Print - ISSN : 2319–9814
Online - ISSN : 2319–9822

Journal of
Space Exploration

WWW.MEHTAPRESS.COM

Full Paper

On the idea of superunified fields

Volker Achim Weberruss

V.A.W. Scientific consultation, Im Lehenbach 18, D-73650 Winterbach, (GERMANY)
E-mail: v.weberruss@freenet.de

Received : May 02, 2014
Accepted : June 10, 2014
Published : June 25, 2014

***Corresponding author's Name & Add.**

Volker Achim Weberruss
V.A.W. Scientific consultation, Im Lehenbach 18, D-73650 Winterbach, (GERMANY)
E-mail: v.weberruss@freenet.de

Abstract

It is a common belief that Einstein's theory of gravitation does cover masses, but no charges. It is also a common belief that Einstein's field equations of gravitation and the equation of geodetic lines do cover macroscopic masses, but no microscopic masses. I very often hear that charges that are considered within Einstein's field equations of gravitation and the equation of geodetic lines do lead to inconsistencies! I also often hear that Einstein's metric tensors and Schrödinger's wave functions have nothing in common! I also often hear that all this is experimentally well proven! However, all that i have done during the past decades shows that only some simple ideas that go beyond the mechanistic way of thinking of nowadays are needed to concatenate these apparently contradicting notions to a unity, and this Consistent with calculations, computations, and experiments. Let me here present the first theoretical elements that are needed wanting to achieve All this, i.e. Let me here establish the simple Ideasthat enable to concatenate masses and charges to a unity which can be processed by Einstein's field equations of gravitation and the equation of geodetic lines consistent with basic relations such as Poisson's equationsfor masses and charges or Newton's equation of MoTion for masses and charges. However, the simple ideas that additionally enable to concatenate macroscopic masses and charges and microscopic masses and charges to a unityshall be presented in a subsequent Publication. Moreover, the simple ideas that additionally enable to concatenate macroscopic masses and charges and microscopic masses and charges to a unity have Technological consequences as well as philosophical consequences, which also shall be presented in a subsequent Publication.

Keywords

Charge-corrected mass; Mass–charge exchange relation; Vacuum tension or generation tension; Mass–charge metric.

INTRODUCTION

There are a lot of attempts to unify Einstein's general theory of relativity[1] and quantum theory[2,3] to obtain a unified field theory, and this includes usual approaches[4] and unusual approaches[5]. However, these approaches as well as the mathematically complicated approaches of nowadays[6] seem to point into nowhere. So the questions arise: Do we all think much too complicated? Do we all still think much too usual?Inspired by this idea, by way of trial, let me here think much more simple. Inspired by this idea, by way of trial, let me here think much more unusal. Let me here firstly work out that not only Poisson's equation for masses, but also Poisson's equation for charges is obtained as limiting case of Einstein's field equation of gravitation introducing a suitable mathematical expression. Let me here secondly work out that not only Newton's equation of motion for masses, but also Newton's equation of motion for charges is obtained as limiting case of the equation of geodetic lines introducing a suitable mathematical expression. Going beyond that, let me here thirdly develop some simple graphic interpretations recasting these mathematical expressions into physical terms, in this context, extending[7,8]. As already quoted above, microscopic masses and microscopic charges showing quantum effects ("wave–particle effects") shall be studied in a subsequent publication.

More precisely speaking, aiming at the concatenation of the notion "mass" and the notion "charge" to a unity that can be processed by Einstein's field equations of gravitation and the equation of geodetic lines as well as derived physical relations, I want to establish twotheoretical notionsthat go beyond the theoretical notions that are used nowadays, namely a firstnotion here denoted as "charge-corrected mass" $m_0 = \mathfrak{m}_0 + \lambda_C q$ with $\lambda_C = \lambda_C(U)$ and a second notion here denoted as "mass–charge exchange relation" $m_0c^2 = qU$, both based upon a third notion here denoted as "vacuum tension (voltage)" U or "generationtension (voltage)" U, in the latter case, to be interpreted more colorful in the framework of some additional inventivegraphic illustrations[7-9].

Abbreviations

We here basically apply the following abbreviations: $R_{\mu\nu}$ = tensor of curvature, $T_{\mu\nu}$ = energy momentum tensor, $g_{\mu\nu}$ = metric tensor, R= scalar of curvature, K = Einstein's constant of gravitation, G = Newton's constant of gravitation, ρ_g = mass density, ρ_C = charge density, ϕ_g = mass potential, ϕ_C= charge potential, m_0 = measurable mass, q = measurable charge, q = generalized position vector, x = Cartesian position vector.

CHARGE-CORRECTED MASS

In what follows, we follow Box 2.1, collecting the basic formulae in LATEX style which I am preferringdespite some slight differences face to face with the WORD style predetermined by the text template. Let me introduce the charge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ as follows.

