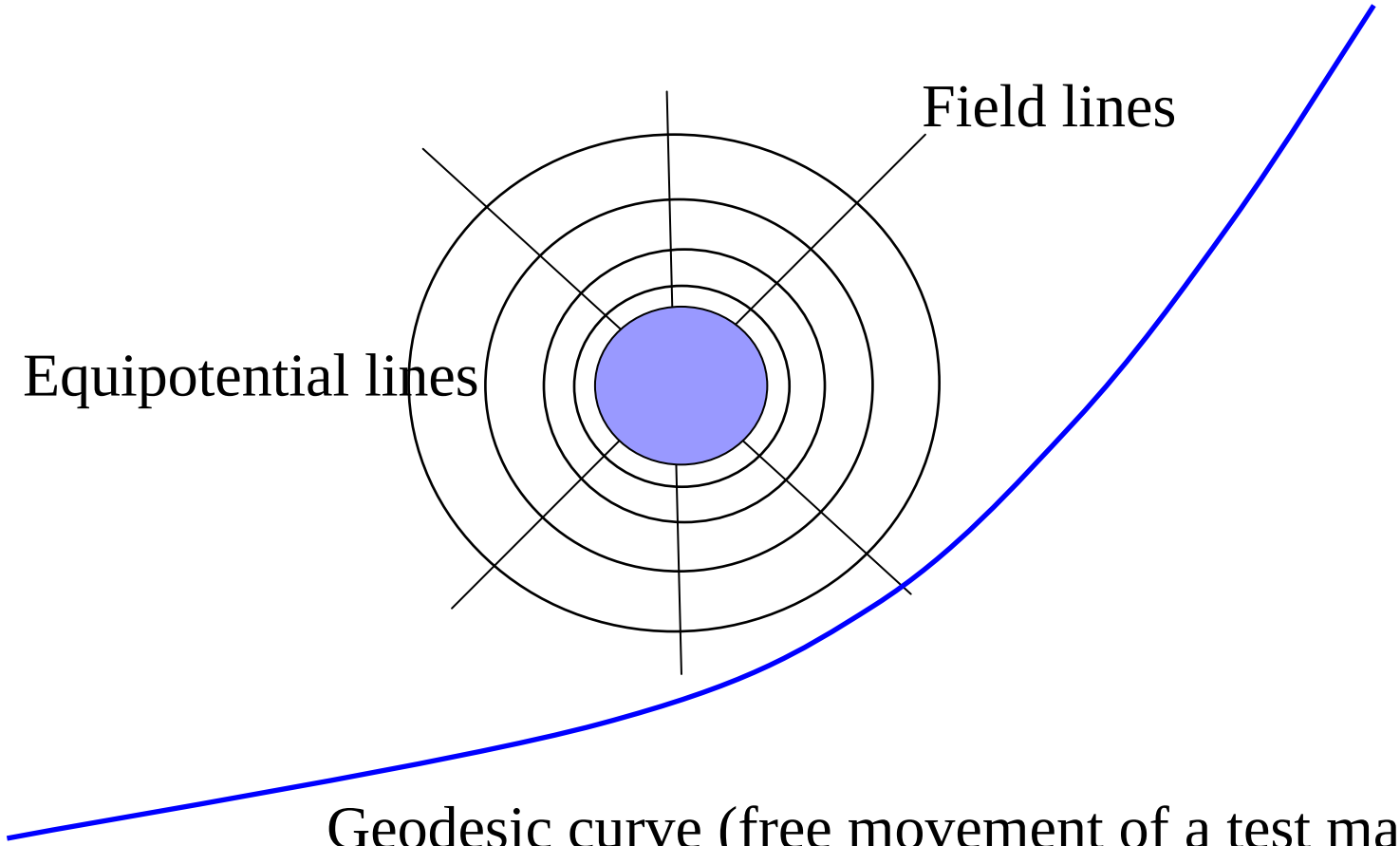
General Relativity





- Einstein 1915
- Spacetime is geometry
- Described by curvature and metric
- Curvature defined by energy-momentum tensor R = -kT
- R is *internal* curvature of Riemann space

Geodesics in General Relativity



Metric and Field Equations

- Symmetric metric
  - differential line element of Riemann geometry:

    $$ds^2 = g_{\mu\nu}\, dx^\mu\, dx^\nu$$

    (Einstein summation convention)
  - corresponds to coordinate transformation
  - applied to tensor calculus
- Einstein Field equation

  $$R^{\mu\nu} - \tfrac{1}{2} R\, g^{\mu\nu} = kT^{\mu\nu}$$

  - non-linear
  - connects curvature and metric

Covariance Principle

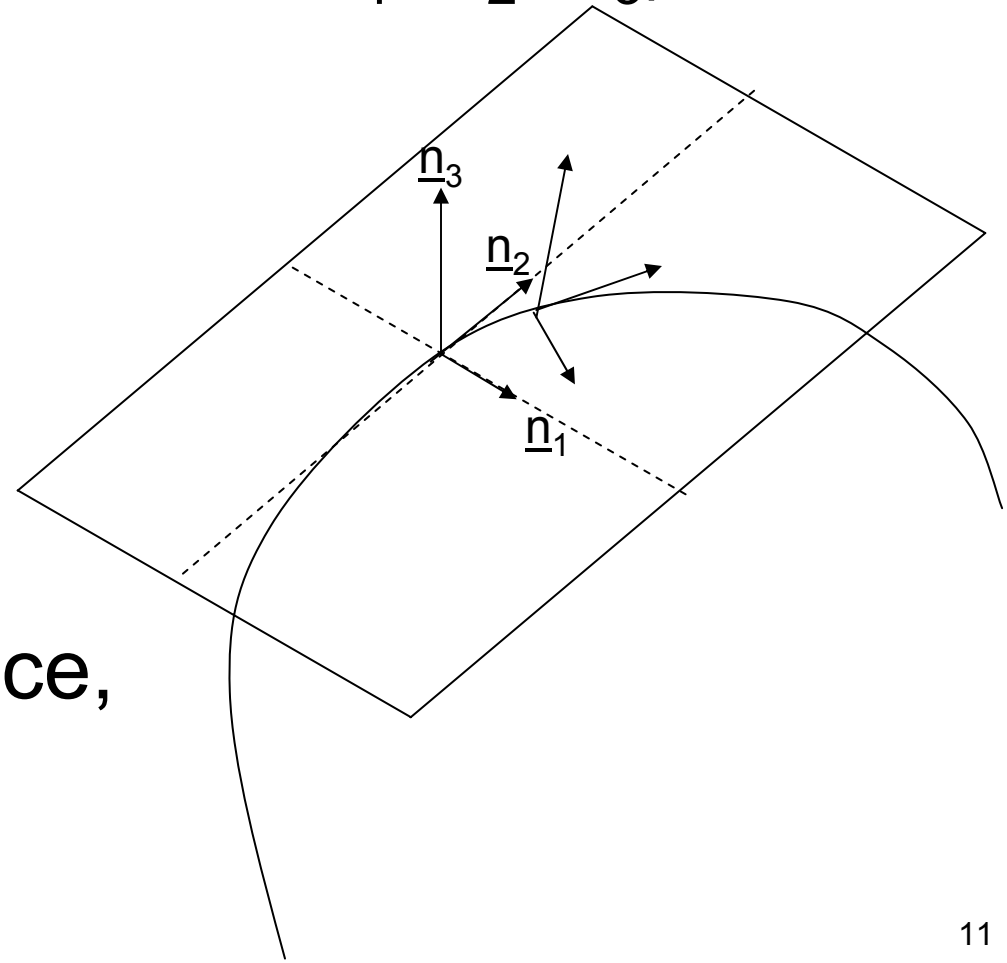
- Derived from Einstein equivalence principle
  - Mass of gravitation = mass of inertia
  - Unified laws of gravitation and inertia
- All laws of nature *should* be describable as independent of any coordinate system
  - Realized by tensors
    - in general relativity: Mechanics
    - in special relativity: Electrodynamics and Dirac equation

