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A Unified Electro-Gravity (UEG) Theory of Nature

A New Electromagnetic Theory of Gravity, and its Application to a Complete Model of the Electron

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For further information/papers on the UEG theory:

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Outline of Presentation

- **Introduction: Electron Structure and Unifying Gravity with Electromagnetics.**
- **A New Unified Electro-Gravity (UEG) Theory and General Relativity.**
- **UEG Theory for a Self-Consistent Model of the Electron.**
- **UEG Theory for other Elementary Particles and Astrophysical Problems (time permitting ?)**
- **Conclusion**

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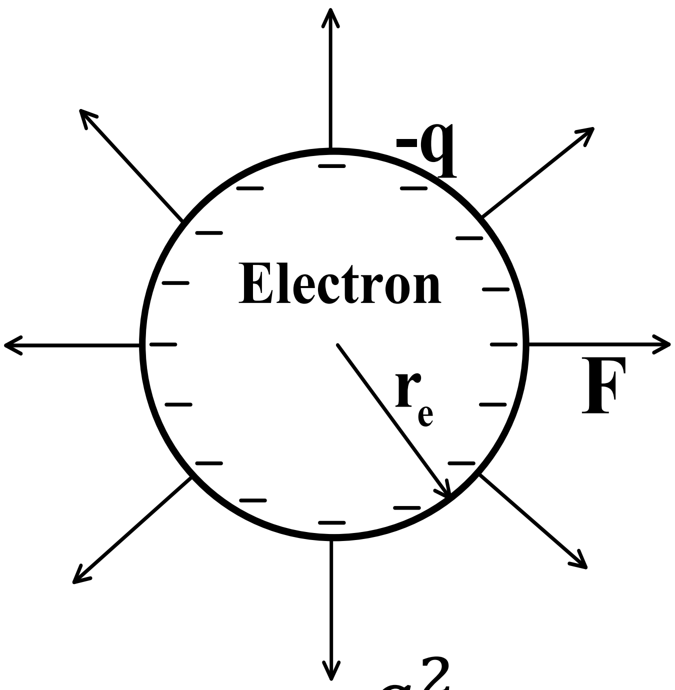
Coulomb's Law and the Electron



The electron is a basic building block of matter, and the basis of modern electronic technology.

A simple question:

Who stops the electron from radially expanding away, countering its self-repulsive force F ?

"It's an unsolved problem," *Richard P. Feynman*

$$F = \frac{q^2}{4\pi\epsilon_0 r_e^2}; \quad \epsilon_0\text{=permittivity of empty space}$$

Assume, for simplicity, charge on a spherical surface

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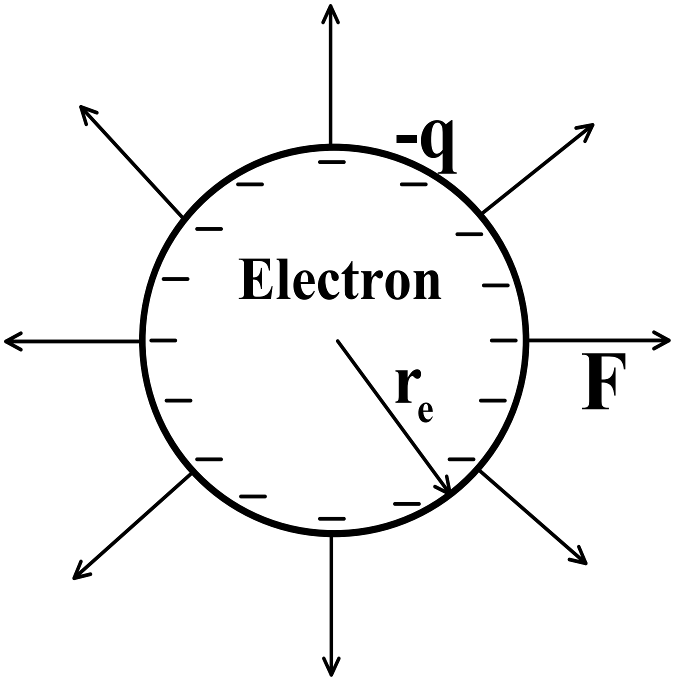
Structure of the Electron



Another simple question:

How small is electron's radius r_e?

Is electron really a point charge, $r_e = 0$, as maybe believed? Impossible, because energy would be infinity!

Coulomb's potential energy = $\dfrac{q^2}{8\pi\epsilon_0 r_e}$

= $\frac{1}{2}$ × charge × surface potential

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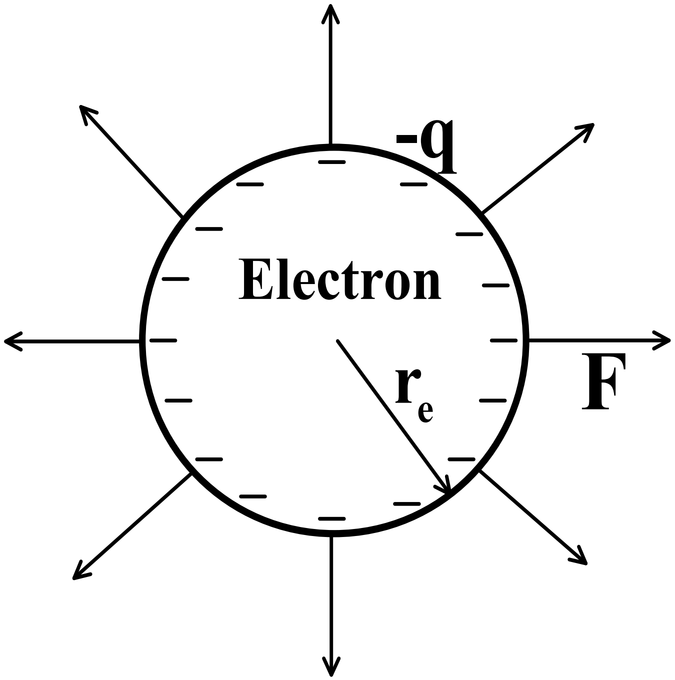
Origin of Electron’s Mass



A few more simple questions:

We know mass is equivalent to energy, from Einstein’s famous theory of relativity: Energy=Mass × c^2.

- So, what kind of internal energy gives electron its mass?

- How does Coulomb’s potential energy relate to electron’ mass?

Is all of electron’s mass due to electrical/ electromagnetic energy?

$$\text{Coulomb's potential energy} = \frac{q^2}{8\pi\epsilon_0 r_e}$$

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Answers for a Self-Consistent Electron Structure

- Coulomb's law, and accordingly conventional electromagnetic theory, is not self-consistent.

- Electromagnetics may be combined with gravitation as a unified theory– Einstein's dream.

- Coulomb's self-repulsion could be countered with gravitational self-attraction, but how?

- Conventional Newtonian/Einsteinian gravitation would not suffice: it can be shown to be way too small (by a factor $\sim\mathbf{10^{-40}}$!) compared to the Coulomb's force.

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Answers for a Self-Consistent Electron Structure: Newtonian/Einsteinian Gravitation Needs to be Modified

- Conventional Newtonian/Einsteinian gravitation is strictly valid only in the external region of an electrically neutral, non-radiating, massive body (Rock, Moon, Earth, Sun), as we experience every day.

- However, we maybe deceived: The Newtonian gravitation is only a residual effect of much stronger gravitation in the internal charged structure of the neutral body.

- A charged particle “looks” lot heavier, particularly as you get closer to the charge.

- Equivalently, the conventional definition of electrical or electromagnetic energy density needs to be modified, while maintaining the total energy unchanged. Conventional energy density is theoretically non-unique.

- A new energy density needs to be added, allowing both positive and negative energy, so that the total additional energy is zero.

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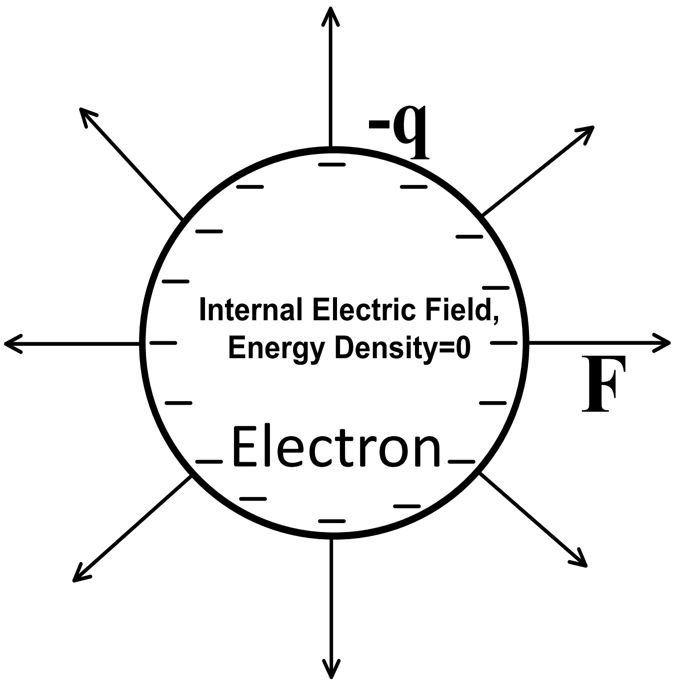
Answers for a Self-Consistent Electron Structure: Newtonian/Einsteinian Gravitation Needs to be Modified



- How would a modified, strong gravitational force cancel electron's self repulsive force F ?
- Assuming a spherical surface charge, we know the internal electric field, energy density, and presumably the modified energy density, would still be zero, <u>resulting in zero gravitational force at the charge surface.</u>
- Clearly, that would not solve our problem.

$$F = \frac{q^2}{4\pi\epsilon_0 r_e^2};\ \ \epsilon_0 = \text{permittivity of empty space}$$

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Answers for a Self-Consistent Electron Structure: A Modified, Unified Electro-Gravity (UEG) Theory

- A key issue we are still overlooking: The "empty-space" permittivity may not be the same constant ϵ_0 everywhere, as simplistically assumed in the Coulomb's law.

- The "Empty space" may seem to be indifferent from location to location, but that is an illusion. It may have different characteristics, such as its permittivity, at different locations.

- The "empty-space" permittivity around the electron which determines the charge's electric field, would be modified in the presence of the new strong gravity due to the charge's own electric field: gravitation and electricity/electromagnetics needs to be treated complementary to each other.

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Answers for a Self-Consistent Electron Structure: A Modified, Unified Electro-Gravity (UEG) Theory (Continued..)

- Modification of Newtonian/Einsteinian gravity, combined with complementary treatment of gravity together with electromagnetic theory, constitutes the new Unified Electro-Gravity (UEG) Theory.

- In the UEG theory, the permittivity ϵ could be infinity, or the inverse-permittivity $1/\epsilon$ =0, at the charge surface, for the specific value of the electron's radius r_e. Accordingly, the Coulomb force $F = q^2/(4\pi\epsilon r_e^2)$ would be zero. That would make the electron a self-consistent structure, with a definite radius r_e.

- The energy associated with the electron's electric field, as per the new UEG theory, would be equal to electron's mass times c^2, by Einstein's special relativity.

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Relating Permittivity of the "Empty Space" to the Gravitational Field

- Like electron's mass, mass of any other elementary particle (proton, neutron), and therefore mass m ($= \boldsymbol{W}/\boldsymbol{c}^2$) of any material body, is fundamentally electromagnetic in origin, where $\boldsymbol{W}$ is the total electromagnetic energy associated with the body's internal arrangement of electric charge.

- As we discussed, electromagnetic property (permittivity $\boldsymbol{\epsilon}$) of the "empty space" is not uniform ($\boldsymbol{\epsilon} = \boldsymbol{\epsilon_0}$) everywhere, as conventionally assumed, but is a non-uniform distribution $(\boldsymbol{\epsilon}(\overline{\boldsymbol{r}}))$.

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Relating Permittivity of the "Empty Space" to the Gravitational Field (Continued..)

- The mass (energy) of a material body at a given location changes proportional to the inverse-permittivity $\underline{\epsilon} = 1/\epsilon$ of the empty space at the location, like the Coulomb potential energy W$= q^2/(8\pi\epsilon r_e)$ of the electron.

- The negative-gradient of the mass (energy) results in a force applied on the body, which is the gravitational force.

- The gradient of the inverse-relative-permittivity function $\underline{\epsilon}_r(\overline{r})$ of the empty space represents the gravitational force field.

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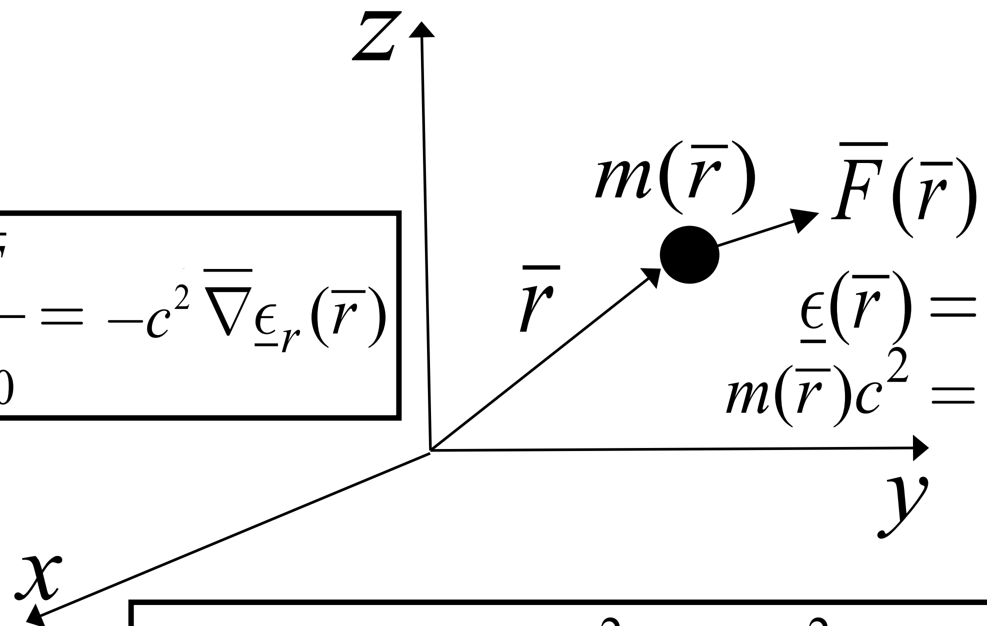
Relating Inverse-Relative-Permittivity Distribution $\underline{\boldsymbol{\epsilon}}_{\boldsymbol{r}}(\overline{\boldsymbol{r}})$ of the "Empty Space" to the Gravitational Field $\overline{\boldsymbol{E}}_{\boldsymbol{g}}$

$$\overline{E}_g = \frac{\overline{F}}{m_0} = -c^2\,\overline{\nabla}\underline{\epsilon}_r(\overline{r})$$



$$\underline{\epsilon}(\overline{r}) = \underline{\epsilon}_0\underline{\epsilon}_r(\overline{r})$$

$$m(\overline{r})c^2 = m_0\underline{\epsilon}_r(\overline{r})c^2$$

$$W(\overline{r}) = m(\overline{r})c^2 = m_0c^2\underline{\epsilon}_r(\overline{r})$$

$$\overline{F}(\overline{r}) = -\overline{\nabla}W(\overline{r}) = -m_0c^2\overline{\nabla}\underline{\epsilon}_r(\overline{r})$$

$\underline{\epsilon} =$ **Inverse Permittivity**

$\underline{\epsilon}_r =$ **Inverse Relative Permittivity**

$$\underline{\epsilon} = 1/\epsilon,\ \underline{\epsilon}_0 = 1/\epsilon_0,\ \underline{\epsilon}_r = 1/\epsilon_r,\ \epsilon = \epsilon_0\epsilon_r$$

c = light speed in free space (r → ∞)