The energy contribution to Einstein's field equations of gravitation (2.1) is provided by (2.2). The Ansatz $g_{\mu\nu} = \eta_{\mu\nu} + \gamma_{\mu\nu}$ that is provided by (2.3), on the one hand, implements Cartesian (pseudo-Euclidean) frames via $\eta_{\mu\nu}$, and on the other hand, implements scalar, vectorial, and tensorial potentials via $\gamma_{\mu\nu}$, eventually covering the deviations from the Cartesian (pseudo-Euclidean) frames. Neglecting terms of higher order, the Ansatz $g_{\mu\nu} = \eta_{\mu\nu} + \gamma_{\mu\nu}$ that is provided by (2.3) reduces (2.2) to (2.4), eventually enforcing the transition from curvilinear frames that are well-adapted to relativistic notions to rectilinear frames that are well-adapted to non relativistic notions, in the latter case, matching the "classical ideas" of Galilei, Poisson, and Newton.

We now assume that a mass energy density ϱ_g is present.

Considering the mass density ρg, the energy momentum tensor then is provided by (2.5), leading from (2.4) to (2.8), collecting various formulations of Poisson's equation for mass densities.

We now additionally assume that a charge equivalent ϱ_C of the mass energy density ϱ_g exists and is present.

Considering the charge density ρ_C, the energy momentum tensor then is provided by (2.6), leading from (2.4) to (2.10), collecting various formulations of Poisson's equation for charge densities.

$\lambda_C = \lambda_C(U)$ is a charge-adaptation factor that is chosen according to (2.11), in the first instance, guaranteeing the physical dimension "mass energy density".

Combining the potential equations given by (2.8) and (2.10), we are led to the potential equation given by (2.12), in the following denoted as generalized Poisson equation.

These relations suggest to introduce a charge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ consisting of a pure mass $\mathfrak{m}_0$ and a charge-correction term $\lambda_C q$.

Considering $\mathfrak{m}_0$ and q as the observables, we are led to (A) and (B), eventually relating the mass density to thepure mass $\mathfrak{m}_0$ and the charge density to the charge q.

$$m_0 = \mathfrak{m}_0 + \lambda_C q,\ \lambda_C = -2/Kc^2\varepsilon_0 U, \tag{A}$$

$$\rho_{g,C} \leftrightarrow \mathfrak{m}_0 + \lambda_C q,\ \rho_g \leftrightarrow \mathfrak{m}_0,\ \rho_C \leftrightarrow q. \tag{B}$$

Considering m_0 and q as the observables, we are led to (C) and (D), eventually relating the mass density to the charge-corrected mass m_0 and the charge density to the charge q.

$$m_0 = \mathfrak{m}_0 + \lambda_C q,\ \lambda_C = -2/Kc^2\varepsilon_0 U, \tag{C}$$

$$\rho_{g,C} \leftrightarrow m_0 + \lambda_C q,\ \rho_g \leftrightarrow \mathfrak{m}_0 + \lambda_C q,\ \rho_C \leftrightarrow q. \tag{D}$$

Consistency with measurements, calculations, and computations requires to apply (C) and (D), i.e. tabulated mass values such as tabulated elementary particle masses define charge-corrected masses m_0 and tabulated charge values such as tabulated elementary particle charges define charges q. Consistency with measurements, calculations, and computations also requires to assume that the tension (voltage) U shows positive values for positive charges, negative values for negative charges, and infinite values for vanishing charges, noted by the way, also securing that the pure mass $\mathfrak{m}_0$ always shows positive values.

MASS–CHARGE EXCHANGE RELATION

In what follows, we follow Box 3.1, collecting the basic formulae in LATEX style which I am preferring despite some slight differences face to face with the WORD style predetermined by the text template. Let me introduce the "mass–charge exchange relation" $m_0c^2 = qU$ as follows.

Einstein's field equations of gravitation (2.1) are supplemented by the equation of geodetic lines (3.1), in the latter case, reducing to the specialized equation of motion (3.2) applying the Ansatz $g_{\mu\nu} = \eta_{\mu\nu} + \gamma_{\mu\nu}$ that is provided by (2.3), eventually considering Cartesian (pseudo-Euclidean) frames. The specialized forces F_a that come into being in this way can be written in the basic form (3.5)

Box 2.1 (Einsteinian field equations and Poissonian equations).

$$-R_{\mu\nu}(g_{\alpha\beta}) = KT_{\mu\nu} - \frac{R}{2}g_{\mu\nu} \tag{2.1}$$

$$\Downarrow$$

$$-R_{00}(g_{\alpha\beta}) = KT_{00} - \frac{1}{2}Rg_{00} \tag{2.2}$$

$$\Leftrightarrow$$

$$\begin{aligned} -\frac{1}{2}\triangle_3\gamma_{00} + \cdots = KT_{00} - \frac{1}{2}Rg_{00} = KT_{00} - \frac{1}{2}KTg_{00} = KT^*_{00}\ , \\ T^*_{00} = T_{00} - \frac{1}{2}Tg_{00}\ , \quad T = \sum_{\mu,\nu} g_{\mu\nu}T^{\mu\nu}\ , \quad g_{\mu\nu} = \eta_{\mu\nu} + \gamma_{\mu\nu}\ ; \end{aligned} \tag{2.3}$$

$$\eta_{00} = -1,\ \eta_{ii} = +1,\ \eta_{ij} = 0,$$

in the classical limiting case, terms of first order in $\gamma_{\mu\nu}$ are sufficient

$$\Downarrow$$

$$\triangle_3\gamma_{00} = -2KT^*_{00}{}'\ , \quad T^*_{00}{}' = T_{00} - \frac{1}{2}T^{00}\ . \tag{2.4}$$