Generalization:
Evans Unified Field Theory

- Nature of space and time
  - connected as 4-dimensional continuum („spacetime“)
  - described by General Relativity („covariance pinciple“) plus extensions
- Internal curvature of spacetime
  - experienced as gravitation
  - Einstein‘s General Relativity holds
- External curvature of spacetime
  - experienced as electromagnetism
  - totally new form of description
  - generally covariant

Definition of Torsion

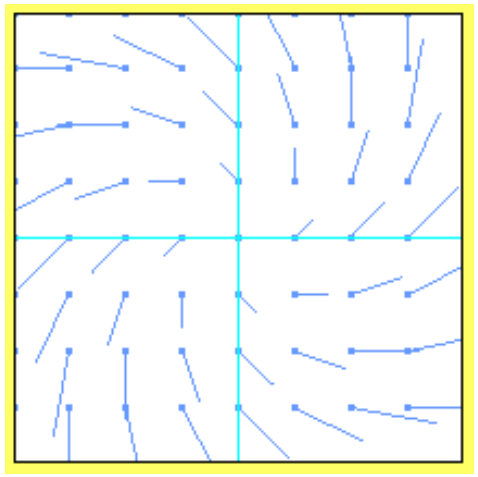
- Frenet frame („Dreibein“ $\underline{n}_1$, $\underline{n}_2$, $\underline{n}_3$) at each point of a curve
- $\underline{n}_3' = -k\,\underline{n}_2 + \kappa\,\underline{n}_1$
- k: curvature
- κ: torsion



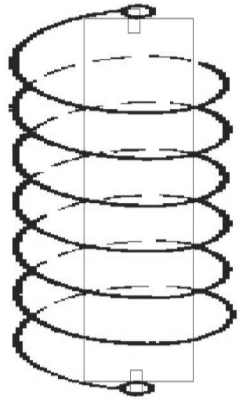
- Rotation of surface, „rotating frame“

Torsion Fields

Fields with external curvature



Vector field

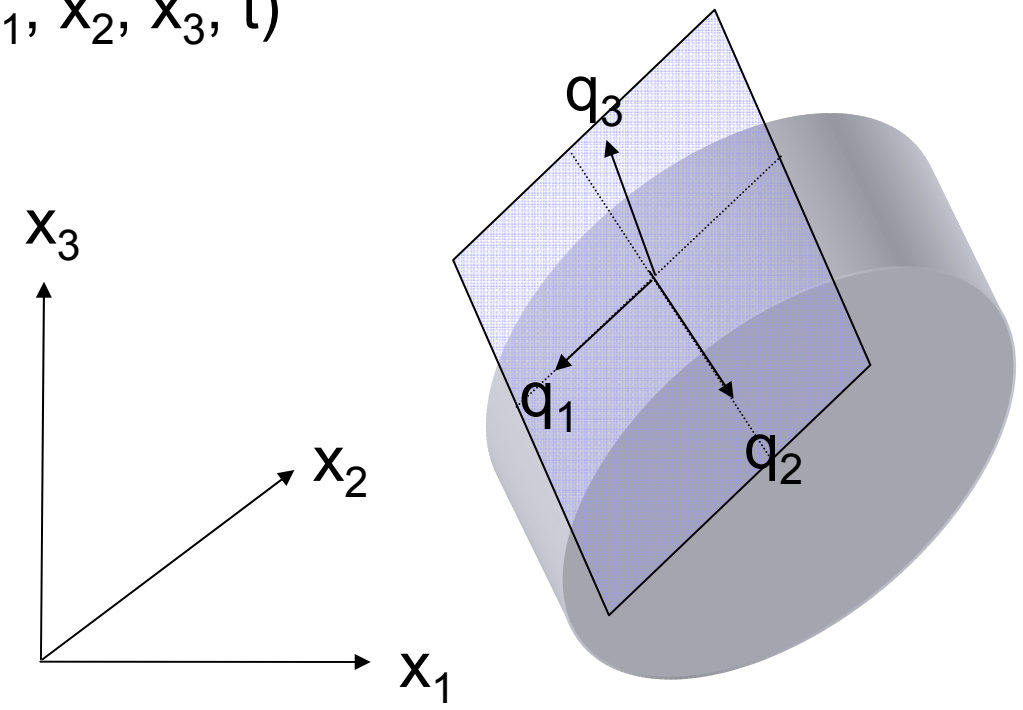


Parametrized curve
or surface

Basic Objects of Evans Theory

- Transformation from fixed coordinate system („base manifold“) to tangent space
  - Basis vectors (a=0,1,2,3), called „tetrad“:

    $q_a = q_a(x_1, x_2, x_3, t)$



Evans Axioms

1. Generalized vector potential
   - Proportional to the tetrad

     $A^a = A^{(0)}\, q^a$
2. Electromagnetic field
   - Proportional to the torsion

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

- $cA^{(0)}$ is „primordial voltage“
  - Defines coupling of electromagnetic radiation field to spacetime:

$$A^{(0)} = \frac{e\mu_0}{4\pi\alpha}\omega$$

ECE Field Equations

- Follow from Cartan structure equations

ECE Equations

$$\nabla \cdot B^a = \mu_0 j^{0a}$$

$$\nabla \times E^a + \frac{\partial B^a}{\partial t} = \mu_0 j^a$$

$$\nabla \cdot E^a = \mu_0 J^{0a}$$

$$\nabla \times B^a - \frac{1}{c^2}\frac{\partial E^a}{\partial t} = \mu_0 J^a$$

Maxwell-Heaviside Eq.

$$\nabla \cdot B = 0$$ Gauss

$$\nabla \times E + \frac{\partial B}{\partial t} = 0$$ Faraday

$$\nabla \cdot E = \frac{\rho}{\varepsilon_0}$$ Coulomb

$$\nabla \times B - \frac{1}{c^2}\frac{\partial E}{\partial t} = \mu_0 J$$ Ampère-Maxwell

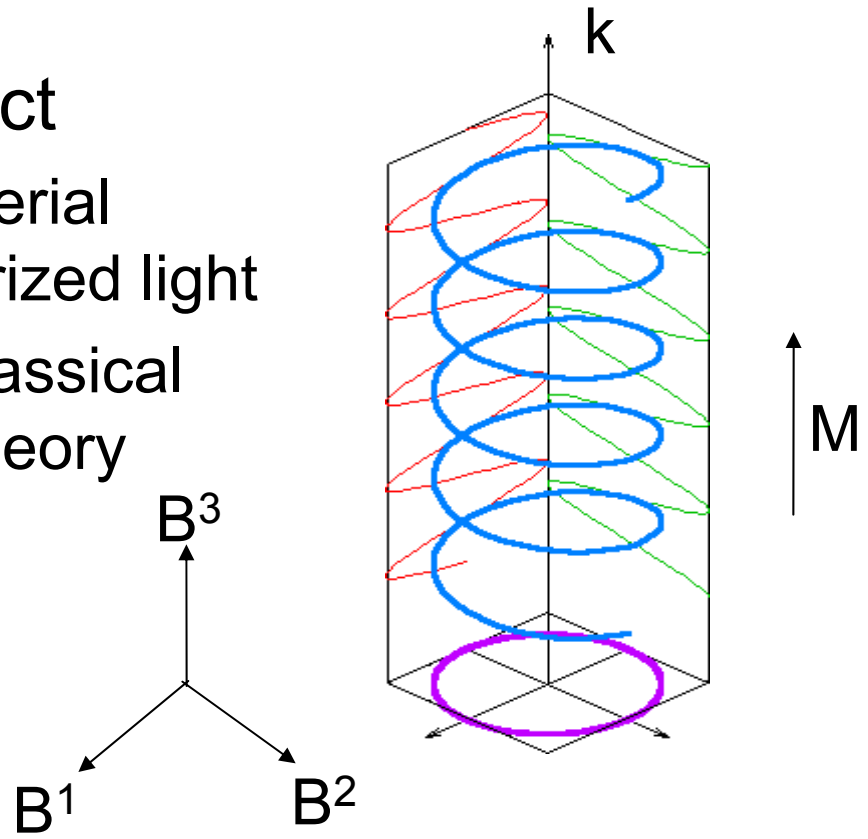
Electromagnetic Polarization Indices

- $E, B \rightarrow E^a, B^a$
- Physical meaning: polarization states
- Experimental evidence:

  Inverse Faraday effect
  - van der Ziel et al., Harvard 1965, Dechamps et al., Orsay 1970
  - circularly polarized light has component in direction of propagation
  - $B^{(3)}$ field, Evans 1992
  - leads to magnetization in all materials

Inverse Faraday Effect

- Faraday effect
  - rotation of polarization plane of light in a magnetic field
- Inverse Faraday effect
  - Magnetization of material due to circularly polarized light
  - Not explainable by classical Maxwell-Heaviside theory



ECE Wave Equation

- From Cartan geometry (tetrad postulate):
  $(1/c^2\,\partial^2/\partial t^2 - \partial^2/\partial x^2 - \partial^2/\partial y^2 - \partial^2/\partial z^2)\,A^a = R\,A^a$
  or
  $\Box A^a = R\,A^a$
- With Einstein's postulate $R = -kT$:
  $(\Box + kT)\,A^a = 0$ (e-m)
  $(\Box + kT)\,q^a = 0$ (mechanics)
- Comparison with Maxwell-Heaviside theory:
  $\Box\,A = 0$

Interpretation of Current Terms

- J: inhomogeneous current

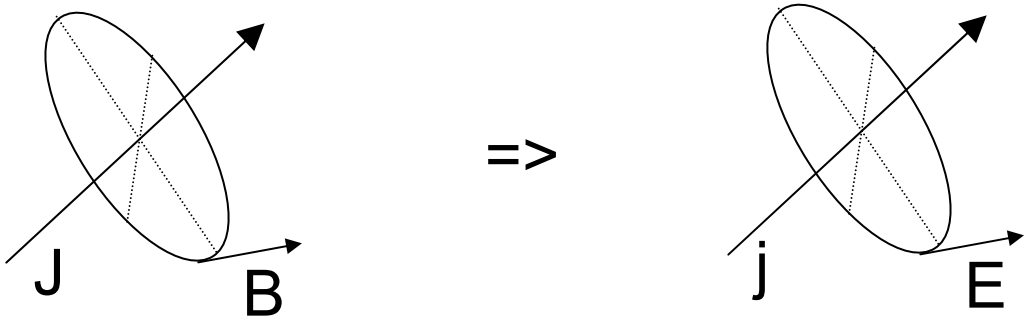
$$J^a = \begin{pmatrix} J^{a0} \\ \vec{J}^a \end{pmatrix} = \begin{pmatrix} c^2\rho^a \\ \vec{J}^a \end{pmatrix} = \begin{pmatrix} \text{charge density} \\ \text{charge current density} \end{pmatrix}$$

- j: homogeneous current

$$j^a = \begin{pmatrix} j^{a0} \\ \vec{j}^a \end{pmatrix} = \begin{pmatrix} m^a \\ \vec{j}^a \end{pmatrix} = \begin{pmatrix} \text{magnetic monopole density} \\ \text{potential current density} \end{pmatrix}$$

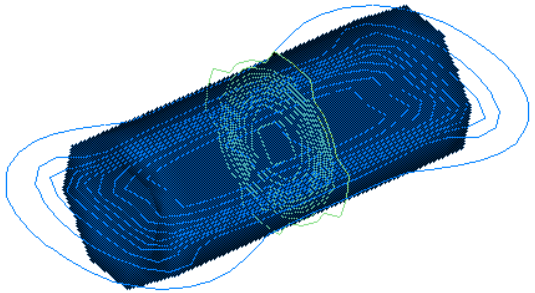
Interpretation of Inhom. Current

- Interchange E↔B
- => Interchange J↔j

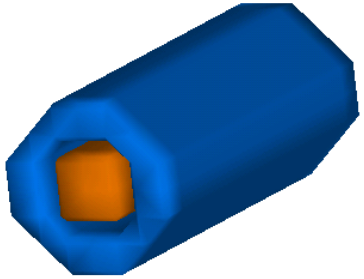


- BUT: j only occurs if electromagnetism is influenced by gravitation

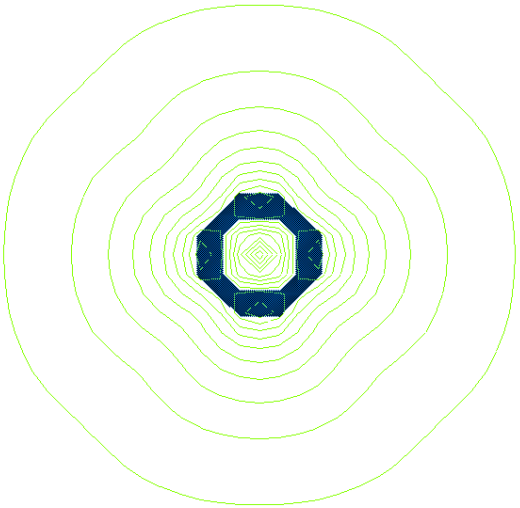
Numerical Calculations



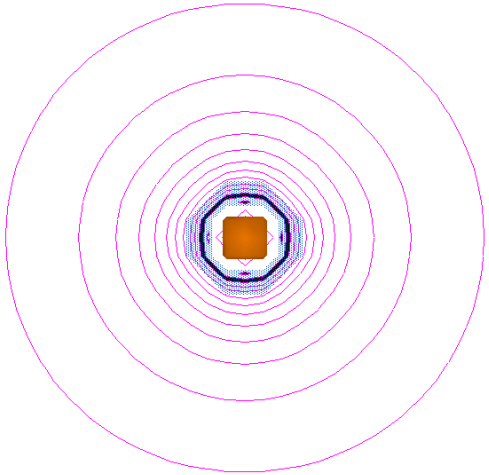
Magnetic Field of coil
without homogeneous current.



Coil with internal conductor
for homogeneous current.



Secondary electric field of
inhomogeneous current (no field in coil).



Primary electric field of
homogeneous current
(strong field enhancement in coil).