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Deflection of Light Path in a Non-Uniform Layered Medium (Snell's Law)

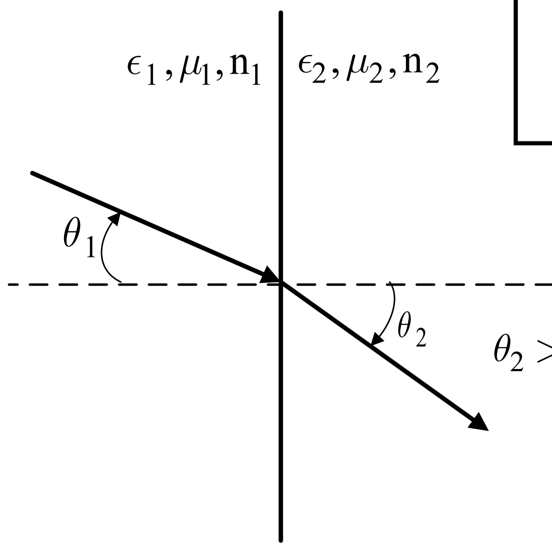
$$\eta = \sqrt{\frac{\mu}{\epsilon}} = \text{constant};\ \underline{\epsilon}_r = \underline{\mu}_r,\ \epsilon_r = \mu_r$$

(Special Condition for Electro-Gravity Model)

$$v_p = \frac{1}{\sqrt{\mu\epsilon}} = \frac{1}{\sqrt{\mu_0\mu_r\epsilon_0\epsilon_r}} = \frac{c}{\sqrt{\mu_r\epsilon_r}} = \frac{c}{\epsilon_r} = c\underline{\epsilon}_r = \frac{c}{\text{n}}$$

$$\frac{\sin\theta_2}{\sin\theta_1} = \frac{\text{n}_1}{\text{n}_2} = \frac{\underline{\epsilon}_{r2}}{\underline{\epsilon}_{r1}}$$

$$\frac{\Delta\sin\theta}{\sin\theta} = \frac{\Delta\underline{\epsilon}_r}{\underline{\epsilon}_r} = -\frac{\Delta\text{n}}{\text{n}}$$



n = refractive index

$$\theta_2 > \theta_1, \epsilon_2 < \epsilon_1,\ \underline{\epsilon}_2 > \underline{\epsilon}_1,\ \text{n}_2 < \text{n}_1$$

$\underline{\epsilon} =$ **Inverse Permittivity**

$\underline{\epsilon}_r =$ **Inverse Relative Permittivity**

$$\underline{\epsilon} = 1/\epsilon,\ \underline{\epsilon}_0 = 1/\epsilon_0,\ \underline{\epsilon}_r = 1/\epsilon_r,\ \epsilon = \epsilon_0\epsilon_r$$

$$\underline{\mu} = 1/\mu,\ \underline{\mu}_0 = 1/\mu_0,\ \underline{\mu}_r = 1/\mu_r,\ \mu = \mu_0\mu_r$$

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Non-Uniform Permittivity Model for Deflection of Light Path by a Massive Body is Consistent with General Relativity

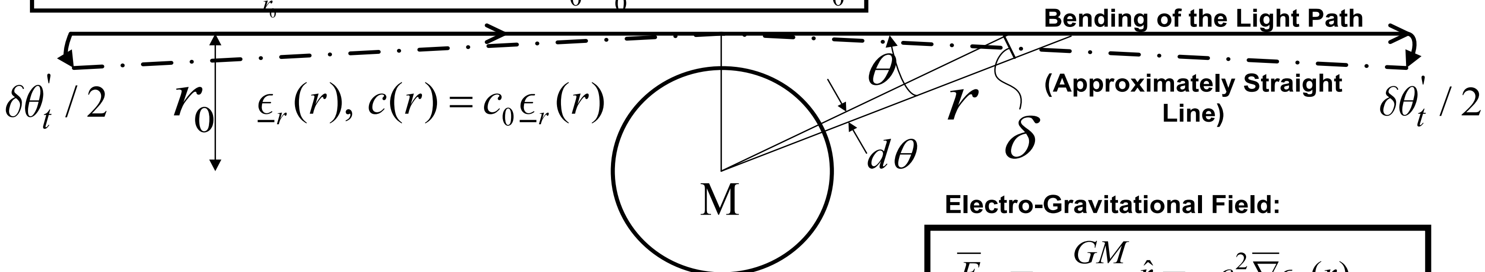
Angular Deflection in Local Frame (Also in External Frame):

$$\Delta \sin\theta = \cos\theta \Delta\theta = \sin\theta \frac{\Delta\epsilon_r(r)}{\epsilon_r(r)}$$

$$\Delta\theta = \tan\theta \frac{\Delta\epsilon_r(r)}{\epsilon_r(r)} \approx \tan\theta (\frac{GM}{c^2 r^2}) dr$$

$$\delta\theta = \int \Delta\theta \approx 2\int_{r_0}^{\infty} \tan\theta (\frac{GM}{c^2 r^2}) dr = \frac{2GM}{c^2 r_0} \int_0^{\pi/2} \sin\theta d\theta = \frac{2GM}{c^2 r_0}$$

$$\frac{\Delta \sin\theta}{\sin\theta} = \frac{\Delta\epsilon_r(r)}{\epsilon_r(r)}$$



Electro-Gravitational Field:

$$\overline{E}_g = -\frac{GM}{r^2}\hat{r} = -c^2 \overline{\nabla}\epsilon_r(r)$$

$$\epsilon_r(r) = 1 - \frac{GM}{c^2 r}$$

Additional Deflection Seen Only in the External (Primed) Frame:

$$d\theta = \frac{\delta}{r},\ d\theta' = \frac{\delta}{r'} = \frac{\delta}{rc(r)/c_0} = \frac{d\theta}{\epsilon_r(r)};\ \delta' = \delta$$

$$\Delta\theta' = d\theta' - d\theta = (\frac{1}{\epsilon_r(r)} - 1)d\theta = (\frac{1}{1 - \frac{GM}{c^2 r}} - 1)d\theta \approx \frac{GM}{c^2 r} d\theta$$

$$\delta\theta' = \int \Delta\theta' \approx 2\int_0^{\pi/2} \frac{GM}{c^2 r} d\theta = 2\int_0^{\pi/2} \frac{GM}{c^2 r_0} \sin\theta d\theta = \frac{2GM}{c^2 r_0}$$

Total Deflection as Seen in the External (Primed) Frame:

$$\delta\theta_t^{'} = \delta\theta + \delta\theta' = \frac{4GM}{c^2 r_0}$$
$$= \text{General Relativity Prediction}$$

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General Relativity and Non-Uniform Permittivity Model for a Central Massive Body

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \text{ (Einstein Field Equation)},$$

$$g^{\mu\nu} G_{\mu\nu} = g^{\mu\nu} R_{\mu\nu} - \frac{1}{2} R g^{\mu\nu} g_{\mu\nu} = -R = \frac{8\pi G}{c^4} g^{\mu\nu} T_{\mu\nu},$$

$$R = -\frac{8\pi G}{c^4} g^{\mu\nu} T_{\mu\nu} = -\frac{8\pi G}{c^4} T,$$

$$G_{00} = R_{00} - \frac{1}{2} R g_{00} = \frac{8\pi G}{c^4} T_{00},$$

$$R_{00} = \frac{8\pi G T_{00}}{c^4} + \frac{1}{2} R g_{00} = \frac{4\pi G (2T_{00} - T g_{00})}{c^4} = \frac{4\pi G T'_{00}}{c^4},$$

$$\text{Geodesic Equation: } m_0 \frac{d^2 r}{dt^2} = -m_0 \Gamma^1_{00} = \frac{m_0}{2 g_{11}} \frac{\partial g_{00}}{\partial r},$$

$$m_0 \sqrt{-g_{00} / c^2} \, \frac{d^2 (r \sqrt{g_{11}})}{d(t \sqrt{-g_{00} / c^2})^2} = m'_0 \frac{d^2 r'}{dt'^2} = F' \text{(in "local" (proper) coordintes)}$$

$$= \frac{m_0}{2\sqrt{-g_{00} g_{11} / c^2}} \frac{\partial g_{00}}{\partial r} = -m_0 c^2 \frac{\partial \epsilon_r}{\partial r} \text{ (Electro-gravity Theory)} = \frac{m_0}{2} \frac{\partial g_{00}}{\partial r};\ g_{00} = -c^2 / g_{11}$$

Vacuum Solution, Outside the Mass (Schwarzschild Solution):

$$g_{00} = -c^2 / g_{11},\ \nabla^2 g_{00} = -2c^2 \nabla^2 \underline{\epsilon}_r(\bar{r}) = -8\pi G \rho_M = 0,$$

$$-g_{00}(\bar{r} \to \infty) = \underline{\epsilon}_r(\bar{r} \to \infty) = 1,$$

$$g_{00} = -c^2 [2\underline{\epsilon}_r(\bar{r}) - 1] = -c^2 (1 - \frac{2GM}{c^2 r});\ \underline{\epsilon}_r(\bar{r}) = (1 - g_{00} / c^2)/2 = (1 - \frac{GM}{c^2 r}).$$

$$ds^2 = -(1 - \frac{2GM}{c^2 r}) c^2 dt^2 + (1 - \frac{2GM}{c^2 r})^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2$$

$$ds^2 = -(2\underline{\epsilon}_r(r) - 1) c^2 dt^2 + (2\underline{\epsilon}_r(r) - 1)^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2$$

General Relativity Metric Derived from, Consistent with, the Electro-Gravity Theory

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The New UEG Theory for a "Static" Electron Without Spin, Towards Full Unification with Quantum Mechanics, Particle Physics, and Astrophysics/Cosmology

- **Based on the non-uniform permittivity model of the new UEG theory, in consistency with general relativity, we first formulate self-consistent equations for a static elementary charge (electron).**

- **Then, extend the UEG theory for a spinning electron, unifying gravity, electromagnetics, with quantum mechanics.**

- **The UEG theory for electron similarly applies to model other elementary particles: proton, neutron, neutrino, …**

- **The new UEG theory applies as well to successfully model mysterious astrophysical/cosmological phenomena (dark matter, dark energy).**

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General Relativity and the New Unified Electro-Gravity (UEG) Theory for a Charge Particle with only Electromagnetic Mass

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu}\text{(Charge's EM Stress-Energy Tensor, Properly Corrected, Modified)}$$

$$R_{\mu\nu} = \frac{4\pi G}{c^4}(2T_{\mu\nu} - Tg_{\mu\nu}),\ \text{Show } R_{00}\sqrt{-c^2 g_{11}/g_{00}} = -\frac{1}{2}\overline{\nabla}\left(\frac{1}{\sqrt{-g_{11}g_{00}/c^2}}\overline{\nabla}g_{00}\right) = \frac{4\pi G\rho}{c^2} = c^2\nabla^2\underline{\epsilon}_r(r)$$

First solve $\underline{\epsilon}_r$(r) using proper energy density ρ; All $g_{\mu\nu}$'s could then be derived from the $\underline{\epsilon}_r$(r)

Energy density needs correction, because empty-space permittivity is non-linear:

$$\text{Energy Density } \rho \neq \frac{1}{2}\epsilon E^2 = \frac{1}{2}\underline{\epsilon}\mathrm{D}^2 = \frac{1}{2}\underline{\epsilon}_r\underline{\epsilon}_0\mathrm{D}^2,$$

$$\rho = \int \overline{E}\cdot d\overline{\mathrm{D}} = \int \underline{\epsilon}_r(D)\epsilon_0\overline{D}\cdot d\overline{\mathrm{D}} = \frac{1}{2}\int \underline{\epsilon}_r(D)\epsilon_0 d\mathrm{D}^2 = \frac{1}{2}\underline{\epsilon}_r'\underline{\epsilon}_0\mathrm{D}^2,$$

$$\underline{\epsilon}_r' = \frac{1}{\mathrm{D}^2}\int \underline{\epsilon}_r(D)d\mathrm{D}^2 = \frac{1}{q^2}\int \underline{\epsilon}_r(q)dq^2,$$

Particle's intrinsic (bare) mass = 0
Particle's measured mass = Total electromagnetic mass

The UEG theory modifies the definition of energy density:

$$\text{Modified Energy Density } \rho' = \rho + \overline{\nabla}\cdot(\zeta\rho\hat{r}),$$

$$\int \rho' d\tau = \int (\rho + \overline{\nabla}\cdot(\zeta\rho\hat{r}))d\tau = \int \rho d\tau + \zeta(4\pi r^2\rho)_{r\to\infty} = \int \rho d\tau,$$

$$-\frac{1}{2}\overline{\nabla}\left(\frac{1}{\sqrt{-g_{11}g_{00}/c^2}}\overline{\nabla}g_{00}\right) = c^2\nabla^2\underline{\epsilon}_r(\overline{r}) = \frac{4\pi G\rho'}{c^2} = \frac{4\pi G(\rho + \overline{\nabla}\cdot(\zeta\rho\hat{r}))}{c^2} \approx \frac{4\pi G\overline{\nabla}\cdot(\zeta\rho\hat{r}))}{c^2}$$

$$-\frac{1}{2}\frac{1}{\sqrt{-g_{11}g_{00}/c^2}}\overline{\nabla}g_{00}/c^2 = \overline{\nabla}\underline{\epsilon}_r(\overline{r}) = -\frac{\overline{E}_g}{c^2} \approx \frac{\gamma\rho\hat{r}}{c^2};\ \gamma\text{(UEG Constant)} = \frac{4\pi G\zeta}{c^2},\ \overline{E}_g \approx -\gamma\rho\hat{r}$$

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Energy Density W_τ in the Non-Linear Electro-Gravitational Field of an Electric Charge

- Permittivity distribution in the ``empty-space'' surrounding a charge would be dependent on the energy distribution in the charge's own electric field, or equivalently on the strength of the electric field.

- The electric field surrounding the charge is dependent on the permittivity distribution, which in turn is dependent on the strength of the electric field itself: The UEG field is a non-linear field .