Energy situation described by a mass density:
mass density $\rho_g = \sigma$, mass energy density $\rho_g c^2 = \sigma c^2$,
$\dim[\rho_g] = \mathrm{kg/m^3}$, $\dim[\rho_g c^2] = \mathrm{J/m^3}$

$$\Downarrow$$

$$T_{\mu\nu} = \begin{pmatrix} -\rho_g c^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} -\sigma c^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} = T^{\mu\nu}\ . \tag{2.5}$$

Energy situation described by a charge density:
charge density ρ_C,
charge-related mass density $\lambda_C\rho_C$, charge-related mass energy density $\lambda_C\rho_C c^2$,
$\dim[\rho_C] = \mathrm{C/m^3}$, $\dim[\lambda_C\rho_C] = \mathrm{kg/m^3}$, $\dim[\lambda_C\rho_C c^2] = \mathrm{J/m^3}$,
λ_C generates the physical dimension "energy density"

$$\Downarrow$$

$$T_{\mu\nu} = \begin{pmatrix} -\lambda_C\rho_C c^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} = T^{\mu\nu}\ . \tag{2.6}$$

The charge-correction term $\lambda_C q$ here is introduced in order to achieve compatible physical dimensions on both the mass level and the charge level!

Continuation of Box 2.1.

(2.4) + (2.5),
in the classical limiting case, relatively small space time areas are sufficient, $\boldsymbol{q}$ can be replaced by $\boldsymbol{x}$, $\triangle_3 = \triangle_3(\boldsymbol{q})$ passes into $\triangle = \triangle(\boldsymbol{x})$

$$\Downarrow$$

$$-\triangle\gamma_{00} = -K\rho_{\rm g}c^2 = -K\sigma c^2 \Leftrightarrow -\frac{1}{2}\triangle\gamma_{00} = -\frac{K}{2}\rho_{\rm g}c^2 = -\frac{K}{2}\sigma c^2 \,, \tag{2.7}$$

$$-\frac{1}{2}\triangle\gamma_{00} = -\frac{K}{2}\rho_{\rm g}(\boldsymbol{x})c^2$$

$$\Downarrow \Phi=-\gamma_{00}/2=+\phi_{\rm g}/c^2 \tag{2.8}$$

$$-\frac{1}{2}\triangle\phi_{\rm g} = +\frac{Kc^2}{4}\rho_{\rm g}(\boldsymbol{x})c^2 \overset{G=Kc^4/8\pi}{\Rightarrow} -\frac{1}{2}\triangle\phi_{\rm g} = +2\pi G\rho_{\rm g}(\boldsymbol{x})$$

(Poissonian equation for mass densities).

(2.4) + (2.6),
in the classical limiting case, relatively small space time areas are sufficient, $\boldsymbol{q}$ can be replaced by $\boldsymbol{x}$, $\triangle_3 = \triangle_3(\boldsymbol{q})$ passes into $\triangle = \triangle(\boldsymbol{x})$

$$\Downarrow$$

$$-\triangle\gamma_{00} = -K\lambda_{\rm C}\rho_{\rm C}c^2 \Leftrightarrow -\frac{1}{2}\triangle\gamma_{00} = -\frac{K}{2}\lambda_{\rm C}\rho_{\rm C}c^2 \,, \tag{2.9}$$

$$-\frac{1}{2}\triangle\gamma_{00} = -\frac{K}{2}\lambda_{\rm C}\rho_{\rm C}(\boldsymbol{x})c^2$$

$$\Downarrow \Phi=-\gamma_{00}/2=+\phi_{\rm C}/U \tag{2.10}$$

$$-\frac{1}{2}\triangle\phi_{\rm C} = +\frac{Kc^2}{4}\lambda_{\rm C}\rho_{\rm C}(\boldsymbol{x})U \overset{\lambda_{\rm C}=-2/Kc^2\epsilon_0 U}{\Rightarrow} -\frac{1}{2}\triangle\phi_{\rm C} = -\frac{1}{2\epsilon_0}\rho_{\rm C}(\boldsymbol{x})$$