Field Equations of Mechanics

- Generally covariant dynamics
- Approximation: Schwarzschild metric
  - No polarization indices

$$\vec{R}^{orbital} = \begin{pmatrix} R^{0}{}_{1}{}^{01} \\ R^{0}{}_{2}{}^{02} \\ R^{0}{}_{3}{}^{03} \end{pmatrix}$$

$$\vec{R}^{spin} = \begin{pmatrix} R^{2}{}_{3}{}^{23} \\ R^{1}{}_{3}{}^{31} \\ R^{1}{}_{2}{}^{12} \end{pmatrix}$$

$$\nabla \cdot \vec{R}^{spin} = \tilde{j}^{0}$$

$$\nabla \times \vec{R}^{orbital} + \frac{1}{c}\frac{\partial \vec{R}^{spin}}{\partial t} = \vec{\tilde{j}}$$

$$\nabla \cdot \vec{R}^{orbital} = J^{0}$$ Newton's Law

$$\nabla \times \vec{R}^{spin} - \frac{1}{c}\frac{\partial \vec{R}^{orbital}}{\partial t} = \vec{J}$$

Quantum Mechanics: Klein-Gordon Equation

- ECE Wave equation
- $(\square + kT)\, q^a = 0$
- Approximation: T = m/V = const., with Compton wave length λ_C:

$$kT = \frac{m^2 c^2}{\hbar^2} = \frac{1}{\lambda_C{}^2}$$

- Insert into wave equation

$$\left(\overline{\underline{\square}} + \frac{m^2 c^2}{\hbar^2} \right) q^a = 0$$

- => Klein-Gordon equation after quantization
- Tetrad q^a is „boson wave function“
- Wave function is deterministic

Quantum Mechanics: Dirac Equation

- Define the Dirac spinor from tetrad in SU(2) symmetry:
  - Tangent space C^2

$$\psi = \begin{pmatrix} (\xi^R)^T \\ (\xi^L)^T \end{pmatrix} = \begin{pmatrix} s_1 \\ s_2 \end{pmatrix} \begin{pmatrix} q^R{}_1 & q^R{}_2 \\ q^L{}_1 & q^L{}_2 \end{pmatrix}$$

$$s_1 = \begin{pmatrix} 1 & 0 \end{pmatrix}, \quad s_2 = \begin{pmatrix} 0 & 1 \end{pmatrix}$$

- Pauli spinors:

$$\xi^R = \begin{pmatrix} q^R{}_1 \\ q^R{}_2 \end{pmatrix}, \quad \xi^L = \begin{pmatrix} q^L{}_1 \\ q^L{}_2 \end{pmatrix}$$

- Dirac equation:

$$\left(\overline{\square} + \frac{m^2 c^2}{\hbar^2} \right) \psi = 0 \quad \Rightarrow \quad \boxed{\left(\gamma^\mu p_\mu + \frac{mc}{\hbar} \right) \psi = 0}$$

Strong and Weak Nuclear Fields

- Proceed in same way as for Dirac equation
- Strong force: „Quark color spinor“ of strong field is a tetrad with SU(3) symmetry:

$$q = \begin{pmatrix} q^R \\ q^W \\ q^B \end{pmatrix}$$

- Weak force: Wave function of weak field is a tetrad with SU(2) symmetry
- Masses of elementary particles to be inserted into ECE wave equation
- Contradictions between Quantum Mechanics and General Relativity removed through use of massive photons and gluons

Heisenberg Uncertainty Principle

- Product of conjugate variables: $\delta x \delta p \geq \frac{\hbar}{2}$
- Experimental results of Croca et al., „Towards a non-Linear Quantum Physics“: $\delta x \delta p \geq 10^{-9} \frac{\hbar}{2}$
- Afshar: photon (particle) and e-m wave simultaneously observed
- Copenhagen school of Quantum Mechanics is wrong!

Generally Covariant Heisenberg Equation

- Heisenberg momentum operator:

$$p_x = -i\hbar \frac{\partial}{\partial x}$$

- Unified field theory
  - Densities have to be considered:

$$\bar{p}_x = -i\bar{\hbar} \frac{\partial}{\partial x}$$

$$\bar{p}_x = \frac{p_x}{V}, \quad \bar{\hbar} = \frac{\hbar}{V}$$

- Correct Heisenberg equation:

$$[x, \bar{p}_x] = -\frac{1}{V} i\hbar$$

$$[x, \bar{p}_x] \to 0 \quad \text{for} \quad V >> V_{atom}$$

Magnetization and Polarization of Spacetime

- If gravity interacts with electromagnetism (j≠0):
  - material property of spacetime changes
  - E, B → E+P, B+M → $\varepsilon_r\varepsilon_0 E$, $\mu_r\mu_0 B$ → nE, B/n
  - n: optical refractive index
  - ECE Field equations take the form

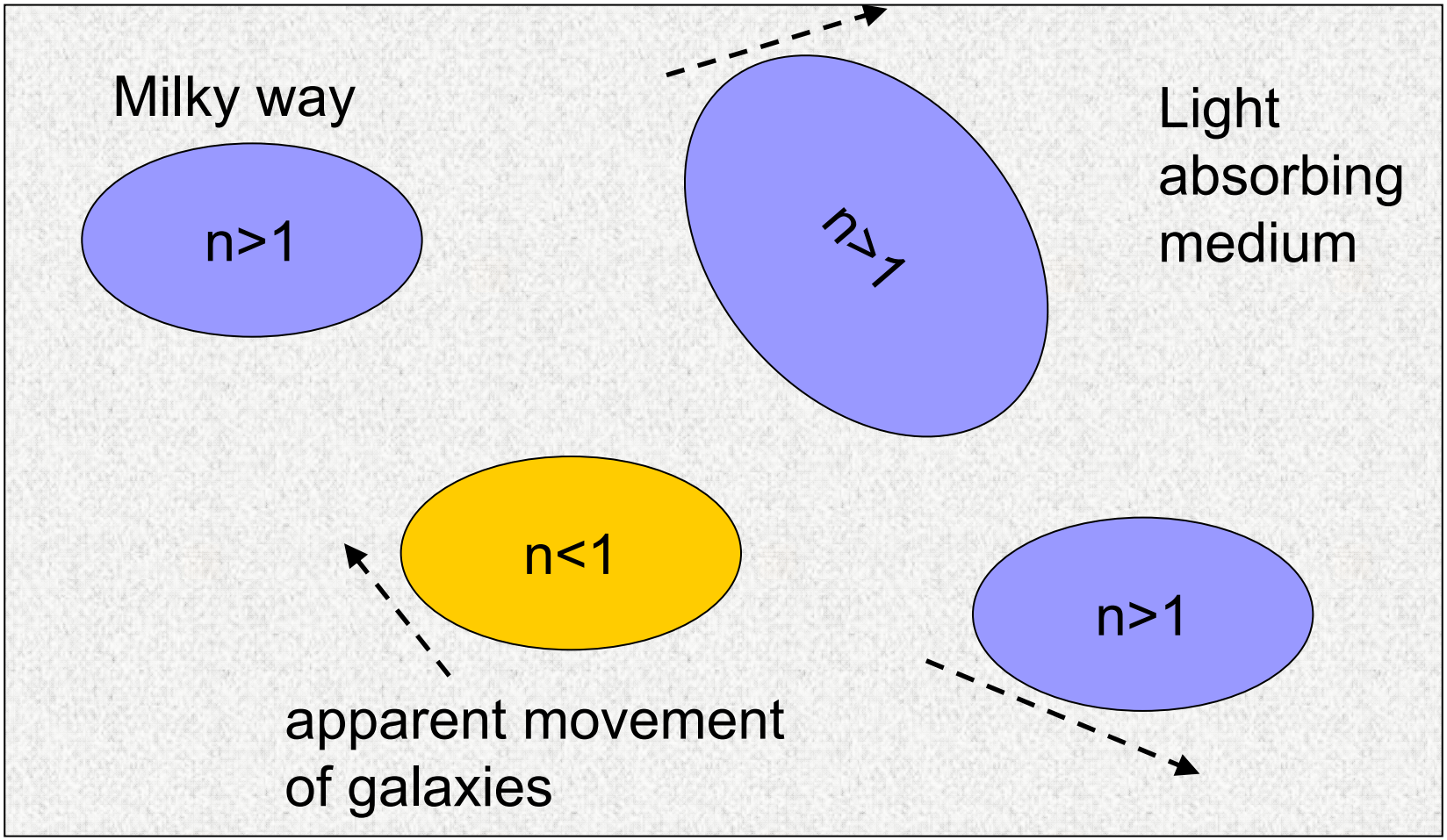
$$\nabla \times \left(\frac{1}{\mu_{r1}} B^a \right) - \frac{1}{c^2} \frac{\partial}{\partial t} \left(\varepsilon_{r1} E^a \right) = 0$$

$$\nabla \times \left(\varepsilon_{r2} E^a \right) + \frac{\partial}{\partial t} \left(\frac{1}{\mu_{r2}} B^a \right) = 0$$