- Energy density in the non-linear electro-gravitational field must be properly modeled using an effective permittivity ϵ'

$$\mathbf{W_\tau = \int_0^q \bar{E}\cdot d\bar{D} = \int_0^q \underline{\epsilon}\bar{D}\cdot d\bar{D} = \int_0^q \frac{1}{2}\underline{\epsilon}\frac{d(\bar{D}\cdot\bar{D})}{dq}dq = \frac{1}{2}|\bar{D}|^2(\frac{2}{q^2}\int_0^q \underline{\epsilon}(q)qdq)}$$

$$\mathbf{W_\tau = \frac{1}{2}\underline{\epsilon}'|\bar{D}|^2 = \frac{1}{2}\underline{\epsilon_0}\underline{\epsilon_r}'|\bar{D}|^2,\ \underline{\epsilon}' = \frac{2}{q^2}\int_0^q \underline{\epsilon}(q)qdq,\ \underline{\epsilon_r}' = \frac{2}{q^2}\int_0^q \underline{\epsilon_r}(q)qdq}$$

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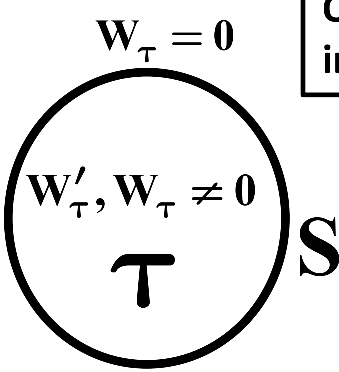
Modified Definition of Gravitation, or Modified Energy Density W'_τ, due to an Electromagnetic Field

$$\mathrm{W} = \iiint_\tau \mathrm{W}'_\tau d\tau = \iiint_\tau (\mathrm{W}_\tau + \bar{\nabla}\cdot(\zeta \mathrm{W}_\tau \hat{\mathbf{r}}))d\tau = \iiint_\tau \mathrm{W}_\tau d\tau + \iiint_\tau \bar{\nabla}\cdot(\zeta \mathrm{W}_\tau \hat{\mathbf{r}})d\tau$$

$$= \iiint_\tau \mathrm{W}_\tau d\tau + \oiint_S \zeta \mathrm{W}_\tau \hat{\mathbf{r}}\cdot\overline{d\mathrm{S}} = \iiint_\tau \mathrm{W}_\tau d\tau,\ \mathrm{W}_\tau = 0, \text{on S}$$

$$\mathrm{W}_\tau > 0;\ \mathrm{W}'_\tau \lessgtr 0$$

W'_τ can be both positive and negative, whereas W_τ is always positive



Original W_τ and modified W'_τ energy densities result in the same total energy W, by divergence theorem

$$\boxed{\mathrm{W}'_\tau = \mathrm{W}_\tau + \bar{\nabla}\cdot(\zeta \mathrm{W}_\tau \hat{\mathbf{r}})}$$

$$\nabla\cdot\bar{\mathrm{E}}_g = -\frac{4\pi G \mathrm{W}'_\tau}{c^2} = -\frac{4\pi G \mathrm{W}_\tau}{c^2} - \bar{\nabla}\cdot(\gamma \mathrm{W}_\tau \hat{\mathbf{r}}),\ \gamma = \frac{4\pi G\zeta}{c^2}$$

$$\bar{\nabla}\cdot\bar{\mathrm{E}}_g = -c^2\bar{\nabla}\cdot\bar{\nabla}\underline{\varepsilon}_r(r) = -\frac{4\pi G \mathrm{W}_\tau}{c^2} - \bar{\nabla}\cdot(\gamma \mathrm{W}_\tau \hat{\mathbf{r}}) \simeq -\bar{\nabla}\cdot(\gamma \mathrm{W}_\tau \hat{\mathbf{r}}),\ \frac{4\pi G \mathrm{W}_\tau}{c^2} << \bar{\nabla}\cdot(\gamma \mathrm{W}_\tau \hat{\mathbf{r}})$$

$$\boxed{\bar{\mathrm{E}}_g = -c^2\bar{\nabla}\underline{\varepsilon}_r(r) \simeq -\gamma \mathrm{W}_\tau \hat{\mathbf{r}},\ \bar{\nabla}\underline{\varepsilon}_r(r) \simeq \frac{\gamma \mathrm{W}_\tau}{c^2}\hat{\mathbf{r}},\ \gamma\text{=UEG Constant}}$$

W'_τ is much stronger in magnitude than the original energy density W_τ

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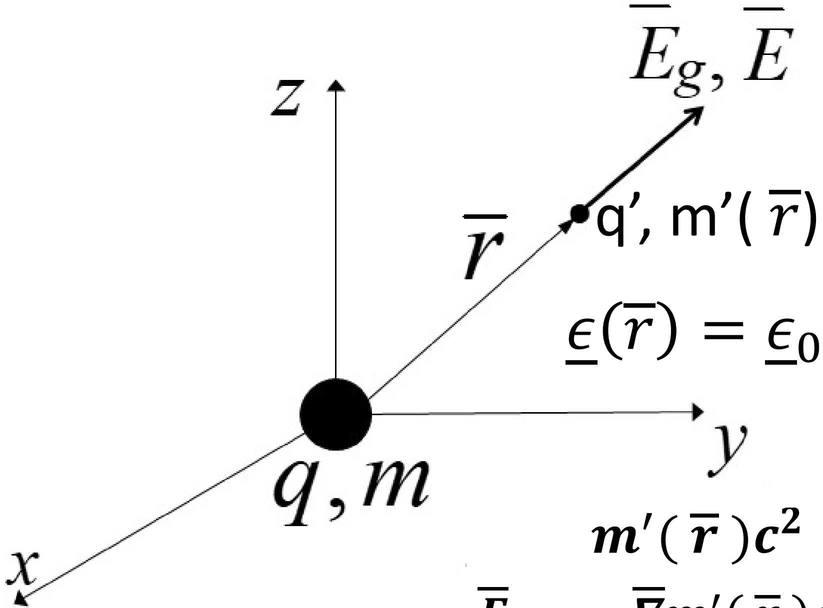
Summary: Gravitational $\overline{E}_g$ and Electric $\overline{E}$ Fields of an Elementary Particle with Charge q and Mass m



Alternate Energy Densities:
$\boldsymbol{W_\tau}$ and $\boldsymbol{W'_\tau = W_\tau + \overline{\nabla}\cdot(\zeta\hat{r}W_\tau)}$

$\boldsymbol{|W'_\tau| \gg W_\tau\,,\ W'_\tau \approx \overline{\nabla}\cdot(\zeta\hat{r}W_\tau)}$

$$\underline{\epsilon}(\overline{r}) = \underline{\epsilon}_0\underline{\epsilon}_r(\overline{r}) = 1/\epsilon(\overline{r})$$

$\boldsymbol{\gamma = UEG\ Constant}$

$$\boldsymbol{m'(\overline{r})c^2 = m'_0\underline{\epsilon}_r(\overline{r})c^2}$$

$$\boldsymbol{\overline{F}_g = -\overline{\nabla}m'(\overline{r})c^2 = -c^2 m'_0\overline{\nabla}\underline{\epsilon}_r(\overline{r})}$$

$$\overline{E}_g = \frac{\overline{F}_g}{m'_0} = -c^2\overline{\nabla}\underline{\epsilon}_r(\overline{r}),$$

$$\overline{\nabla}\cdot\overline{E}_g = -\frac{4\pi G W'_\tau}{c^2} \approx -\frac{4\pi G}{c^2}\overline{\nabla}\cdot(\zeta W_\tau\,\hat{r})$$

$$\overline{E} = \frac{q}{4\pi r^2}\,\underline{\epsilon}(\overline{r})\hat{r},$$

$$\overline{E}_g \approx -\frac{4\pi G\zeta}{c^2}W_\tau\hat{r} = -\gamma W_\tau\hat{r}$$

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A Modified/Unified Electro-Gravity Theory for an Elementary Charge Particle: Key Principles

- **Original W_{τ} and modified W'_{τ} energy densities result in the same total energy W.**

- W'_{τ} is **much stronger in magnitude than the original energy density W_{τ} .**

- **The new UEG gravitational field $\overline{E}_g$ is proportional to the original energy density W_{τ} , as a simple first-order approximation, with the constant of proportionality γ, called the UEG constant.**

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Complete Unified Electro-Gravity (UEG) Solutions for the Inverse-Permittivity Function and Mass of a Static Electron

$$\bar{E}_g = -c^2\bar{\nabla}\underline{\varepsilon}_r(r) \simeq -\gamma W_\tau \hat{r}, \quad \frac{\partial \underline{\varepsilon}_r(r)}{\partial r} \simeq \frac{\gamma W_\tau}{c^2} = \frac{\gamma D^2 \underline{\varepsilon}_r'}{2c^2\varepsilon_0} = \frac{\gamma}{16\pi^2 r^4 \varepsilon_0 c^2}\int_0^q \underline{\varepsilon}_r(q) q\,dq$$

$$\frac{\partial^2 \underline{\varepsilon}_r(r,q)}{\partial(r^{-3})\partial(q^2)} \simeq -\frac{r_\mu^3}{4q^2}\underline{\varepsilon}_r(r,q),\ r_\mu^3 = \frac{\gamma q^2}{24\pi^2\varepsilon_0 c^2},\ \boxed{r_\mu = 5.14\times10^{-16}\gamma^{1/3}}$$

$$\boxed{\underline{\varepsilon}_r(r) = 1 - \frac{t^2}{2^2[1!]^2} + \frac{t^4}{2^4[2!]^2} - \frac{t^6}{2^6[3!]^2} + \ldots = J_0(t),\ t = (\frac{r_\mu}{r})^{1.5}}$$

$$\underline{\varepsilon}_r'(r) = \frac{2}{q^2}\int_0^q \underline{\varepsilon}_r(r,q) q\,dq = 1 - \frac{t^2}{2^2[1!]^2\times 2} + \frac{t^4}{2^4[2!]^2\times 3} - \frac{t^6}{2^6[3!]^2\times 4} + \ldots = (\frac{2}{t})J_1(t)$$

$$\boxed{W = m(r=r_e')c^2 = \iiint_\tau \frac{q^2\underline{\varepsilon}_r'}{32\pi^2 r^4\varepsilon_0}d\tau = \int_r^\infty \frac{q^2\underline{\varepsilon}_r'(r)}{8\pi r^2\varepsilon_0}dr = m_\mu c^2\sum_{k=0}^{\infty}\frac{(-1)^k t^{(2k+2/3)}}{2^{2k}(k!)^2(k+1)(3k+1)},\ m_\mu = \frac{q^2}{8\pi\varepsilon_0 r_\mu c^2}}$$

$$\boxed{m_\mu = 2.49\times10^{-30}\times\gamma^{-1/3}}$$

With a linear medium:

$$\underline{\varepsilon}_r(r) = \underline{\varepsilon}_r'(r) = 1 - \frac{t^2}{2^2 1!} + \frac{t^4}{2^4 2!} - \frac{t^6}{2^6 3!} + \ldots = e^{-t^2/2}$$

$$W = mc^2 = m_\mu c^2 \sum_{k=0}^{\infty}\frac{(-1)^k t^{(2k+2/3)}}{2^{2k}k!(3k+1)}$$

Coulomb mass/energy:

$$\underline{\varepsilon}_r(r) = \underline{\varepsilon}_r'(r) = 1,\ W = mc^2 = m_\mu c^2\frac{r_\mu}{r},\ \frac{m}{m_\mu} = \frac{r_\mu}{r} = t^{2/3}$$

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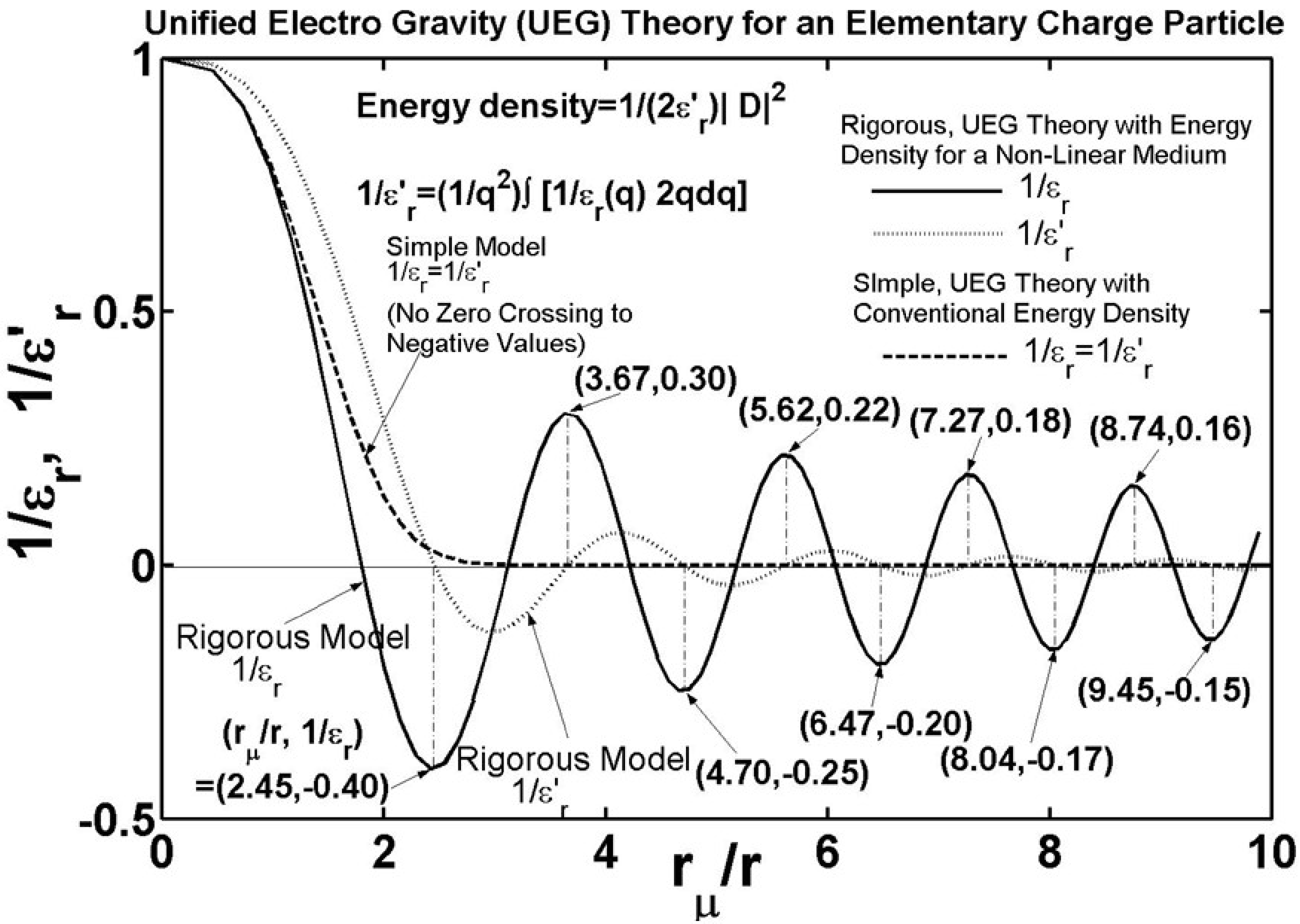
Inverse-Relative-Permittivity Function Around an Elementary Charge Particle



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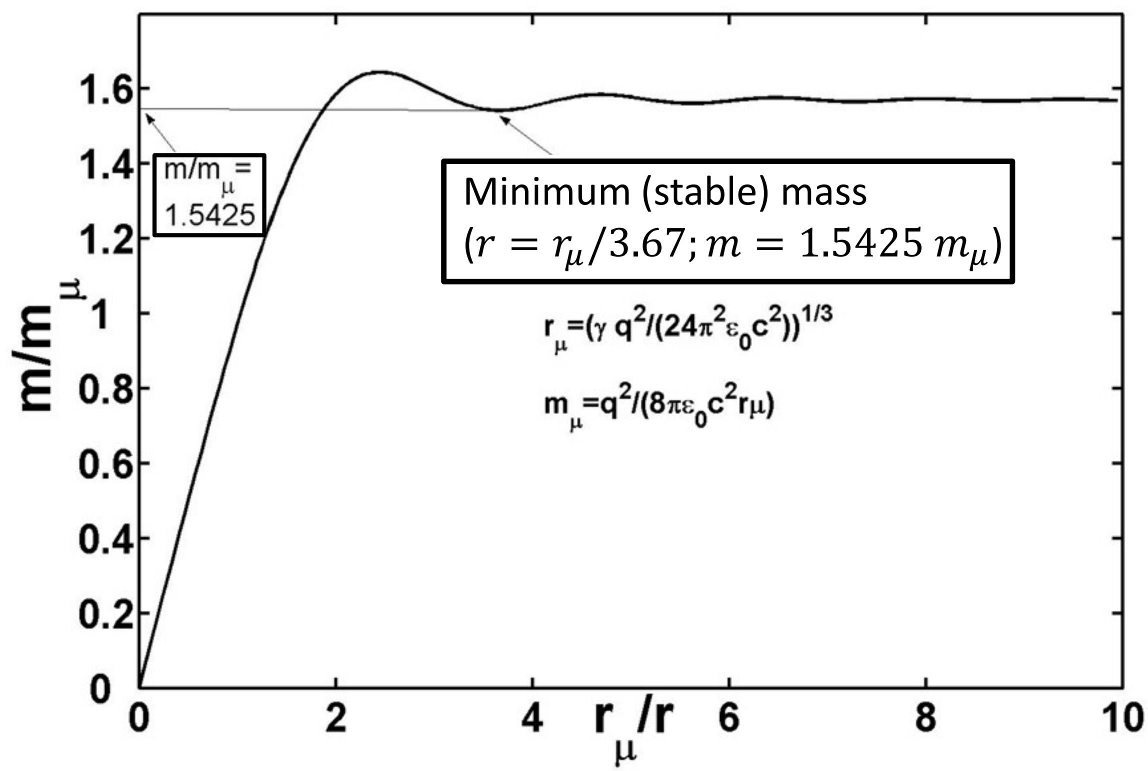
The UEG and Fine-Structure Constants Related by the Normalized Mass Function of an Elementary Charge Particle