(Poissonian equation for charge densities),

$$\lambda_{\rm C} = -\frac{2}{Kc^2\epsilon_0 U} \,,\; \tilde{\lambda}_{\rm C} = -\frac{2}{Kc^2\epsilon_0} \,. \tag{2.11}$$

$$KT_{00} - \frac{1}{2}Rg_{00} = KT_{00} - \frac{R}{2}\eta_{00} - \frac{R}{2}\gamma_{00} = -\frac{K}{2}\rho_{\rm g,C}c^2 \,,$$

$$-\frac{1}{2}\triangle\phi_{\rm g,C} = +\frac{K}{4}\rho_{\rm g,C}c^2 \,,\; \phi_{\rm g,C} = \frac{\phi_{\rm g}}{c^2} + \frac{\phi_{\rm C}}{U} \,, \tag{2.12}$$

$$\rho_{\rm g,C}(\boldsymbol{x}) = \rho_{\rm g}(\boldsymbol{x}) + \lambda_{\rm C}\rho_{\rm C}(\boldsymbol{x})$$

(generalized Poisson equation).

The tension (voltage) U here is introduced in order to achieve compatible physical dimensions on both the mass level and the charge level!

introducing special abbreviations, in particular, setting $\Phi = -\gamma_{00}/2$, denoting the vector that is formed of the γ_{i0} with i= 1,2,3 as $\boldsymbol{A}_\ni$, and denoting the vector product formed of the nabla operatorand $\boldsymbol{A}_\ni$ as $\boldsymbol{B}_\ni$. In addition to the charge-corrected mass (3.4), introducing the mass–charge exchange relation (3.3), the specialized forces F_a are immediately recast into a classical form covering masses and charges as it is illustrated by Examples 3.1–3.3, also allowing to reproduce the trajectories of charged particles correctly as it is illustrated by Example 3.4, eventually justifying the terms Newton's equation of motion for masses and charges and generalized Einstein field equations, in the latter case, also pointing at further generalizations needed dealing with quantum systems ("wave–particle systems").

The first theoretical notion "charge-corrected mass" $m_0 = \mathfrak{m}_0 + \lambda_C q$ with $\lambda_C = \lambda_C(U)$ thus concatenates the notion "mass" and the notion "charge" to such an extent that Poisson's equation for mass densities and Poisson's equation for charge densities can be considered as limiting cases of Einstein's field equations of gravitation.

We here additionally note the following.
Firstly, we note that neither a charge can be removed measuring a mass nor a mass can be removed measuring a charge, and these issues apply for elementary particles such as electrons and protons as well as for objects consisting of elementary particles such as atoms and molecules so that the extended formula $m_0 = \mathfrak{m}_0 + \lambda_C q$, together with the related mass density function $\rho_g = \mathfrak{p}_0 + \lambda_C \rho_C$ defining the mass observables, reflects what we always are observing. Secondly, we note that the extended formula $m_0 = \mathfrak{m}_0 + \lambda_C q$, together with the related mass density function $\rho_g = \mathfrak{p}_0 + \lambda_C \rho_C$ defining the mass observables, needs to be completed by the stand-alone charge observable q, reflecting that a mass is always measurable and always present considering a physical entity, whereas a charge certainly is always measurable, but is not always present considering a physical entity, implying that a mass can depend on a sum term covering charge contributions, but a charge cannot depend on a sum term covering mass contributions, then occurring as stand-alone charge observable.

Box 3.1 (Equation of geodetic lines and Newtonian equation of motion).

$$\frac{\mathrm{d}^2 q^\epsilon}{\mathrm{d}s^2} + \sum_{\mu,\nu} \Gamma^\epsilon_{\mu\nu}(g_{\alpha\beta}) \frac{\mathrm{d}q^\mu}{\mathrm{d}s}\frac{\mathrm{d}q^\nu}{\mathrm{d}s} = 0\,,$$

$$\Gamma^\epsilon_{\mu\nu} = \Gamma^\epsilon_{\mu\nu}(g_{\alpha\beta}) = \frac{1}{2}\sum_\lambda g^{\epsilon\lambda}\left(\frac{\partial g_{\lambda\mu}}{\partial q^\nu} - \frac{\partial g_{\mu\nu}}{\partial q^\lambda} + \frac{\partial g_{\nu\lambda}}{\partial q^\mu}\right)\,, \tag{3.1}$$

$$(\mathrm{d}s)^2 = \sum_{\mu,\nu} g_{\mu\nu}\,\mathrm{d}q^\mu \mathrm{d}q^\nu$$

(equation of geodetic lines)

⇓

$$m_0 \frac{\mathrm{d}^2 \boldsymbol{x}}{\mathrm{d}t^2} = \sum_{a=1}^{14} \boldsymbol{F}_a \tag{3.2}$$

(Newtonian equation of motion for masses/charges),

$$qU = m_0 c^2 \Leftrightarrow m_0 = qU/c^2 \Leftrightarrow q = m_0 c^2/U \Leftrightarrow U = m_0 c^2/q \tag{3.3}$$

(mass–charge exchange relation),

$$m_0 = \mathfrak{m}_0 + \lambda_C q\,,\quad \lambda_C = -\frac{2}{K c^2 \epsilon_0 U} \tag{3.4}$$

(charge-corrected mass),

$$\boldsymbol{F}_1 = -m_0 c^2 \nabla\Phi\,,\quad \boldsymbol{F}_2 = -m_0 c \frac{\partial \boldsymbol{A}_\ni}{\partial t}\,,\quad \boldsymbol{F}_3 = +m_0 c\,(\boldsymbol{v} \times \boldsymbol{B}_3)\,,\ \ldots \tag{3.5}$$

(Newtonian forces for masses/charges).