Cosmological Consequences

- Interaction of gravitation and electromagnetism leads to variations in refractive properties in large parts of the universe
  - c → c/n, n>1: red-shift of optical spectra
  - c → c/n, n<1: blue-shift also possible
- No evidence for expanding universe!
- No evidence for big bang!
- Cosmic background radiation
  - Complex refractive index
  - Absorption by residual gravitational field
  - Experiments: inhomogeneous red shifts, no uniform Hubble constant
  - Standard model: no absorption due to „vacuum“

Model of the Universe



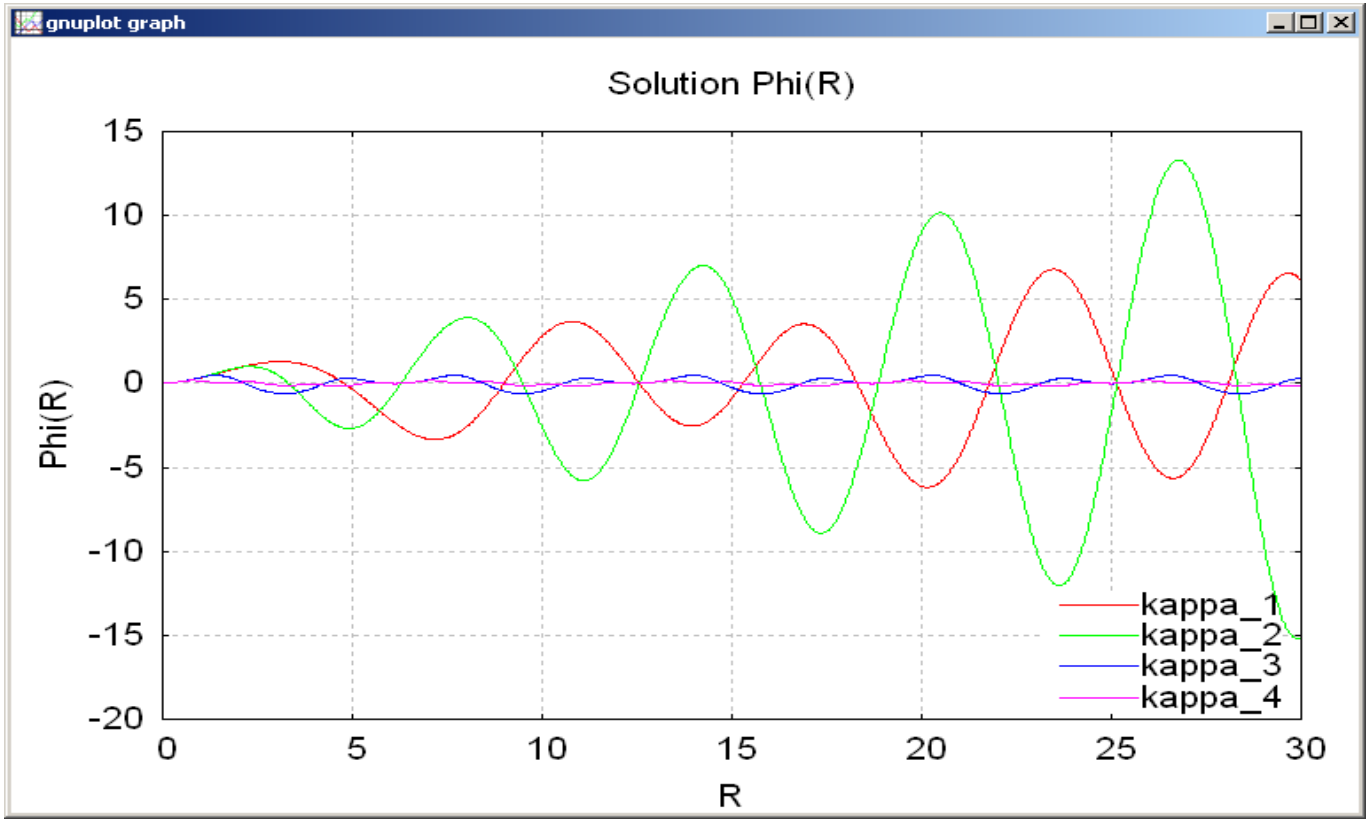
Resonance Effects

- In ECE field equations: replace fields E^a, B^a by potential A^a
- Result: Differential Equations of type

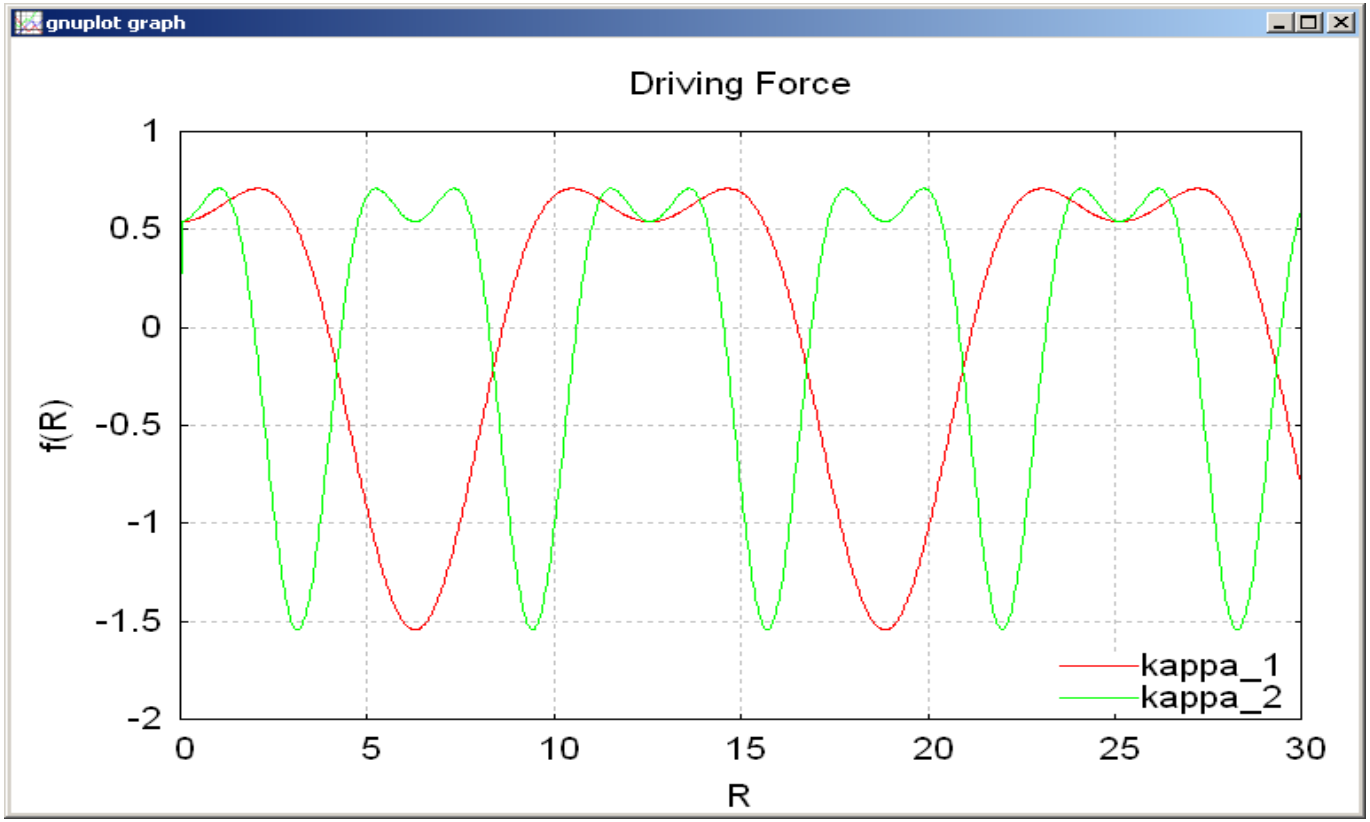
$$\phi'' + \alpha\phi' + \omega_0{}^2\phi = J$$