Unified Electro-Gravity (UEG) Theory for an Elementary Charge Particle



$$\left(\frac{m_\mu}{m'_e}\right)^3 = \frac{3q^4}{64\pi c^4 \varepsilon_0^2 \gamma m_e'^3} = \frac{3r_e'^2\pi}{\gamma m'_e}, \quad m'_e = \frac{q^2}{8\pi\varepsilon_0 c^2 r'_e}$$

$$\frac{4\gamma m'_e}{r_e'^2} = 12\pi\left(\frac{m'_e}{m_\mu}\right)^3 = 12\pi \times (1.5425)^3 = 138.360 \simeq \frac{1}{\alpha}, \quad \alpha = \text{Fine-Structure Constant}$$

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Dimensionless Relationship Between the UEG Constant, Mass and Classical Radius of an Elementary Charge Particle – Origin of the Fine Structure Constant

$$\frac{m'_e}{m_\mu} = \frac{m_e}{2m_\mu} = 1.5425,\ m_\mu = 2.49\times10^{-30}\times\gamma^{-1/3} = \frac{m_e}{3.085},\ m_e = 9.1\times10^{-31}\text{kg}$$

$$\gamma^{-1/3} = \frac{m_e}{2.49\times3.085\times10^{-30}} = 0.1185,\ \boxed{\text{UEG Constant } \gamma = 5.997\times10^2 (\text{m}/\text{s}^2)/(\text{J}/\text{m}^3)}$$

= A new physical constant of nature

$$m_e = \text{electron mass with spin},\ m'_e = \text{"static" electron mass with no spin} = \frac{m_e}{2}$$

$$\left(\frac{m_\mu}{m'_e}\right)^3 = \frac{3q^4}{64\pi c^4\varepsilon_0^2\gamma m_e'^3} = \frac{3r_e'^2\pi}{\gamma m'_e},\ m'_e = \frac{q^2}{8\pi\varepsilon_0 c^2 r'_e},\ m_e = \frac{q^2}{8\pi\varepsilon_0 c^2 r_e},\ r'_e = 2r_e$$

$$\frac{\gamma m'_e}{r_e'^2} = 3\pi\left(\frac{m'_e}{m_\mu}\right)^3 = 3\pi\times(1.5425)^3 = 34.590 \simeq \frac{1}{4\alpha},\ \frac{\gamma m_e}{r_e^2} = 8\times\frac{\gamma m'_e}{r_e'^2} = 276.720 \simeq \frac{2}{\alpha}$$

$$\alpha = \text{Fine-Structure Constant} = \frac{q^2}{4\pi\epsilon_0 c\hbar},\ \frac{2}{\alpha} = \frac{8\pi\epsilon_0 c\hbar}{q^2} = 274.072$$

The small (< 1%) of difference between the fine-structure constant (measured) and the new dimensionless constant from the first-order UEG theory would be corrected through a more rigorous UEG model

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Fundamental Significance of the Fine Structure Constant

"… It's one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by humans. You might say the "hand of God" wrote that number, and we don't know how He pushed His pencil." — *Richard Feynman*

"When I die my first question to the Devil will be: What is the meaning of the fine structure constant?" — *Wolfgang Pauli*

"…Werner Heisenberg once proclaimed that all the quandaries of quantum mechanics would shrivel up when 137 was finally explained." — *Leon M. Lederman*

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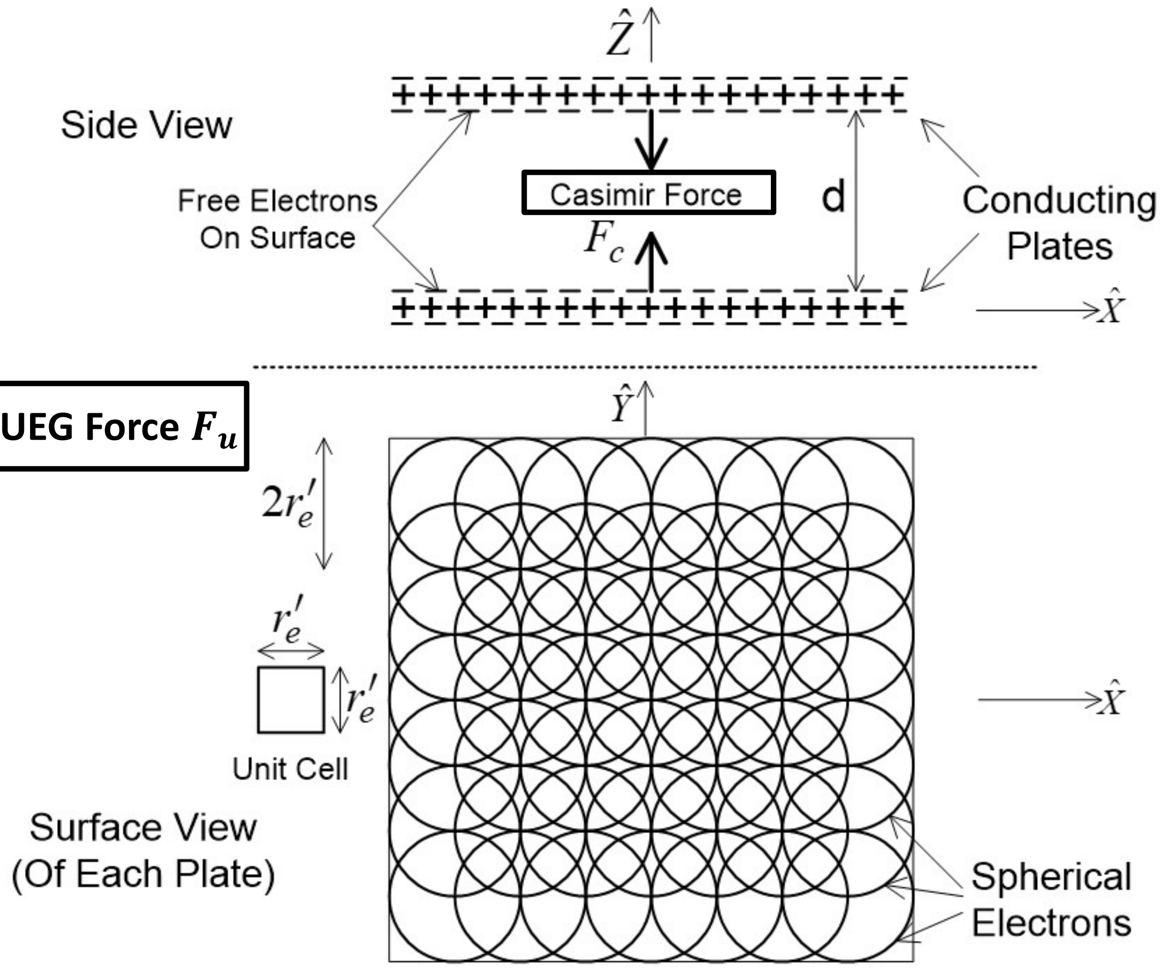
Casimir Effect Modeled as UEG Force Due to Residual Electric Fields of the Free Electrons in a Conducting Plate

Casimir Force F_c = UEG Force F_u



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Fine-Structure Constant Derived from the Casimir Effect Modeled as an UEG Effect – Validations of the UEG Theory and the Origin of the Fine-Structure Constant

$$<w_e>_{spin=\pm\frac{1}{2}} = \frac{<Q^2>}{32\pi^2\varepsilon_0 d^4} = \frac{q^2}{64\pi^2\varepsilon_0 d^4}$$

$$<w_e> = <w_e>_{spin=+\frac{1}{2}} + <w_e>_{spin=-\frac{1}{2}} = 2<w_e>_{spin=\pm\frac{1}{2}} = \frac{q^2}{32\pi^2\varepsilon_0 d^4}$$

$$<F_0>_{spin=\pm\frac{1}{2}} = E_{ueg} m_e = \gamma <w_e> m_e = \frac{\gamma q^2 m_e}{32\pi^2\varepsilon_0 d^4}$$

$$<F_0> = <F_0>_{spin=+\frac{1}{2}} + <F_0>_{spin=-\frac{1}{2}} = 2<F_0>_{spin=\pm\frac{1}{2}} = \frac{\gamma q^2 m_e}{16\pi^2\varepsilon_0 d^4}$$

$$F_u(\text{UEG Force}) = <F_0>\frac{A}{A_0} = \frac{\gamma q^2 m_e A}{64\pi^2\varepsilon_0 r_e^2 d^4} = F_c(\text{Casimir Force}) = \frac{\hbar c \pi^2 A}{240 d^4},\quad A_0 = r_e'^2 = 4r_e^2$$

$$\boxed{\frac{\gamma m_e}{r_e^2} = \left(\frac{\pi^3}{15}\right)\left(\frac{4\hbar c\varepsilon_0\pi}{q^2}\right) = \frac{2.067}{\alpha} \simeq \frac{2}{\alpha},\ \alpha = \frac{q^2}{4\hbar c\varepsilon_0\pi} = \text{Fine-Structure Constant}}$$

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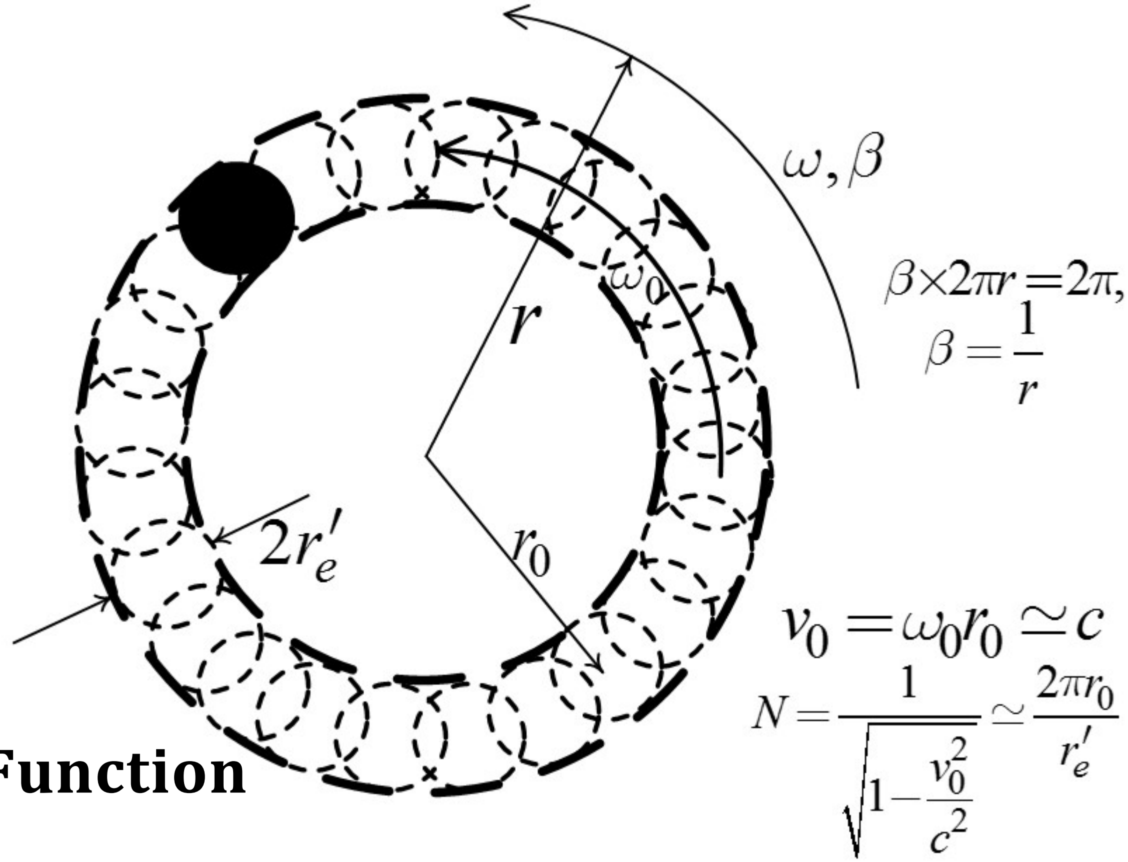
Spinning of a Stable Static Elementary Charge, Supported by the UEG Forces Due to its Own Electromagnetic Fields

Spinning Orbit is an Equivalent <u>Rotational Electro-Gravitational Inertial Frame</u>



$$\boldsymbol{\epsilon_r(\bar{r}, t)} \equiv$$

QuantumWave Function

A Spinning Electron Shown on the X-Y Plane

The oscillating permittivity wave function in the surrounding empty space complements the central spinning charge particle: <u>wave-particle-wave duality</u>

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Dynamical Model of a Spinning Electron, Supported by the UEG Forces Due to its Own Electromagnetic Fields: Re-Confirmation of the Origin of the Fine-Structure Constant

$$\underline{W}_\tau = \frac{\varepsilon_0}{2}\underline{E}^2 = \frac{\varepsilon_0}{2}\left(\frac{q}{4\pi\varepsilon_0 r_0^2}\right)^2 (N)^2 \simeq \frac{\varepsilon_0}{2}\left(\frac{q}{4\pi\varepsilon_0 r_0^2}\right)^2\left(\frac{2\pi r_0}{r_e'}\right)^2$$

$$E_g(\text{Total}) = E_g(\text{UEG, Electric}) = \gamma \underline{W}_\tau\left(\frac{4r'^2}{\pi r'^2}\right) \simeq \gamma\frac{\varepsilon_0}{2}\left(\frac{q}{4\pi\varepsilon_0 r_0^2}\right)^2\left(\frac{2\pi r_0}{r_e'}\right)^2\left(\frac{4}{\pi}\right) = \frac{v_0^2}{r_0} \simeq \frac{c^2}{r_0}$$

$$\boxed{\frac{\gamma q^2}{2\pi\varepsilon_0 c^2 r_e'^3} = \frac{4\gamma m_e'}{r_e'^2} \simeq \frac{r_0}{r_e'} \simeq \frac{1}{\alpha},\ \frac{\gamma m_e}{r_e^2} \simeq \frac{2r_0}{r_e'} \simeq \frac{2}{\alpha},\ \alpha = \text{Fine-Structure Constant}}$$

$$\left(\frac{4r'^2}{\pi r'^2}\right) = \left(\frac{4}{\pi}\right) = \text{Geometrical transform factor between square/circular grid}$$

$$\text{"Static" electron mass without spin} = m_e' = \frac{q^2}{8\pi\varepsilon_0 c^2 r_e'},\ \text{Electron mass with spin} = m_e = \frac{q^2}{8\pi\varepsilon_0 c^2 r_e},\ m_e \simeq 2m_e',\ r_e \simeq \frac{r_e'}{2}$$

$$\text{Electron spin-angular momentum} = m_e' r_0 v_0 = \frac{q^2 r_0 v_0}{8\pi\varepsilon_0 c^2 r_e'} = \frac{\hbar}{2},\ \frac{r_0}{r_e'} = \frac{4\pi\varepsilon_0 c\hbar}{q^2}\left(\frac{c}{v_0}\right) \simeq \frac{4\pi\varepsilon_0 c\hbar}{q^2} = \frac{1}{\alpha},\ v_0 \simeq c$$

$$\boxed{E_g(\text{UEG, Magneticic}) = E_{gum} = -E_g(\text{UEGravitoMagnetic}) = -E_{gm}\ \text{(Next Slide)}}$$

$$E_g(\text{Total}) = E_g(\text{UEG, Electric}) + E_g(\text{UEG, Magneticic}) + E_g(\text{UEGravito} - \text{Magnetic})$$
$$= E_{gue} + E_{gum} + E_{gm} = E_{gue} = E_g(\text{UEG, Electric})$$