Example 3.1 ($\boldsymbol{F}_3$: Lorentz force, gravitational analogue).

$$\boldsymbol{B}_3 := \frac{c}{U}\boldsymbol{B} := \frac{c}{U}\boldsymbol{B}_\mathrm{C}\ , \quad \mathrm{Dim}\,[\boldsymbol{B}_3] = \frac{1}{\mathrm{m}} = \mathrm{Dim}\left[\frac{c}{U}\boldsymbol{B}_\mathrm{C}\right] = \frac{\mathrm{m}}{\mathrm{s}}\frac{1}{\mathrm{V}}\frac{\mathrm{V\,s}}{\mathrm{m}^2}\ , \tag{3.6}$$

$$m_0\frac{\mathrm{d}^2\boldsymbol{x}}{\mathrm{d}t^2} = \frac{m_0c^2}{U}\left(\boldsymbol{v}\times\boldsymbol{B}_\mathrm{C}\right) = q\left(\boldsymbol{v}\times\boldsymbol{B}_\mathrm{C}\right)\ , \tag{3.7}$$

$$\boldsymbol{B}_3 := \frac{1}{c}\boldsymbol{B}_\mathrm{g}\ , \quad \mathrm{Dim}\,[\boldsymbol{B}_3] = \frac{1}{\mathrm{m}} = \mathrm{Dim}\left[\frac{1}{c}\boldsymbol{B}_\mathrm{g}\right] = \frac{\mathrm{s}}{\mathrm{m}}\frac{1}{\mathrm{s}}\ , \tag{3.8}$$

$$m_0\frac{\mathrm{d}^2\boldsymbol{x}}{\mathrm{d}t^2} = m_0\left(\boldsymbol{v}\times\boldsymbol{B}_\mathrm{g}\right)\ . \tag{3.9}$$

Example 3.2 ($\boldsymbol{F}_2$: vector potential contribution to electric force, gravitational analogue).

$$\boldsymbol{A}_\ni := \frac{c}{U}\boldsymbol{A} := \frac{c}{U}\boldsymbol{A}_\mathrm{C}\ , \quad \mathrm{Dim}\,[\boldsymbol{A}_\ni] = 1 = \mathrm{Dim}\left[\frac{c}{U}\boldsymbol{A}_\mathrm{C}\right] = \frac{\mathrm{m}}{s}\frac{1}{\mathrm{V}}\frac{\mathrm{V\,s}}{\mathrm{m}}\ , \tag{3.10}$$

$$m_0\frac{\mathrm{d}^2\boldsymbol{x}}{\mathrm{d}t^2} = -\frac{m_0c^2}{U}\frac{\partial\boldsymbol{A}_\mathrm{C}}{\partial t} = -q\frac{\partial\boldsymbol{A}_\mathrm{C}}{\partial t}\ , \tag{3.11}$$

$$\boldsymbol{A}_\ni := \frac{1}{c}\boldsymbol{A}_\mathrm{g}\ , \quad \mathrm{Dim}\,[\boldsymbol{A}_\ni] = 1 = \mathrm{Dim}\left[\frac{1}{c}\boldsymbol{A}_\mathrm{g}\right] = \frac{\mathrm{s}}{\mathrm{m}}\frac{\mathrm{m}}{\mathrm{s}}\ , \tag{3.12}$$

$$m_0\frac{\mathrm{d}^2\boldsymbol{x}}{\mathrm{d}t^2} = -m_0\frac{\partial\boldsymbol{A}_\mathrm{g}}{\partial t}\ . \tag{3.13}$$

Example 3.3 ($\boldsymbol{F}_1$: scalar potential contribution to electric force, gravitational analogue).

$$\boldsymbol{F} = \boldsymbol{F}_1 + \boldsymbol{F}_2 + \boldsymbol{F}_3\ , \quad \varPhi = -\gamma_{00}/2 := \phi_{\mathrm{g,C}}\ , \tag{3.14}$$

$$\begin{aligned} m_0\frac{\mathrm{d}^2\boldsymbol{x}}{\mathrm{d}t^2} &= -m_0c^2\nabla\phi_{\mathrm{g,C}} - m_0c^2\frac{\partial\boldsymbol{A}_{\mathrm{g,C}}}{\partial t} + m_0c^2\left(\boldsymbol{v}\times\boldsymbol{B}_{\mathrm{g,C}}\right) \\ &= -qU\nabla\phi_{\mathrm{g,C}} - qU\frac{\partial\boldsymbol{A}_{\mathrm{g,C}}}{\partial t} + qU\left(\boldsymbol{v}\times\boldsymbol{B}_{\mathrm{g,C}}\right)\ , \end{aligned} \tag{3.15}$$