- Forced oscillation for $J=J_0 \cos(\omega t)$ or $J=J_0 \cos(\kappa x)$
- Resonance frequency: ω_0
- J may be current, charge density, magnetic field…
- Rich structure of resonances appears
  - Partly undamped
  - Different from excitation of atomic states

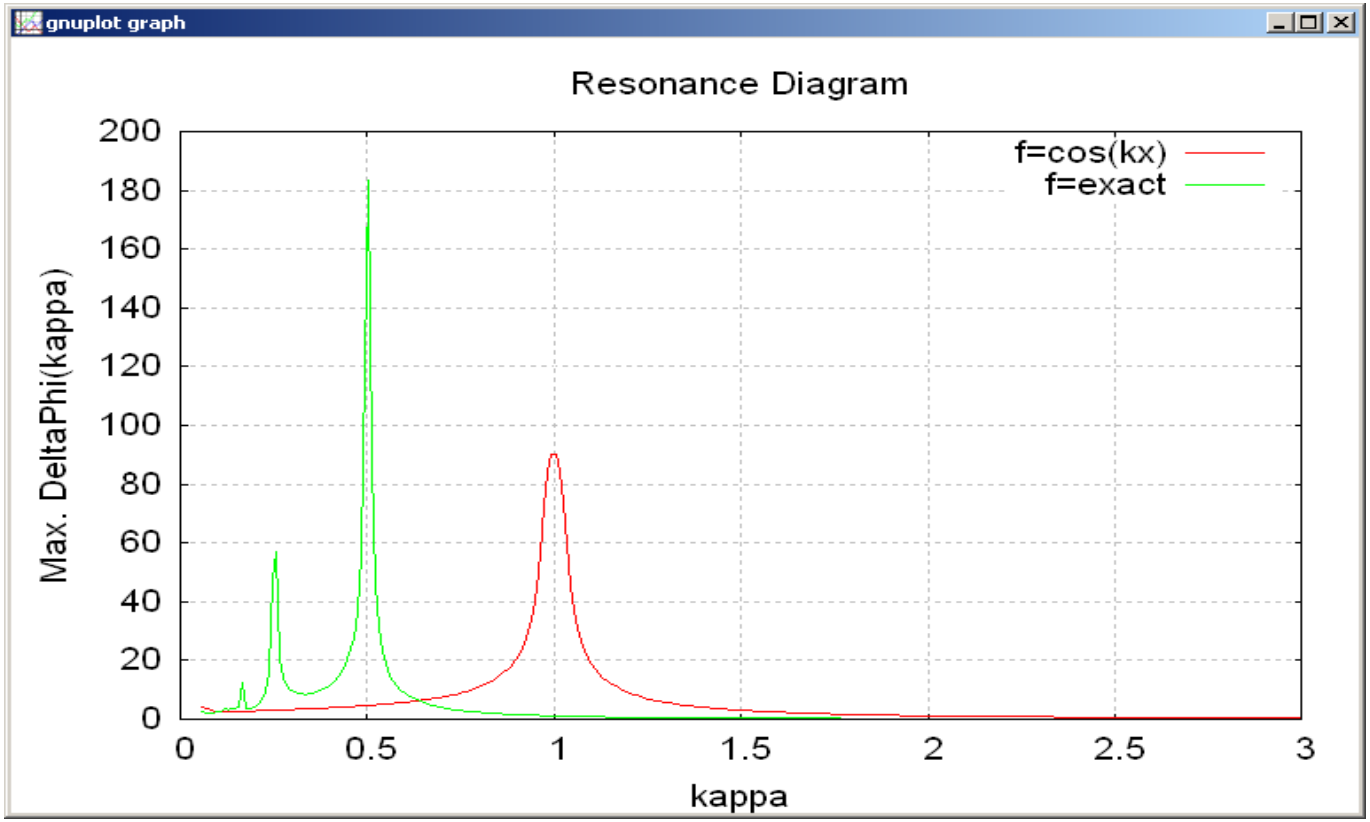
Coulomb Resonance: Radius-dependence