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Dynamical Model of a Spinning Electron, Supported by the UEG Forces Due to its Own Electromagnetic Fields: UEG Force Due to Magnetic Field is Negative of That Due to Gravito-Magnetic field

$$\bar{\mu}_S = \hat{z}\frac{\hbar q}{2m_e},\ \bar{H} = \hat{\theta}\frac{\mu_S}{4\pi r^3}\sin\theta + \hat{r}\frac{\mu_S}{2\pi r^3}\cos\theta,\ \bar{E} = \hat{r}\frac{q}{4\pi\varepsilon r^2},\ \bar{v}(EM) = \frac{\bar{E}\times\bar{H}}{(\frac{1}{2}\varepsilon|\bar{E}|^2)} = \hat{\phi}\frac{2\mu_S\sin\theta}{qr} = \hat{\phi}\frac{\hbar\sin\theta}{m_e r}$$

$$\bar{S} = \hat{z}\frac{\hbar}{2} = m_e'\bar{r}\times\bar{v} = \frac{m_e}{2}\bar{r}\times\bar{v} = \hat{z}\frac{m_e}{2}rv_\phi\sin\theta,\ \bar{v}(QM) = \hat{\phi}\frac{\hbar}{m_e r\sin\theta}$$

$$\bar{E}_{gum} = -\hat{r}\gamma < (\frac{1}{2}\mu|\bar{H}|^2) > = -\hat{r}\frac{\gamma\mu\mu_S^2}{32\pi^2 r^6}\frac{\int_0^\pi(\sin^2\theta + 4\cos^2\theta)\sin\theta d\theta}{\int_0^\pi\sin\theta d\theta} = -\hat{r}\frac{\gamma\mu\mu_S^2}{16\pi^2 r^6} = -\hat{r}\frac{\gamma\mu\hbar^2 q^2}{64\pi^2 m_e^2 r^6}$$

$$\bar{E}_{gue} = -\hat{r}\gamma(\frac{1}{2}|\bar{E}|^2) = -\hat{r}\frac{\gamma q^2}{32\pi^2\varepsilon r^4},\ \rho_{vu} = -\varepsilon\bar{\nabla}\cdot\bar{E}_{gue} = -\frac{\gamma q^2}{16\pi^2 r^5},\ \bar{\nabla}\times\bar{H}_{gu} = \bar{J}_{gu} = \rho_{vu}\bar{v}(EM)$$

$$\bar{H}_{gu} = \hat{\theta}H_{gu\theta},\ \frac{1}{r}\frac{\partial(rH_{gu\theta})}{\partial r} = \rho_{vu}v_\phi(EM) = -\frac{\gamma q^2\hbar\sin\theta}{16\pi^2 m_e r^6},\ H_{gu\theta} = \frac{\gamma q^2\hbar\sin\theta}{64\pi^2 m_e r^5}$$

$$\boxed{\bar{E}_{gm} = -\mu < \bar{v}\times\bar{H}_{gu} > = -\mu\bar{v}(QM)\times\bar{H}_{gu} = \hat{r}\mu v_\phi(QM)H_{gu\theta} = \frac{\gamma\mu q^2\hbar^2}{64\pi^2 m_e^2 r^6} = -\bar{E}_{gum}}$$

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Dynamical Model of a Spinning Electron, Supported by the UEG Forces Due to its Own Electromagnetic Fields: Origin of the Energy-Frequency Relationship of the Quantum Theory and the Electron g-Factor

Approximate Model:

$$m_e' v_0 r_0 = \frac{\hbar}{2}, \quad \boxed{\text{Energy} = W = m_e c^2 \simeq 2m_e' c^2 = \frac{\hbar c^2}{v_0 r_0} \simeq \frac{\hbar v_0}{r_0} = \hbar\omega_0 \simeq \hbar\omega,} \quad v_0 \simeq c,\ \omega_0 \simeq \omega,\ m_e \simeq 2m_e'$$

Rigorous Model:

Transformtion between external (unprimed) and its equivalent rotational (prime) inertial frame:

$$e^{j(\omega t - \beta s)} = e^{j(\omega' t' - \beta' s')},\ t = \frac{t' + s' v_0 / c^2}{\sqrt{1 - \frac{v_0^2}{c^2}}},\ s = \frac{s' + t' v_0}{\sqrt{1 - \frac{v_0^2}{c^2}}},\ \beta \times (s = 2\pi r_0) = 2\pi,\ \beta = \frac{1}{r_0}$$

$$\omega = \omega' = \frac{\omega - \beta v_0}{\sqrt{1 - \frac{v_0^2}{c^2}}} = \frac{\omega - v_0 / r_0}{\sqrt{1 - \frac{v_0^2}{c^2}}} = \frac{\omega - \omega_0}{\sqrt{1 - \frac{v_0^2}{c^2}}},\ \omega_0 = \omega(1 - \frac{1}{N}) = \frac{v_0}{r_0} \simeq \omega,\ N = \frac{1}{\sqrt{1 - \frac{v_0^2}{c^2}}} >> 1$$

Energy (W) — UEG wave frequency (ω) — electron g — factor Relationship :

$$J = \frac{\hbar}{2} = m_e' v_0 r_0,\ \mu_J = \frac{q}{2} v_0 r_0 = J \frac{q}{2m_e} g,\ m_e = g m_e',\ W = m_e c^2 = g m_e' c^2 = g c^2 \frac{\hbar}{2 v_0 r_0} = \hbar (\frac{c^2}{v_0^2})(\frac{v_0}{r_0})(\frac{g}{2})$$

$$= \hbar \frac{\omega_0}{(1 - \frac{1}{N^2})} \frac{g}{2} = \hbar\omega \frac{(1 - \frac{1}{N})}{(1 - \frac{1}{N^2})} \frac{g}{2} = \hbar\omega \frac{1}{(1 + \frac{1}{N})} \frac{g}{2},\quad \boxed{\text{Energy=}W = m_e c^2 = \hbar\omega,\quad \frac{g}{2} - 1 = \frac{1}{N} = \frac{r_e'}{2\pi r_0} \simeq \frac{\alpha}{2\pi}}$$

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UEG Theory: Origin of Other Fundamental Quantum Concepts

- The fine-structure constant $\boldsymbol{\alpha}$, relates the elementary charge q and Planck's constant $\hbar$ (given $\boldsymbol{c}, \boldsymbol{\epsilon_0}$), and its value is predetermined as per the UEG theory.

- Therefore, the elementary charge q must take a fixed value (quantized charge), given a fixed $\hbar$ (quantized angular momentum), and vice versa. q and $\hbar$ are not independent parameters.

- The UEG fields of one electron, due to its non-linear nature, would mix with that of an interacting, colliding electron, or the fields of an interacting electromagnetic/light radiation, resulting in frequency shifts

- This would physically explain frequency shifts in the photo-electric effect, as well as in Raman and Compton Scatterings, under a unified theoretical/physical framework

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Unified Electro-Gravity (UEG) Theory of an Electron, and Origin of the Fine-Structure Constant and Quantum Concepts: Summary

- The new UEG theory self-consistently models a stable electron structure.
- A dimensionless constant deduced from the UEG theory is shown to be closely (numerologically) related to the fine-structure constant of electrodynamics.
- The Casimir effect is shown to be a UEG effect. This re-validates the UEG theory, and its relation to the fine-structure constant.
- The UEG theory also self-consistently models a spinning electron, sustained by the UEG effects of its own electro-magnetic fields.

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Unified Electro-Gravity (UEG) Theory of an Electron, and Origin of the Fine-Structure Constant and Quantum Concepts: Summary (Continued)

- The complete UEG model of the spinning electron re-validates the UEG theory, and reveals that the new UEG theory is the physical origin of the fine-structure constant, as well as of many fundamental quantum concepts and phenomena.

Supplementary Slides:

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Generalization of the UEG Theory to Model Other Charged Particles

- The fixed UEG constant γ is replaced by a general UEG function $\gamma(r)$, dependent on the radial distance (r) or equivalent energy density.
- The general UEG function $\gamma(r)$ maybe discretized into fixed constants γ_i for different ranges of radius or equivalent energy density.
- Extending the dimensionless relationship $\frac{\gamma m_e}{r_e^2} = \frac{2}{\alpha} = \frac{\gamma_i m_i}{r_i^2}$ would result in having stable charged particles of increasing mass m_i (and other close masses m_{ij}) with proportionately smaller classical radius r_i, associated with appropriately smaller UEG constant γ_i

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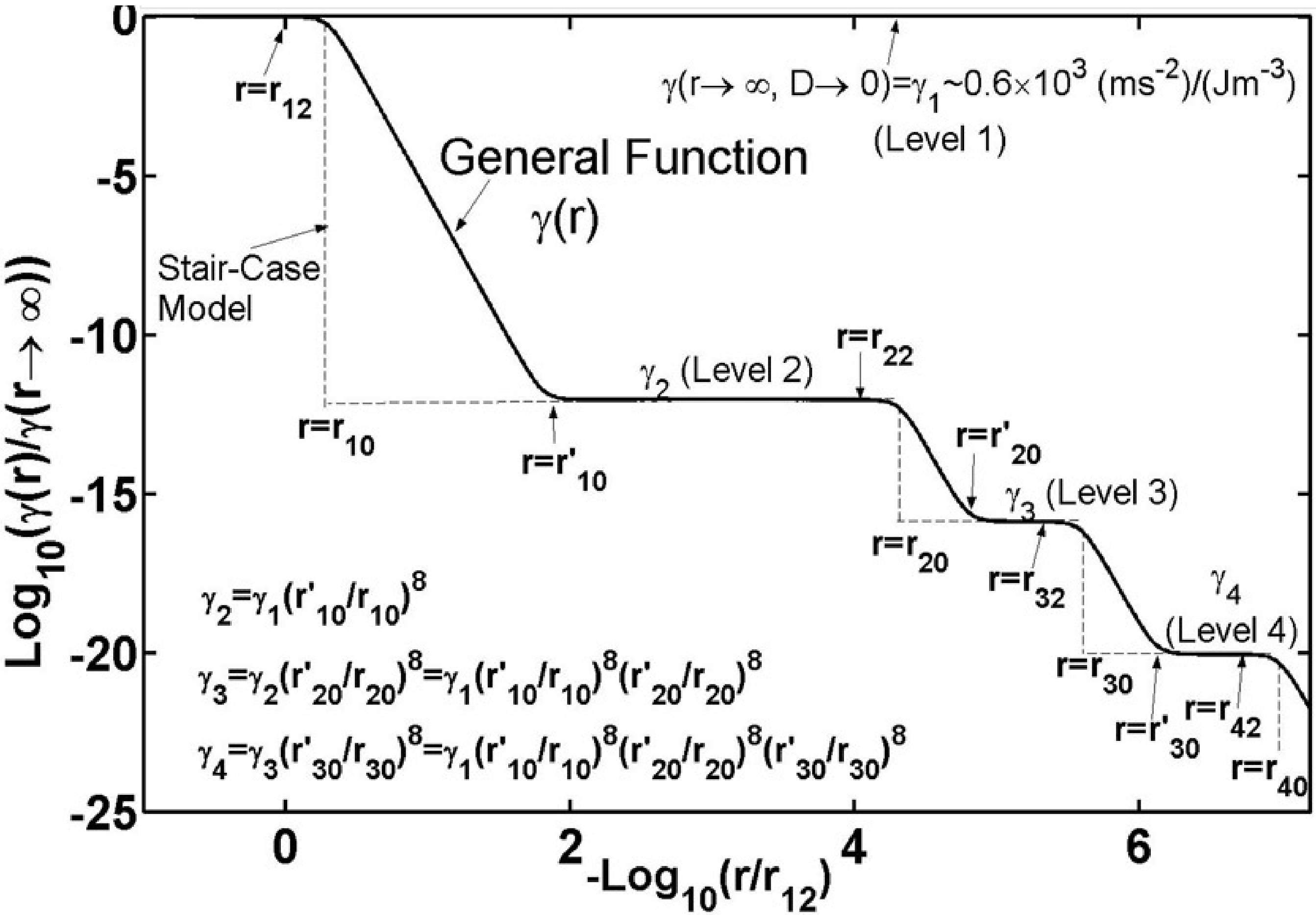
A Generalized UEG Model: A General UEG Parameter $\gamma(r)$, as a Function of Radial Distance (r)



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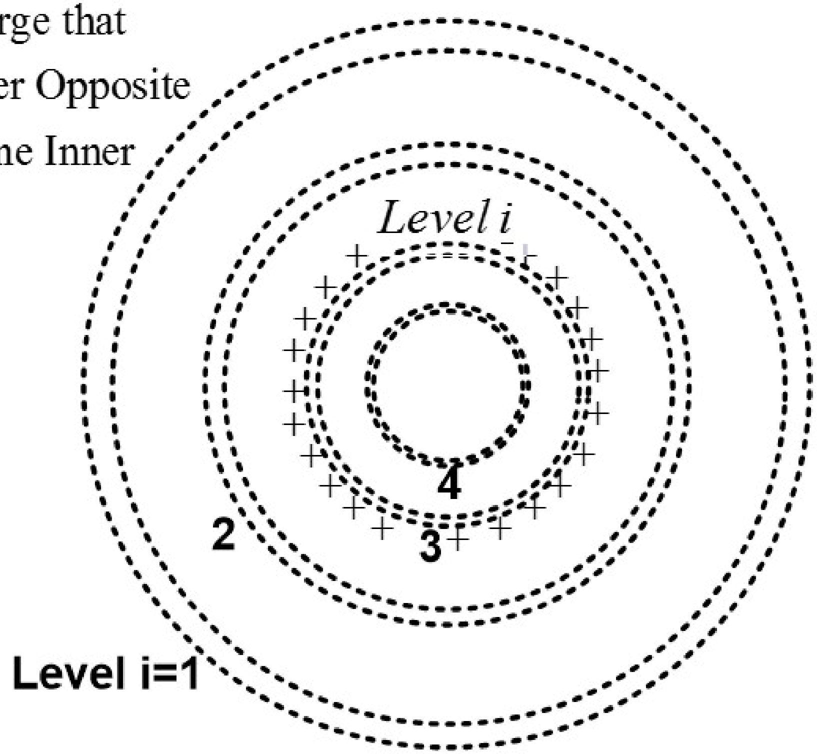
For a Neutral Particle:
$\underline{i}$ is the Outer-Most Level
Having a Charge that
Sheilds another Opposite
Charge at Some Inner
Level $i \geq \underline{i}$

For a Charged Particle (Shown in the Diagram):
$\underline{i}$ is the Outer-Most Charged Level