$$\phi_{\mathrm{g,C}} := \frac{\phi_\mathrm{g}}{c^2} + \frac{\phi_\mathrm{C}}{U}\ , \qquad \begin{aligned} \boldsymbol{A}_{\mathrm{g,C}} &:= \frac{\boldsymbol{A}_\mathrm{g}}{c^2} + \frac{\boldsymbol{A}_\mathrm{C}}{U} = \frac{\boldsymbol{A}_\mathrm{g}}{c^2} + \frac{\boldsymbol{A}}{U}\ , \\ \boldsymbol{B}_{\mathrm{g,C}} &:= \frac{\boldsymbol{B}_\mathrm{g}}{c^2} + \frac{\boldsymbol{B}_\mathrm{C}}{U} = \frac{\boldsymbol{B}_\mathrm{g}}{c^2} + \frac{\boldsymbol{B}}{U}\ . \end{aligned} \tag{3.16}$$

Example 3.4 (Electron trajectory and positron trajectory).

The mass–charge exchange relation of observables m_0 and q is provided by

$$qU = m_0 c^2 . \tag{3.17}$$

It is telling us that the charge-corrected mass m_0 together with the square of the light velocity c establishes the mass-specific energy m_0c^2 which is on a par with the charge-specific energy qU formed of the resulting pure charge q related to the charge-corrected mass m_0 and the tension (voltage) U which eventually is fixed by the mass–charge exchange relation (3.17).

The charge-corrected mass m_0 is provided by

$$m_0 = \mathfrak{m}_0 + \lambda_C q \,, \quad \lambda_C = -\frac{2}{Kc^2\epsilon_0 U} . \tag{3.18}$$

It is telling us that the pure mass $\mathfrak{m}_0$ combined with the charge-correction term $\lambda_C q$ establishes the charge-corrected mass m_0 specified by the tension (voltage) U which eventually is fixed by the mass–charge exchange relation (3.17) enabling us to compute the pure mass $\mathfrak{m}_0$ starting from the observables m_0 and q concatenated via the mass–charge exchange relation (3.17).

Following the above lines, Newton's law of a test object (m_0, q) moving in the sphere of influence of a field mass M_0 and a field charge Q, evoking a mass potential ϕ_g and a charge potential ϕ_C, is provided by

$$m_0 \frac{d^2 \boldsymbol{x}}{dt^2} = -m_0 c^2 \nabla \phi_{g,C} \,, \; \phi_{g,C} = \frac{\phi_g(M_0)}{c^2} + \frac{\phi_C(Q)}{U} . \tag{3.19}$$

Applying the mass–charge exchange relation (3.17), we arrive at

$$m_0 \frac{d^2 \boldsymbol{x}}{dt^2} = -m_0 \nabla \phi_g(M_0) - q \nabla \phi_C(Q) . \tag{3.20}$$

Applying the mass extension formula (3.18), we arrive at

$$(\mathfrak{m}_0 + \lambda_C q) \frac{d^2 \boldsymbol{x}}{dt^2} = -(\mathfrak{m}_0 + \lambda_C q) \nabla \phi_g(M_0) - q \nabla \phi_C(Q) . \tag{3.21}$$

The mass–charge exchange relation (3.17) thus generates the well-known form of the force on a test object (m_0, q) moving in the sphere of influence of a field mass M_0 evoking a mass potential ϕ_g and a field charge Q evoking a charge potential ϕ_C.

Continuation of Example.

Wanting to catch the action of the tension (voltage) U, we may directly consider the related equation of geodetic lines not showing the mass of the test object (m_0, q), i. e.

$$\frac{\mathrm{d}^2 \boldsymbol{x}}{\mathrm{d}t^{\,2}} = -c^2 \nabla \phi_{\mathrm{g,C}}\,, \quad \phi_{\mathrm{g,C}} = \frac{\phi_{\mathrm{g}}(M_0)}{c^2} + \frac{\phi_{\mathrm{C}}(Q)}{U}\,. \tag{3.22}$$