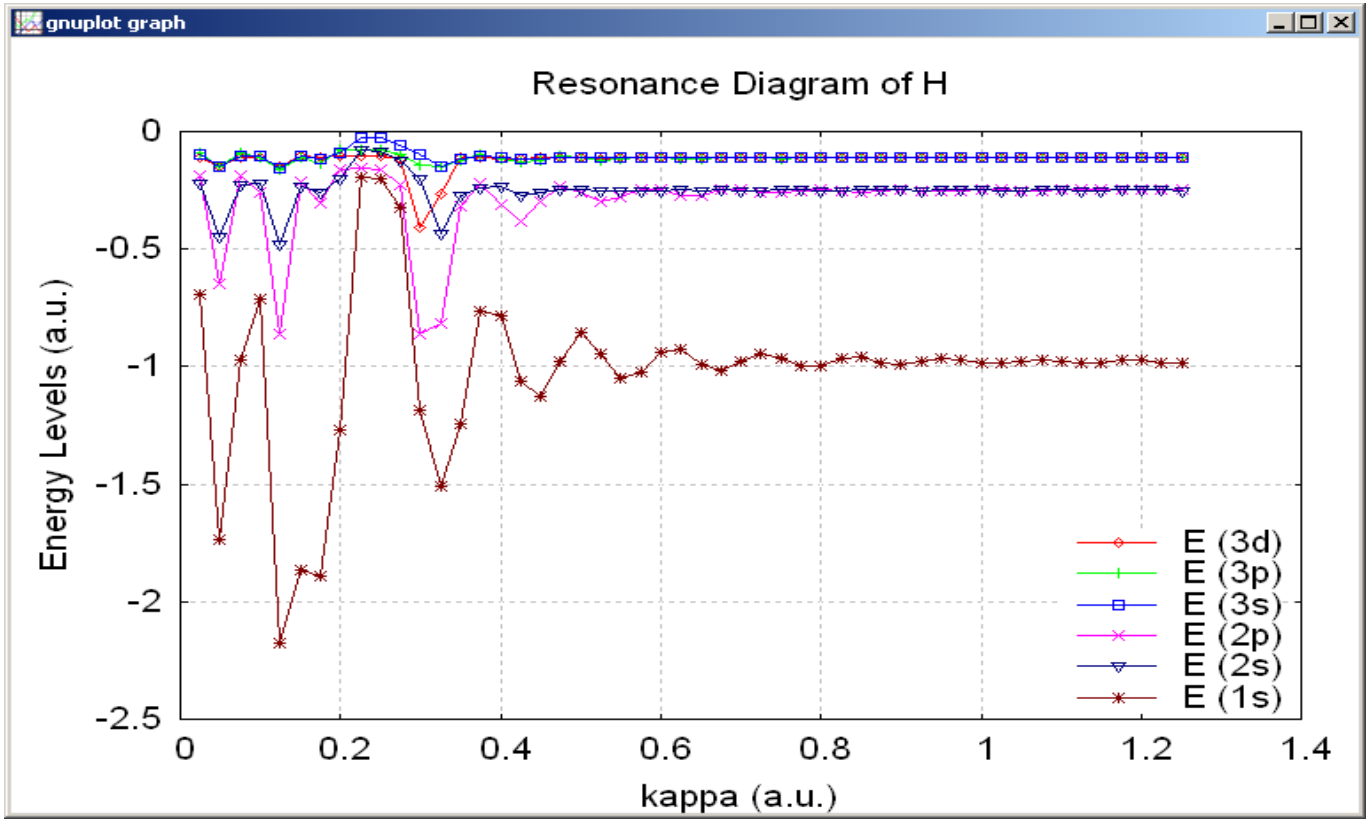
Coulomb Resonance: Driving Force



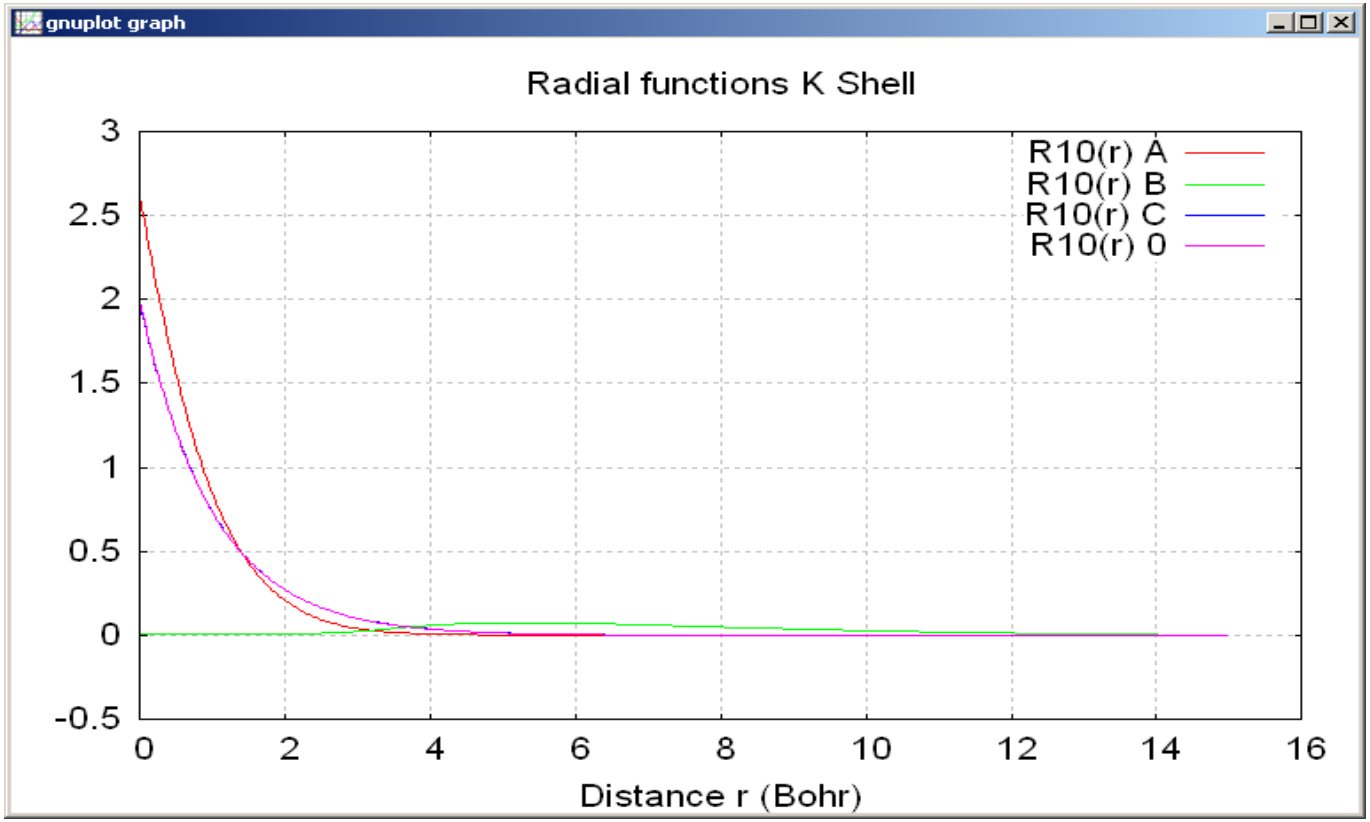
Coulomb Resonance: Resonance Diagram $\Phi_{max}(\kappa)$



Coulomb Resonance: Energy Resonance in H Atom

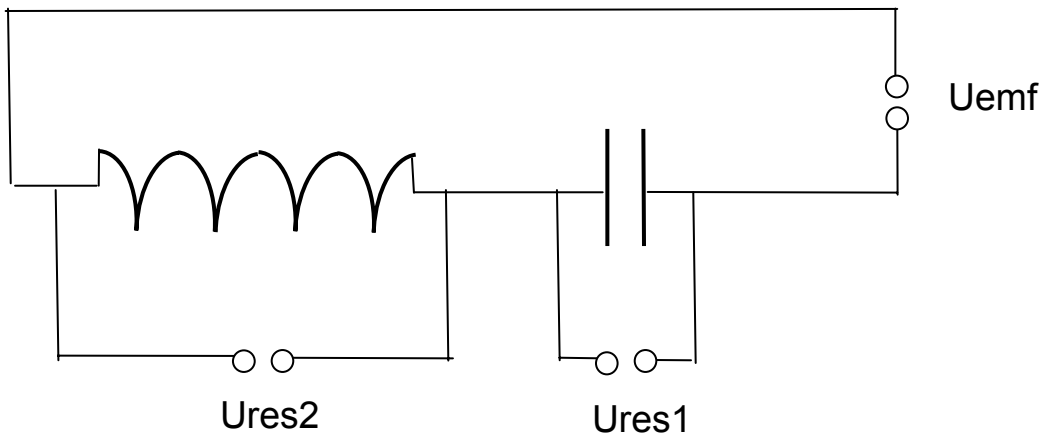


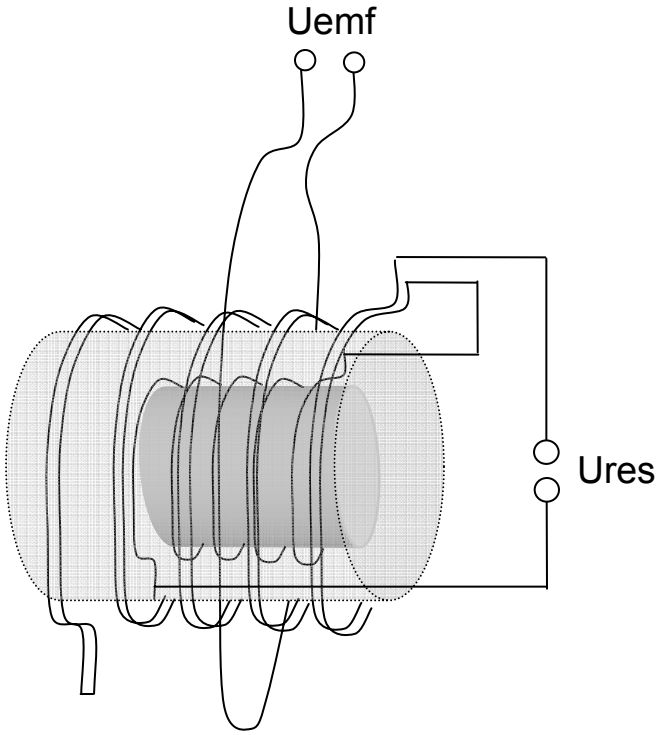
Coulomb Resonance: Atomic Orbitals in H Atom