Energy Levels of Particles Associated With Distinct Levels of Radial Regions

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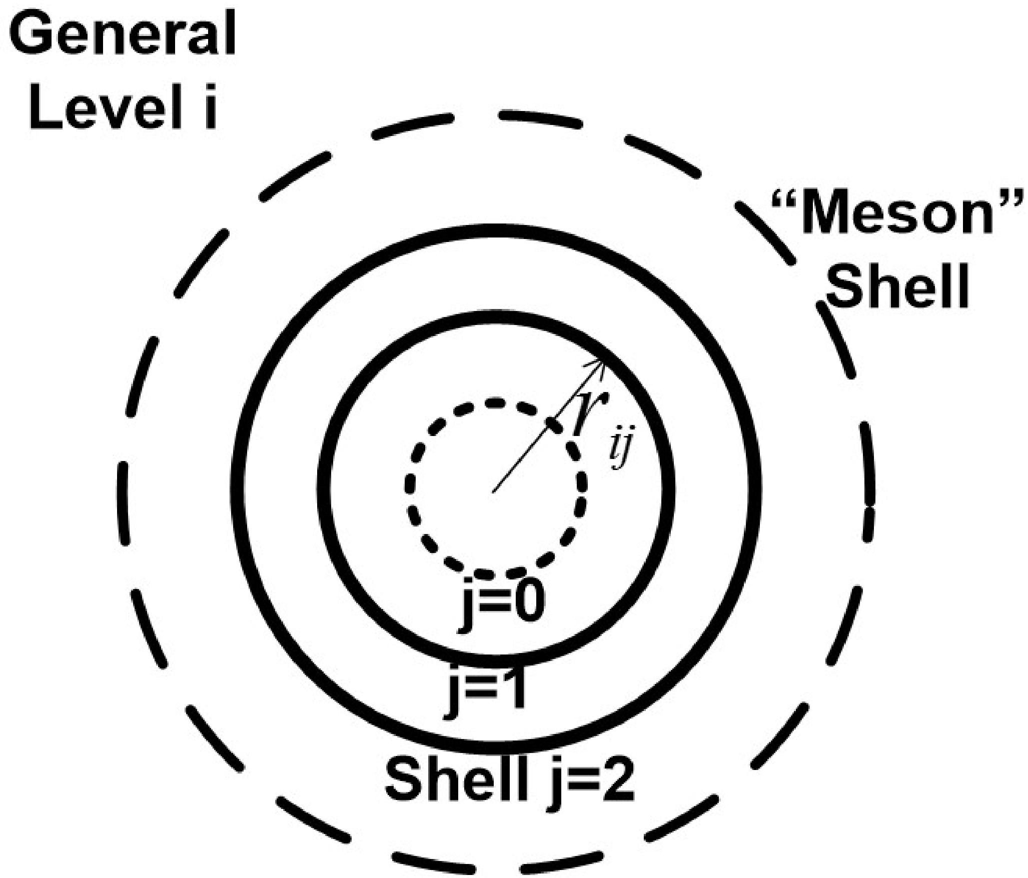

Details of the Radial Region for One Energy Level (i), Having Shells (j) of Finer Structures with Critical Radii r_{ij} and Associated Mass/Energy Sub-Levels m_{ij}

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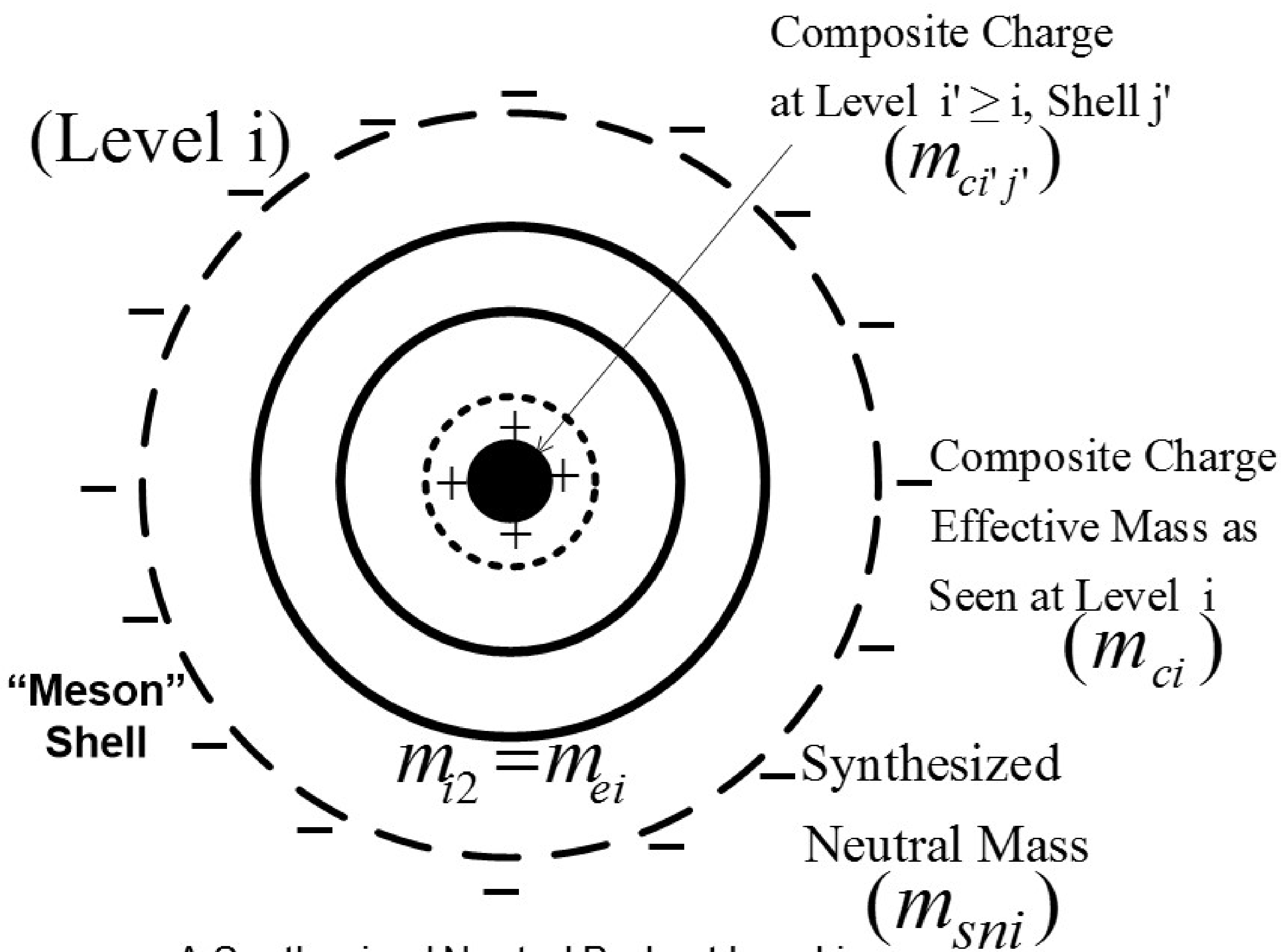
Generalization of the UEG Theory to Model Other Composite Charged/Neutral Particles

- A neutral particle maybe synthesized by enclosing an elementary charge particle by another charge layer of equal magnitude but opposite sign.
- A stable radius for the enclosing charge exists for each level (i), referred to as the "meson shell'' (in reference to its frequent use for mesons), resulting in a synthesized neutral particle with significantly reduced mass compared to the mass m_i of the original charged particle.
- A new charged particle may be synthesized, by having an original elementary charge particle enclosing a synthesized neutral particle.
- The above mechanisms can then be extended to synthesize other charged/neutral particles with increasing number of charge layers



A Synthesized Neutral Body at Level i

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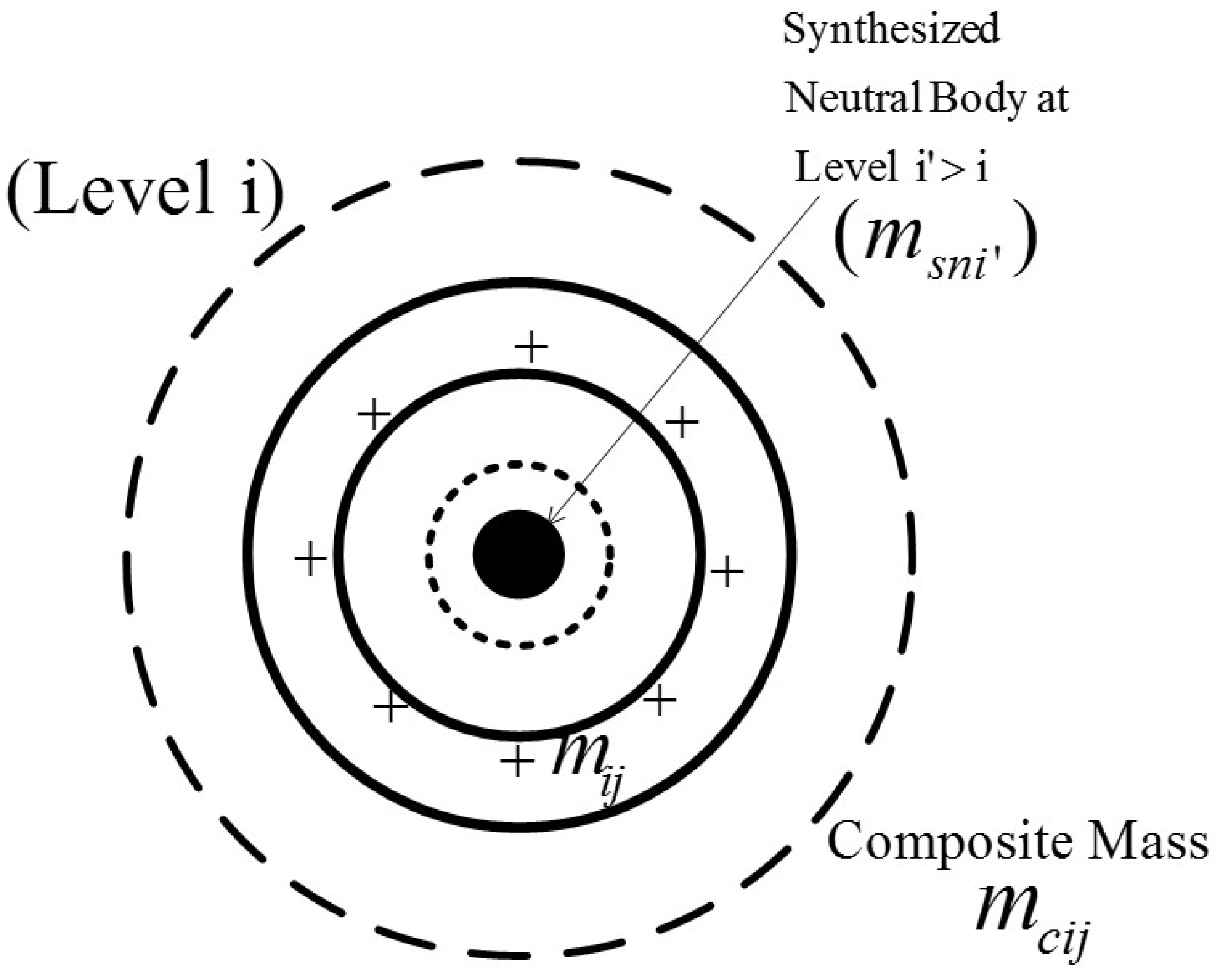

A General "Composite" Positive Charged Body Seen at Level i, Shell (j=1,2)

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Level-Shell Charge Structure for the UEG Model of an Electron

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
	−							

Level-Shell Charge Structure for the UEG Model of a Proton

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
				+				

Level-Shell Charge Structure for the UEG Model of a Neutron

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
−				+				

Level-Shell Charge Structure for the UEG Model of a Muon

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
		−	−	+				

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Level-Shell Charge Structure for the UEG Model of a Charged (+/-) Pion

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
	+/−		−	+				

Level-Shell Charge Structure for the UEG Model of a Neutral Pion

Level-One			Level-Two			Level-three		
Shells			Shells			Shells		
Meson	Two	One	Meson	Two	One	Meson	Two	One
−	+		−	+				

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Similar UEG Level-Shell Models of Other Particles (Baryons):

Table I

UEG Shell Model of Baryons

Name	Energy	Energy (Est)	Level One Configuration			Level Two Configuration			Level Three Configuration			Level Four Configuration		
	(MeV)	(MeV)	Meson Shell	Shell 2	Shell 1	Meson Shell	Shell 2	Shell 1	Meson Shell	Shell 2	Shell 1	Meson Shell	Shell 2	Shell 1
p	938.3	938.3					+							
n	939.6	939.6	−					+						
Λ 0	1115	1114.5	−					+	−	+				
Λ +	2286	2285.8									+			
Λ0b	5620	5619.8	−										+	
Σ +	1189	1199.4						+	−		+			
Σ 0	1192	1199.4	−					+	−		+			
Σ −	1197	1199.4						−	+		−			
Σc++(?)	2454													
Σc +	2453	2353		+					−	+				
Σc0	2454	2353	−	+					−	+				
Σb +	5807	5806.8												+
Σb0		5806.8	−											+
Σb −	5815	5806.8												−
Ξ 0	1314	1320.2	−				+		−		+			
Ξ −	1321	1320.2					−		+		−			
Ξc +	2467	2501			+	−				+				
Ξc0	2470	2501	−		+	−				+				
Ξc+'	2576	2587			+	−					+			
Ξc0'	2578	2587	−		+	−					+			
Ξcc++(?)														
Ξcc+	3518	3495.2		+					−		+			
Ξb0		5796.5	−		+	−		+				−	+	
Ξb −	5790	5796.5			−	+		−				+	−	
Ωc0	2695	2645.4	−		+				−		+			
Ωb −	6165	6143						−	+				−	
Λ +	1232							+	+	−				
Σ +	1383							+	+		−			
Σ 0	1384		−					+	+		−			
Σ −	1387							−	−		+			
Σc +	2517			+					+	−				
Σc0	2518		−	+					+	−				
Ξ 0	1531		−				+		+		−			
Ξ −	1535						−		−		+			

Lower block for selected J=3/2 baryons as examples. Top block for regular J=1/2 baryons.

Compare J=3/2 baryons with corresponding J=1/2 baryons, in terms of their relative charge structure.

They are different equivalent charge states of the same composite structure. Although the two charge states are equivalent electrically, but with spinning they lead to different (magnetically) dynamic states, having somewhat diffeerent energy/mass.