For example, considering an electron $(m_0, -e)$ as test object, we immediately realize that

$$\begin{gathered} qU = m_0 c^2 \\ \rightarrow \\ (-e)(-\,|U|) = m_0 c^2 \end{gathered} \tag{3.23}$$

$$\Downarrow$$

$$U = -\,|U| = \frac{1}{-e} m_0 c^2\,. \tag{3.24}$$

For example, considering a positron $(m_0, +e)$ as test object, we immediately realize that

$$\begin{gathered} qU = m_0 c^2 \\ \rightarrow \\ (+e)(+\,|U|) = m_0 c^2 \end{gathered} \tag{3.25}$$

$$\Downarrow$$

$$U = +\,|U| = \frac{1}{+e} m_0 c^2\,. \tag{3.26}$$

Therefore, assuming a field mass M_0 and a field charge Q as given, depending on the sign of the charge of the test object, we obtain two classes of geodetic lines. Therefore, the tension (voltage) U implements the possibility of two classes of geodetic lines already on the level of the equation of geodetic lines, and this information of duality is carried upwards along the hierarchy ϕ_{C}/U–$\phi_{\mathrm{g,C}}$–γ_{00}–g_{00}, eventually embedding this information of duality into the diverse relativistic/non-relativistic specifications of the generalized Einstein field equations. Obviously, the charge-related elongations of the metric field, on the one hand, then are caught by ϕ_{C}, and on the other hand, then are caught by U, leading to a unified picture of masses and charges.

The second theoretical notion "mass–charge exchange relation" $\mathfrak{m}_0c^2 = qU$ thus concatenates the notion "mass" and the notion "charge" to such an extent that Newton's equation of motion for masses and chargesincluding mass forces and charge forces can be considered as limiting case of the equation of geodetic lines.

We here additionally note the following.

Firstly, we note that the mass–charge exchange relation $m_0c^2 = qU$, which firstly defines U on its part directly configuring $\lambda_C = \lambda_C(U)$ on its part directly configuring $\mathfrak{m}_0 = m_0 - \lambda_C q$, and which secondly installs charges within basic natural laws originally designed to cover masses, for example, then recasting Newton's equation of motion for masses into Newton's equation of motion for masses and charges, most notably is establishing the notion of a charge energy qUthat equals the mass energy m_0c^2 ("mass–charge energy equivalence"). Secondly, we note that the mass–charge exchange relation $m_0c^2 = qU$is completing Einstein's energy"mass formula $E = mc^2 = \gamma\ m_0c^2$, following the above lines, based upon the charge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ and not upon the pure mass $\mathfrak{m}_0$. Mind you, following the above lines, m_0 and not $\mathfrak{m}_0$ is the observable so that nothing changes dealing with Einstein's energy"mass formula $E = mc^2 = \gamma m_0c^2$. Mind you, following the above lines, similar statements apply for Maxwell's equations etc. Here:$\gamma = (1 - v^2/c^2)^{-1/2}$.

MASS–CHARGE METRICS

Considering Einstein's field equations of gravitation and the equation of geodetic lines as well as derived physical relations in this extended framework, in particular, establishing energy momentum tensors based upon mass densities $\boldsymbol{\rho_g = \mathfrak{p}_0 + \lambda_C\rho_C}$ and/or charge densities $\boldsymbol{\rho_C}$ so that we then also can speak of "generalized Einstein field equations" and "generalized equation of geodetic lines", in both cases, also pointing at further generalizations needed dealing with quantum systems ("wave–particle systems"), the notion "metric" is not restricted anymore to masses, but also covers charges, evoking a unified picture of masses and charges, their forces, and their fields related to "mass"charge metrics".

Going beyond that, let me here suggest some further graphic interpretations.

Firstly, let me here further interpret the tension (voltage) U together with the mass–charge exchange relation $\mathfrak{m}_0c^2 = qU$ and the charge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ in the context of amass–charge generation scenario.

Let me here develop the notion of a tension (voltage) U measuring the potential difference traversed by the charge q relative to the "vacuum", in last consequence, thinking of a cosmic event lifting a cosmic entity from the domain of unobservable states ("vacuum") into the domain of observable states ("matter") such that a charge q is running through the tension (voltage) Usetting up the charge energy qU, in this way, generating what we know as mass m_0 and as mass energy m_0c^2. We compare with Figure 1 and Figure 2, in the first case, illustrating this in the context of themass–charge exchange relation, and in the second case, illustrating this in the context of thecharge-corrected mass, in both cases, considering apositive charge q_+, anegative charge q_-, and a chargeless mass $m_0, q = 0$.

Secondly, let me here further interpret the tension (voltage) U together with the mass–charge exchange relation $\mathfrak{m}_0c^2 = qU$ and thecharge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ in the context of a mass–charge composition scenario.

Let me here develop the notion of a tension (voltage) U measuring the potential difference traversed by the charge q relative to the "vacuum", in last consequence, acting in such a way that masses and charges of elementary particles such as electron, protons, and neutrons as well as masses and charges that are composed of masses and charges of elementary particles such as atoms and molecules fulfilstructurally identical relations, and this naturally includes the mass–charge exchange relation and the charge-corrected mass. We compare with Figure 3 and Figure 4, in the first case, illustrating this in the context of the mass–charge exchange relation, and in the second case, illustrating this in the context of the charge-corrected mass, in both cases, consideringtwo negative charges q_- and one positive charge q_+ related to U_- and U_+.

Thirdly, let me here further interpret mass–charge generation and metric field evolution as a self-consistent process fulfilling a law of conservation of energy relating mass–charge objects to metric fields.