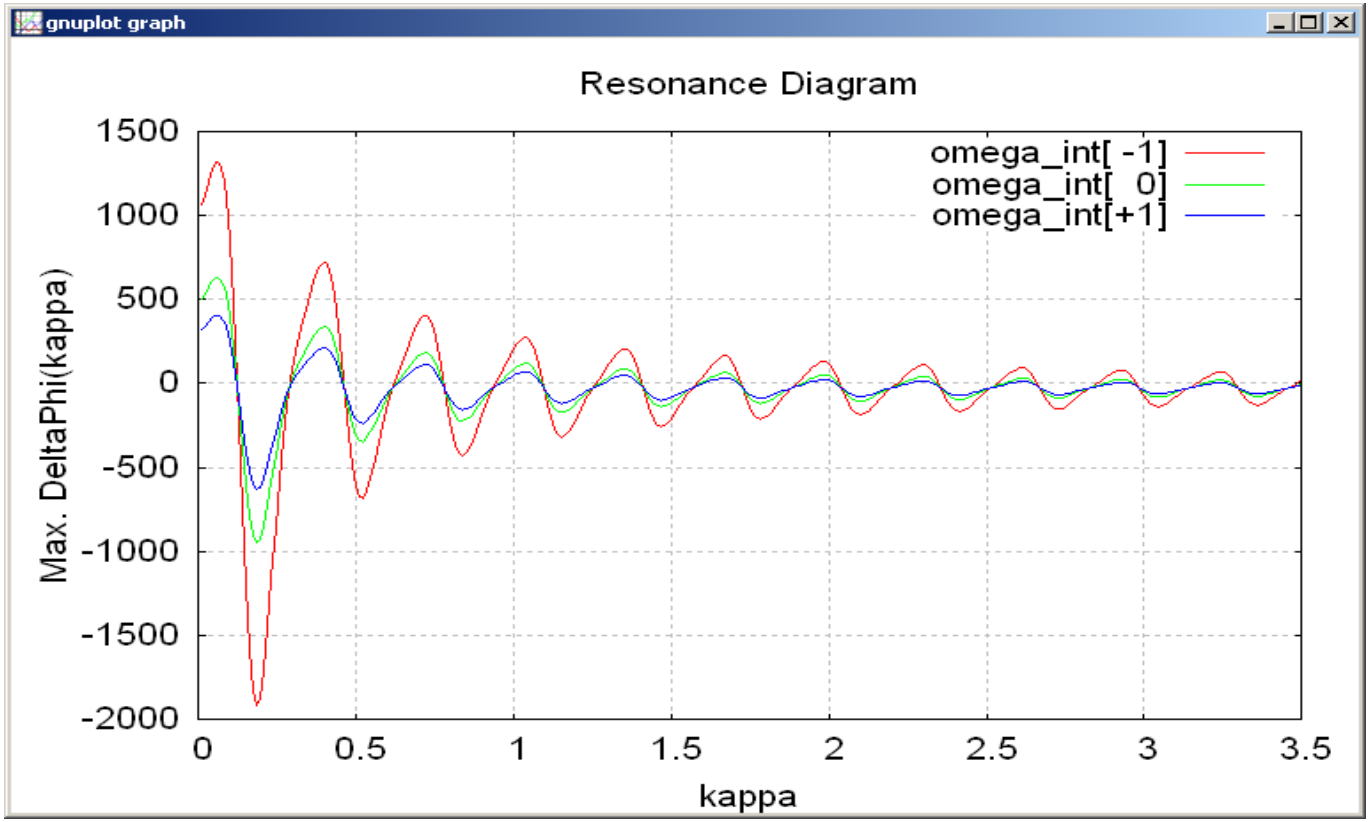
Coulomb Resonance: Equivalent Circuit

- Spacetime resonance to be evoked

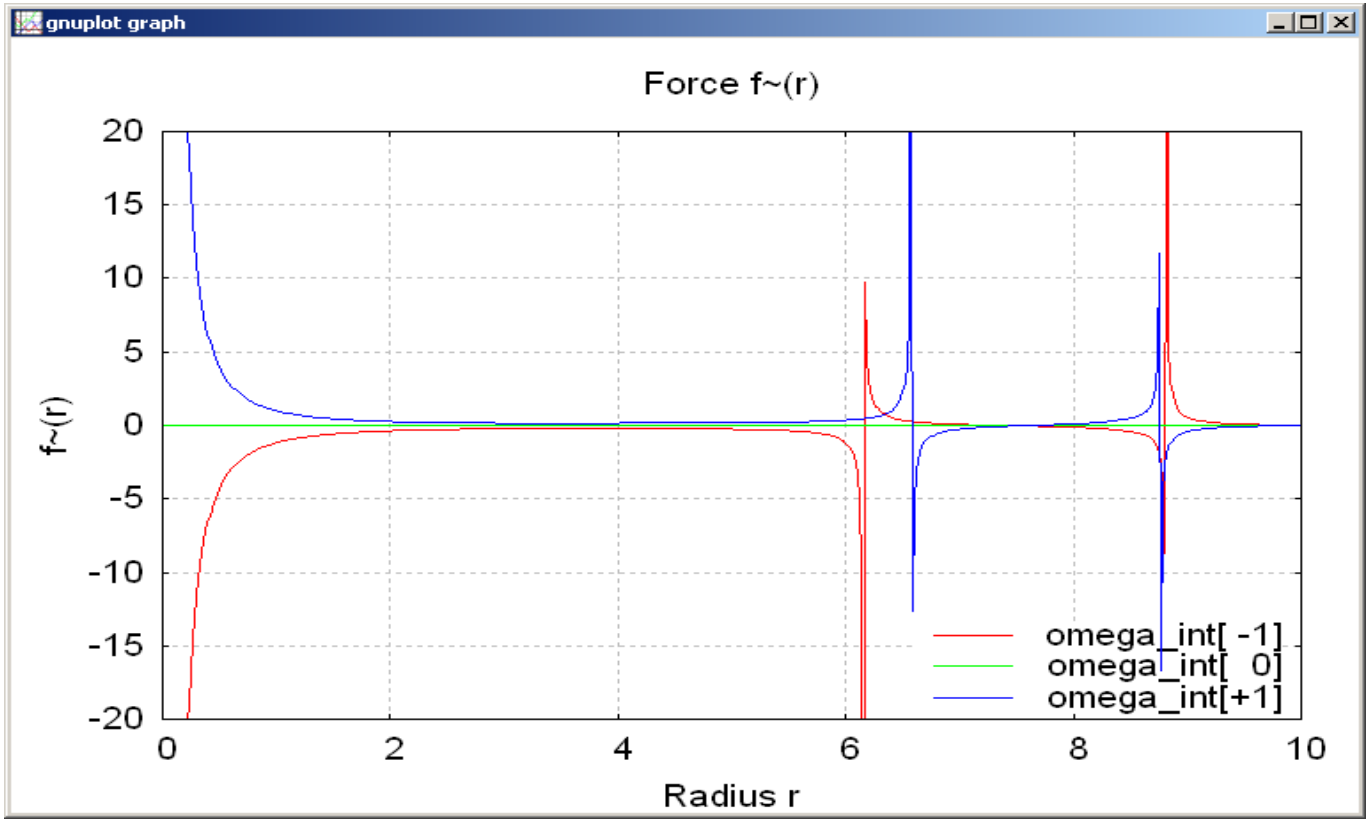




Coulomb Counter Gravitation: Resonance Curves



Coulomb Counter Gravitation: Force Effects



Summary

- ECE theory is based on elementary geometry
- Consistent extension of Einstein‘s gen. relativity
- Unification of all natural forces
- Objective physics
  - Quantum physics put on deterministic basis
- New effects predicted
  - Cosmology
  - Resonances in materials
  - Energy from spacetime
  - Antigravity