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Similar UEG Level-Shell Models of Other Particles (Baryons):

Name	Energy (MeV)	Energy (Est) (MeV)	Calculations
p	938.3	938.3	
n	939.6	939.6	
$\Lambda\ 0$	1115	1114.5	1740/2*0.189*0.117/0.11+939.6=1114.5. Meson factor: 0.189, Level 3.
$\Lambda\ +$	2286	2285.8	1816+939.6/2=2285.8
$\Lambda 0b$	5620	5619.8	4242+1816/2+939.8/2=5619.8
$\Sigma\ +$	1189	1199.4	1816/2*0.269*0.117/0.11+939.6=1199.4. Meson factor: 0.269, Level 3.
$\Sigma\ 0$	1192	1199.4	
$\Sigma\ -$	1197	1199.4	
$\Sigma c++(?)$	2454		
$\Sigma c+$	2453	2353	1740/2*0.189/0.11*0.255/0.162=2353. Meson factor: 0.189, Level 3.
$\Sigma c0$	2454	2353	
$\Sigma b+$	5807	5806.8	4429+1816/2+939.6/2=5806.8
$\Sigma b0$		5806.8	
$\Sigma b-$	5815	5806.8	
$\Xi\ 0$	1314	1320.2	1816/2*0.269*0.172/0.11+938.3=1320.2. Meson factor: 0.269, Level 3.
$\Xi\ -$	1321	1320.2	
$\Xi c+$	2467	2501	(1740+939.6/2)*0.95*0.193/0.162=2501. Meson factor: 0.95 (alpha_c=4.71), Level 2.
$\Xi c0$	2470	2501	
$\Xi c+'$	2576	2587	(1816+939.6/2)*0.95*0.193/0.162=2587. Meson factor: 0.95 (alpha_c=4.87), Level 2.
$\Xi c0'$	2578	2587	
$\Xi cc++(?)$			
$\Xi cc+$	3518	3495.2	1816/2*0.269/0.11*0.255/0.162=3495.2. Meson factor: 0.269, Level 3.
$\Xi b0$		5796.5	(4242/2*0.189/0.097*0.117/0.11+939.6/2)*(1.0)*0.193/0.162=5796.5. Meson factors: 1.0 (alpha_c=10.37), Level 2;
			0.189, Level 4.
$\Xi b-$	5790	5796.5	
$\Omega c0$	2695	2645.4	1816/2*0.269/0.11*0.193/0.162=2645.4. Meson factor: 0.269, Level 3.
$\Omega b-$	6165	6143	(4242+1816/2)*0.95*0.117/0.11+939.6=. Meson factor: 0.95 (alpha_c=5.92), Level 3.
$\Lambda\ +$	1232		
$\Sigma\ +$	1383		
$\Sigma\ 0$	1384		
$\Sigma\ -$	1387		
$\Sigma c+$	2517		
$\Sigma c0$	2518		
$\Xi\ 0$	1531		
$\Xi\ -$	1535		

Refer to the UEG synthesis rules for different particles (sections II-VI). The mass/energy formula associated in the synthesis of a particular particle maybe evident from its calculation shown above. For example, the specific calculations for the particle $(\Xi 0)$ are explained in the following:

Step 1: Neutral Particle of Kind 1, at level 3 (see section IV):
$m_{31} = W_{31}/2 = 1816/2\text{MeV}$ (Table V), $m'_{e3} = W_{32}/2 = 1740/2$ MeV (Table V),
$\alpha_c = m_{31}/m'_{e3} = m_c/m'_{e3} = 1.044$, $\alpha_m = 0.269 = \alpha_{mi1}$ (Table V, Fig.7),
$m_{sn3} = \alpha_m m_c = \alpha_{mi1} m_{31} = 1816/2 * 0.269$ MeV

Step 2: Composite Charge Particle, at level 2 (see section VI):
$m_{22} = W_{22} = 938.3$ MeV (Table V, assume full mass with spin for the level 2),
$\varepsilon_{r22} = 0.172$, $\varepsilon_{r20} = 0.11$ (Table V),
$m_{c2} = m_{22} + [m_{sn3}/\varepsilon_{r20}]\varepsilon_{r22} = 1816/2*0.269*0.172/0.11$ MeV.

Step 3: Neutral Particle of Kind 1, at level 1 (see section IV):
$m_c = m_{c2}$, $m'_{e1} = W_{12}/2 = 0.5/2$ MeV (Table V),
$\alpha_c = m_c/m'_{e1} >> 1$, $\alpha_m \simeq 1$ (Fig.7),
$m_{sn1} = \alpha_m m_c \simeq m_c = m_{c2} = 1816/2*0.269*0.172/0.11$ MeV=1320.2 MeV=mass of the particle Ξ_0.
(Notice that this last step is a trivial approximation. Such a trivial approximate step for synthesis of a neutral particle at the level 1 may not be explicitly shown in the above calculations table.)

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Unified Electro-Gravity (UEG) Theory: Application to Astrophysical Problems

- The UEG theory is successfully applied to support central acceleration in spiral galaxies, with the UEG field produced due to the energy density associated with stellar light radiation. (Presented in AAS 235 meeting, Jan 2020)
- The UEG theory is also applied to model excess gravitational mass in galaxy clusters, with the UEG field produced due to the energy density associated with the cosmic microwave background (CMB) radiation. (Presented in AAS 236 meeting, June 2020)
- The UEG theory is similarly applied to cosmology, by considering the UEG field produced due to the energy density associated with the cosmic microwave background (CMB) radiation, to model the accelerated expansion of the current universe. (Presented in AAS 237 meeting, Jan 2021)

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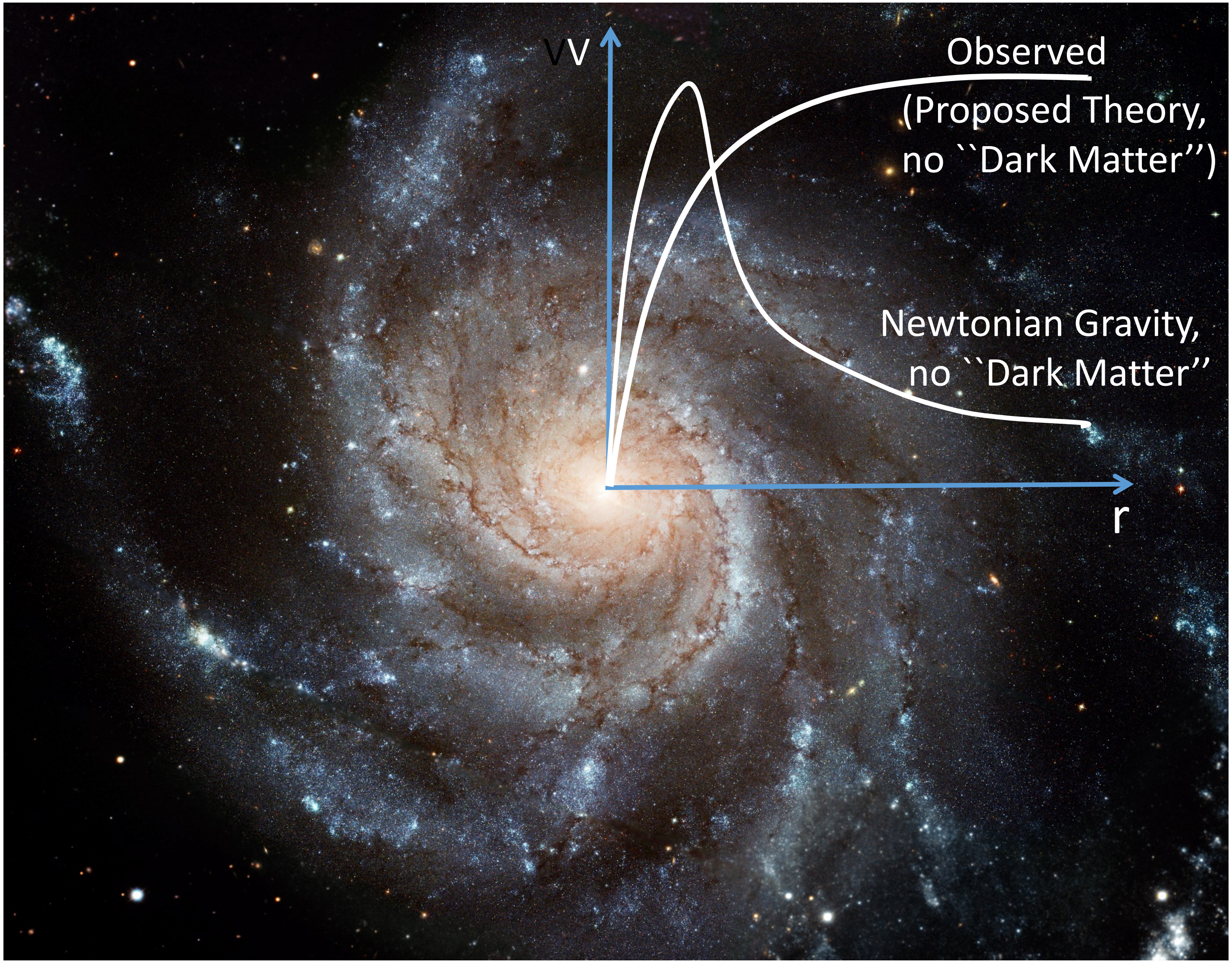
UEG Model for "Flat Rotation" in Spiral Galaxies



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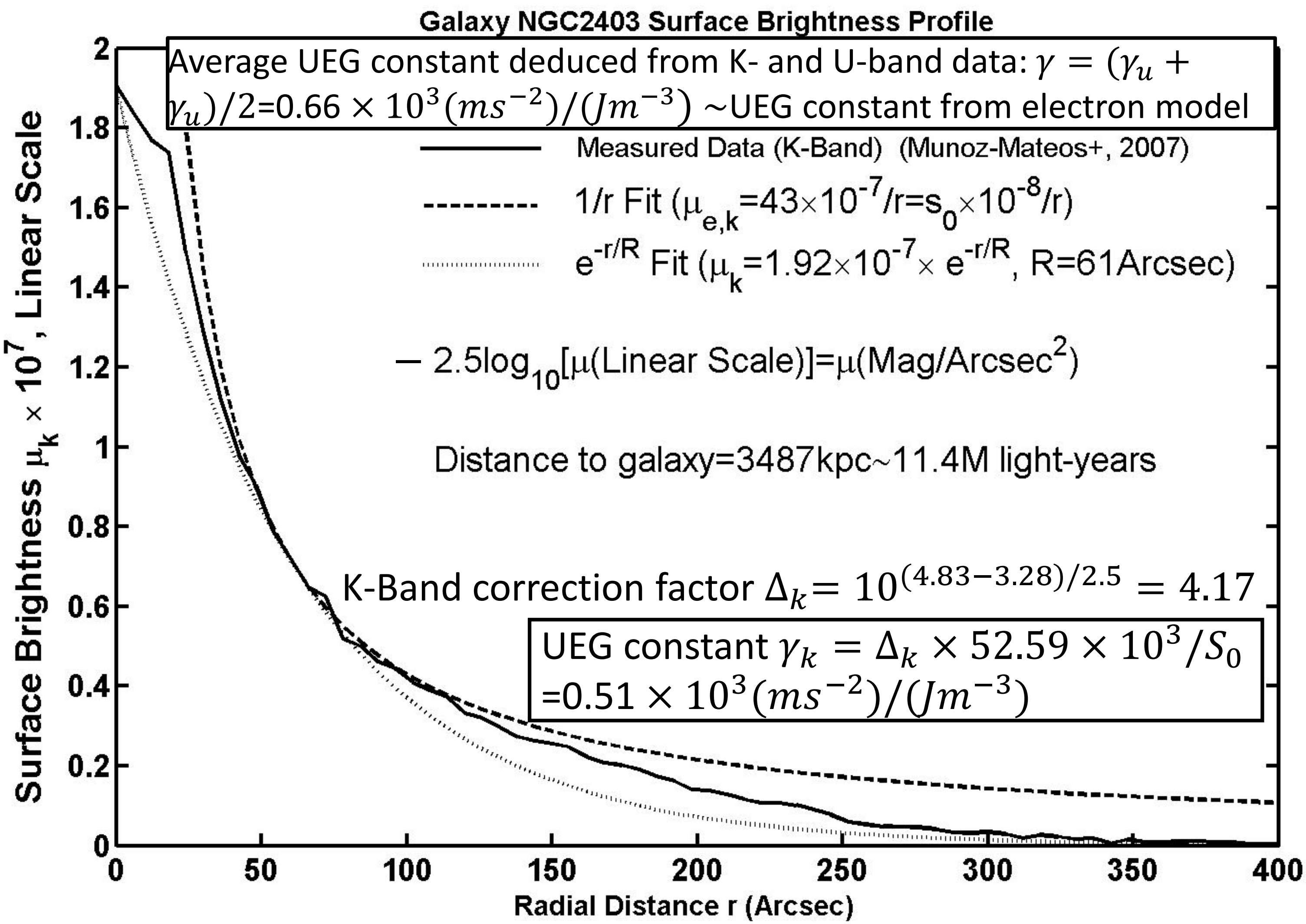
The UEG Constant Deduced from Specific Galaxy Data



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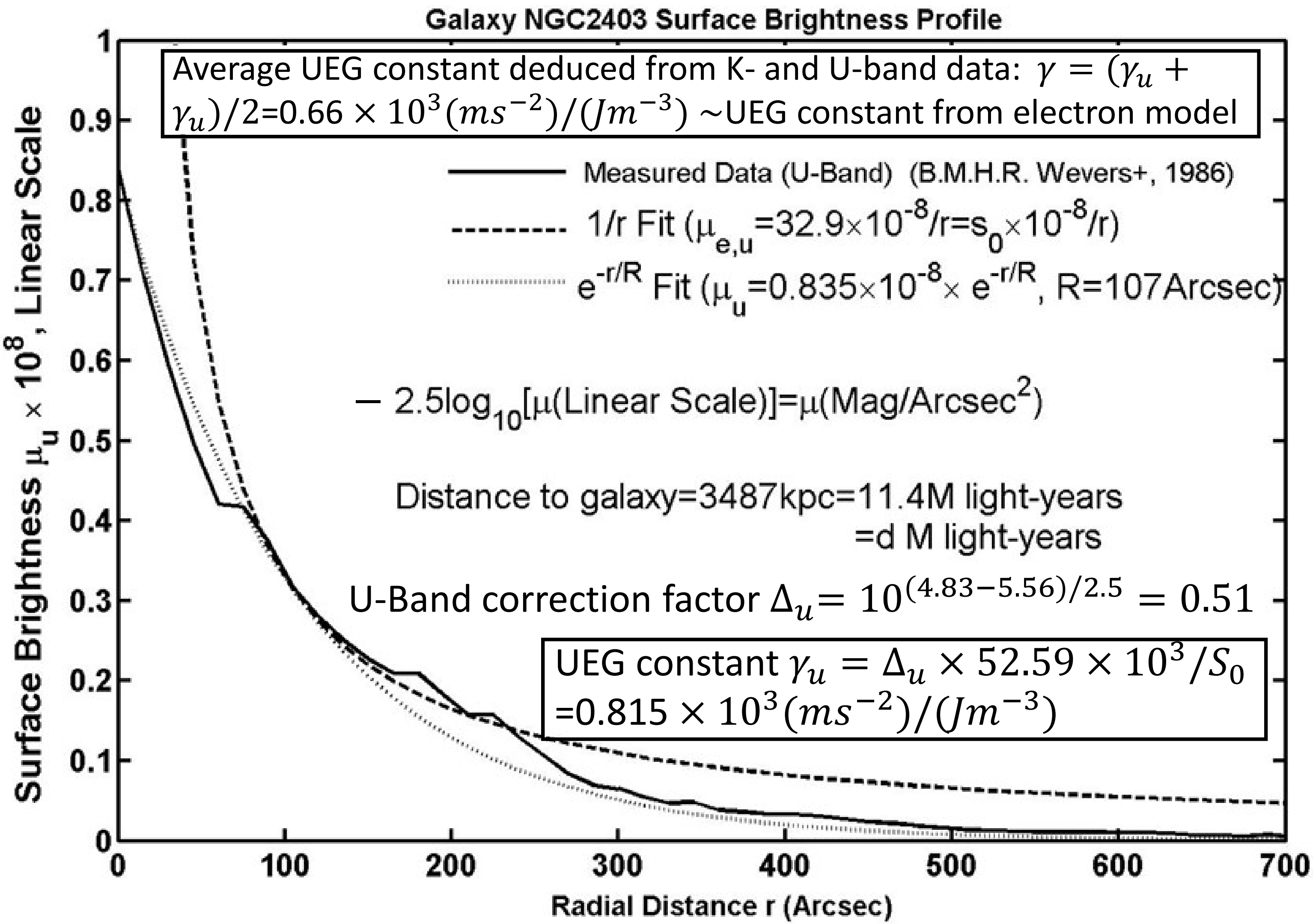
The UEG Constant Deduced from Specific Galaxy Data



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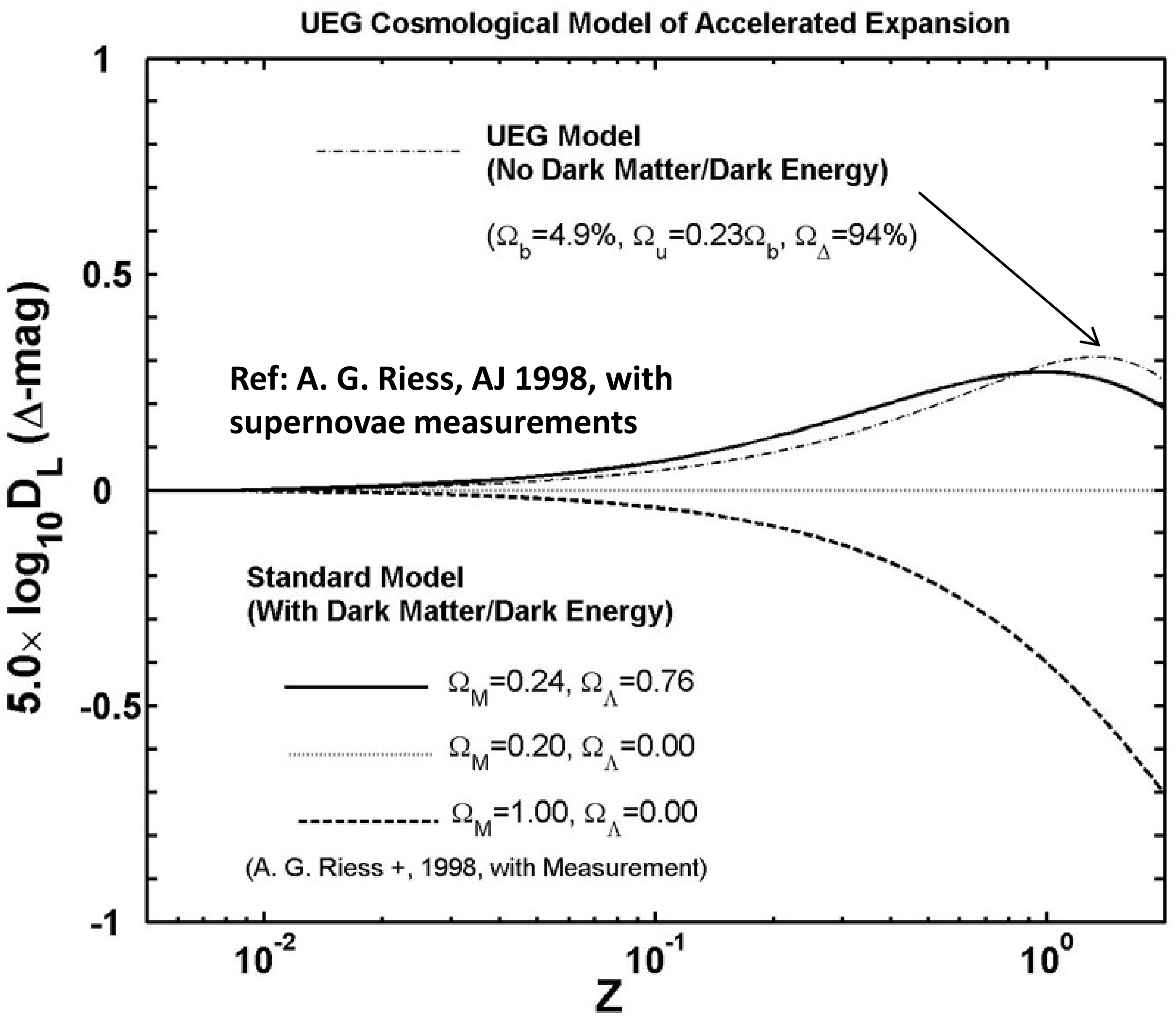
Luminosity Distance (Delta-Magnitude) as a Function of Red-Shift



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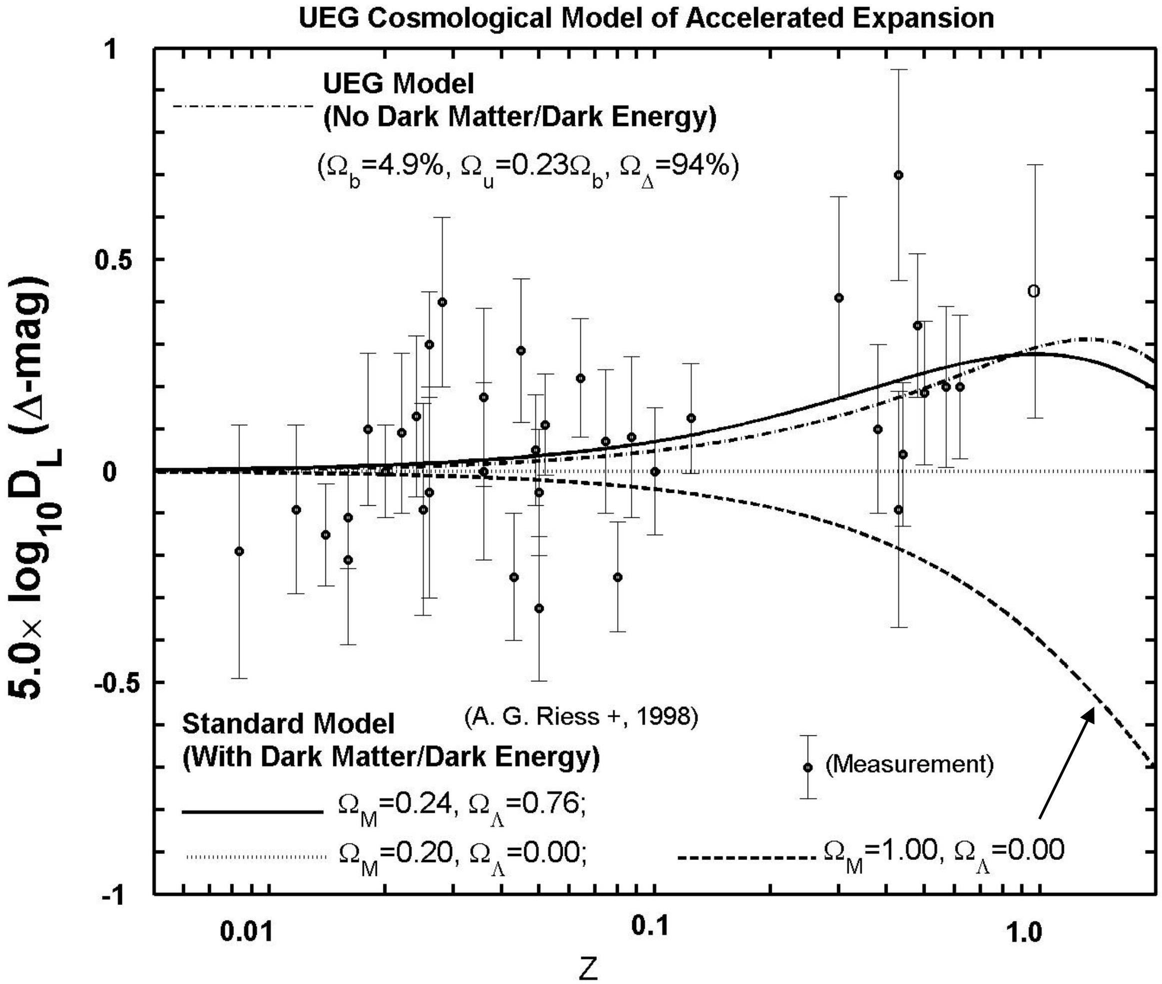
Luminosity Distance (Delta-Magnitude) as a Function of Red-Shift



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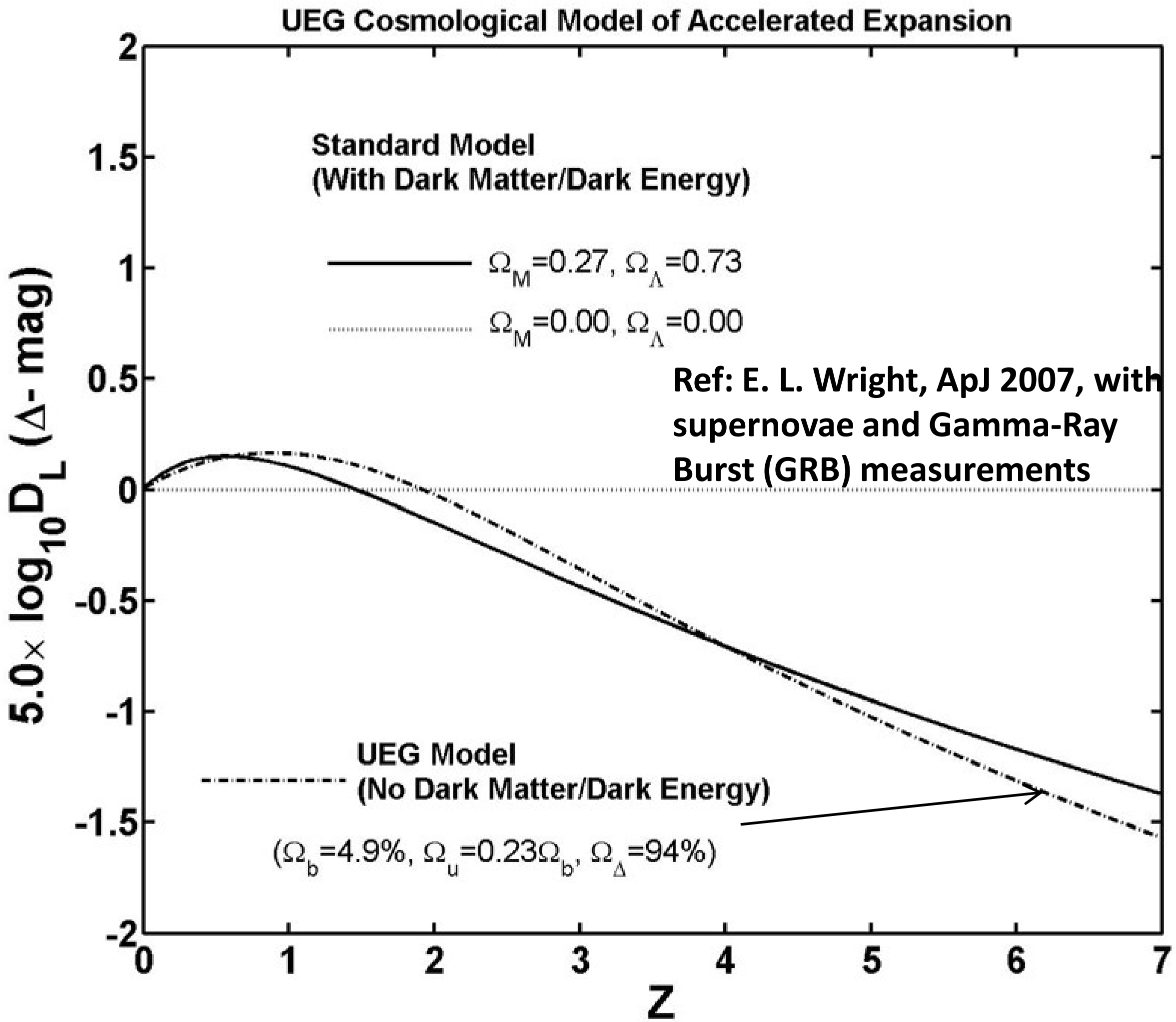
Luminosity Distance (Delta-Magnitude) for Larger Red-Shift



Ref: E. L. Wright, ApJ 2007, with supernovae and Gamma-Ray Burst (GRB) measurements

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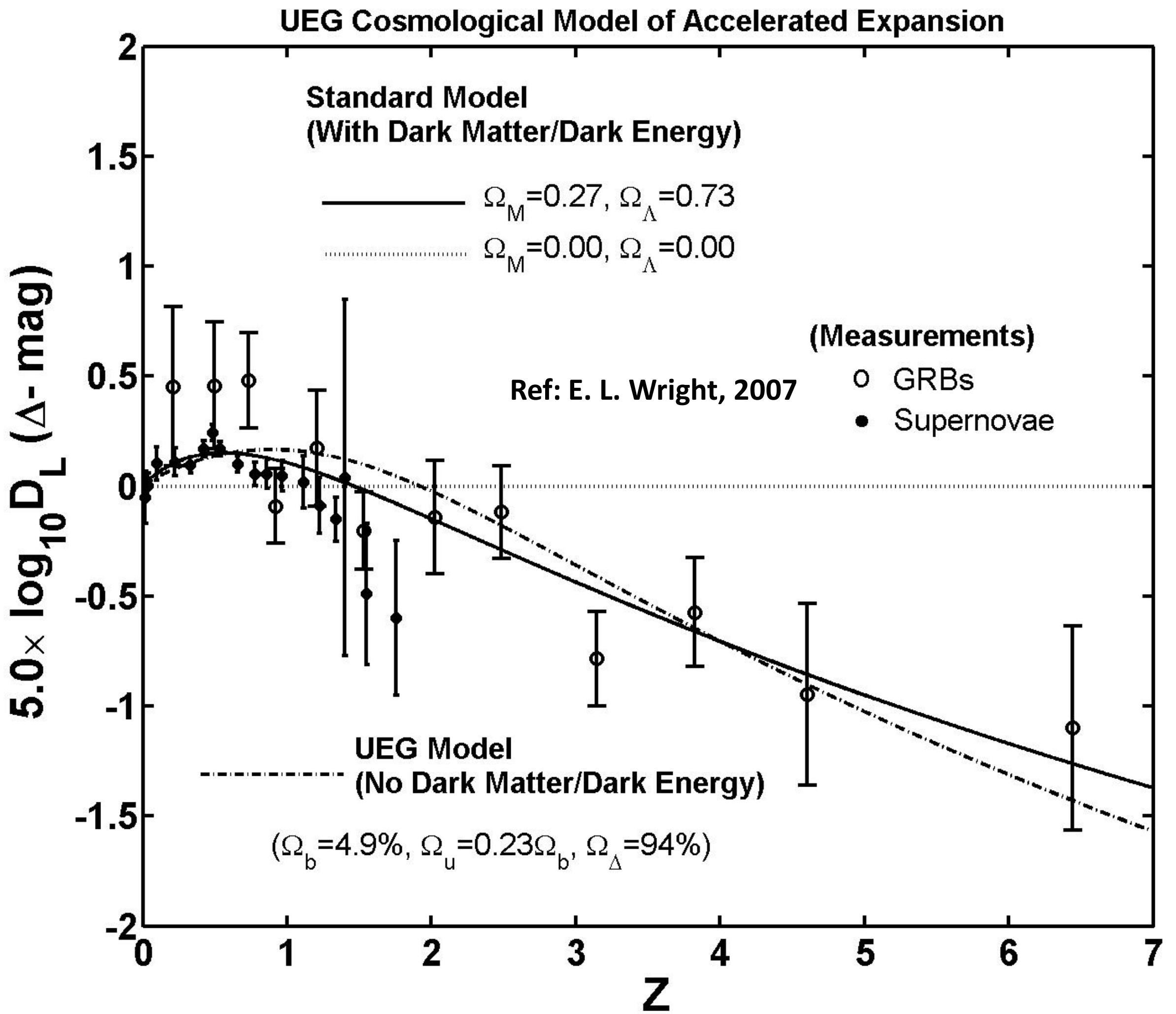
Luminosity Distance (Delta-Magnitude) as a Function of Red-Shift



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A Unified Electro-Gravity (UEG) Theory of Nature: Conclusions

- The UEG theory unifies gravity, electromagnetics, quantum mechanics, and provides a unified paradigm to model all particles in the standard model of particle physics.
- The same UEG theory also models astrophysical problems, such as galaxy rotation, cosmology, without invoking the hypothetical dark matter or dark energy.
- The current UEG theory is still not fully rigorous. A fully rigorous version, Unified Electro-Gravito-Magnetic (UEGM) theory is needed to rigorously model all static and dynamic electro-gravitational problems.
- Thank You.