Let me here develop the notionthat mass–charge generation is accompanied by the evolution of a metric field fulfilling a law of conservation of energy relating mass–charge objects to metric fields, on the classical stage, directly reflected by the generalized Poissonian equation, as it is illustrated by Figure 5 and Figure 6, where ϱ_g is the mass energy density, $\varrho_{g,C}$ is the mass–charge energy density, ϱ_v is the vacuum energy density, and ϱ_m is the metric field energy density, assuming that the mass–charge energy density $\varrho_{g,C} = \varrho_g + \lambda_C\varrho_C$ is related to the mass–charge density $\rho_{g,C} = \rho_g + \lambda_C\rho_C$ with $\rho_g = \mathfrak{p}_0 + \lambda_C\rho_C$ combining the pure mass $\mathfrak{p}_0$ density and the charge density ρ_C, in last consequence, associated with the charge-corrected mass $m_0 = \mathfrak{m}_0 + \lambda_C q$ with the pure mass $\mathfrak{m}_0$ and the charge q,

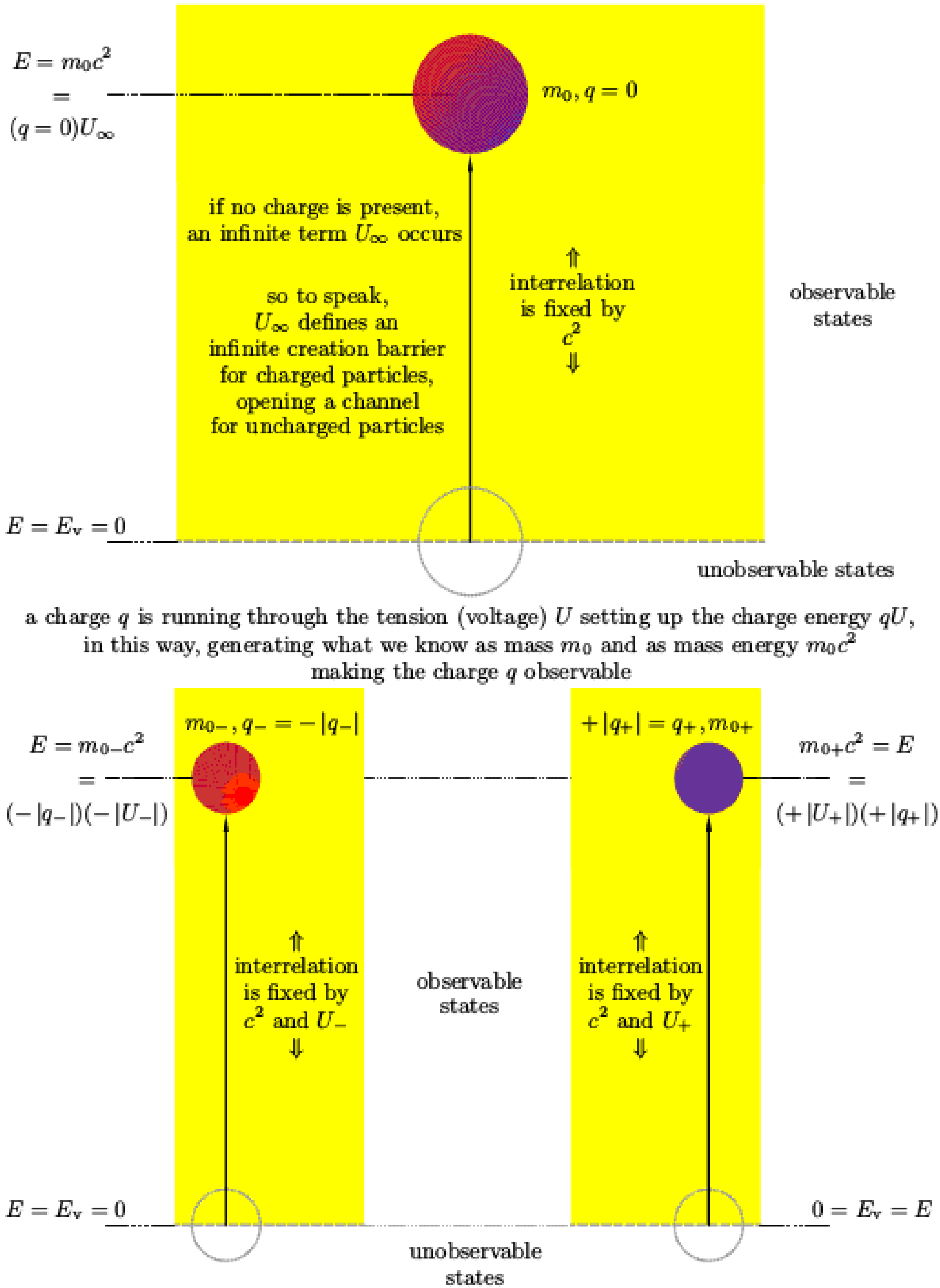


Figure 1 : Mass-charge evolution described by the mass-charge exchange relation.

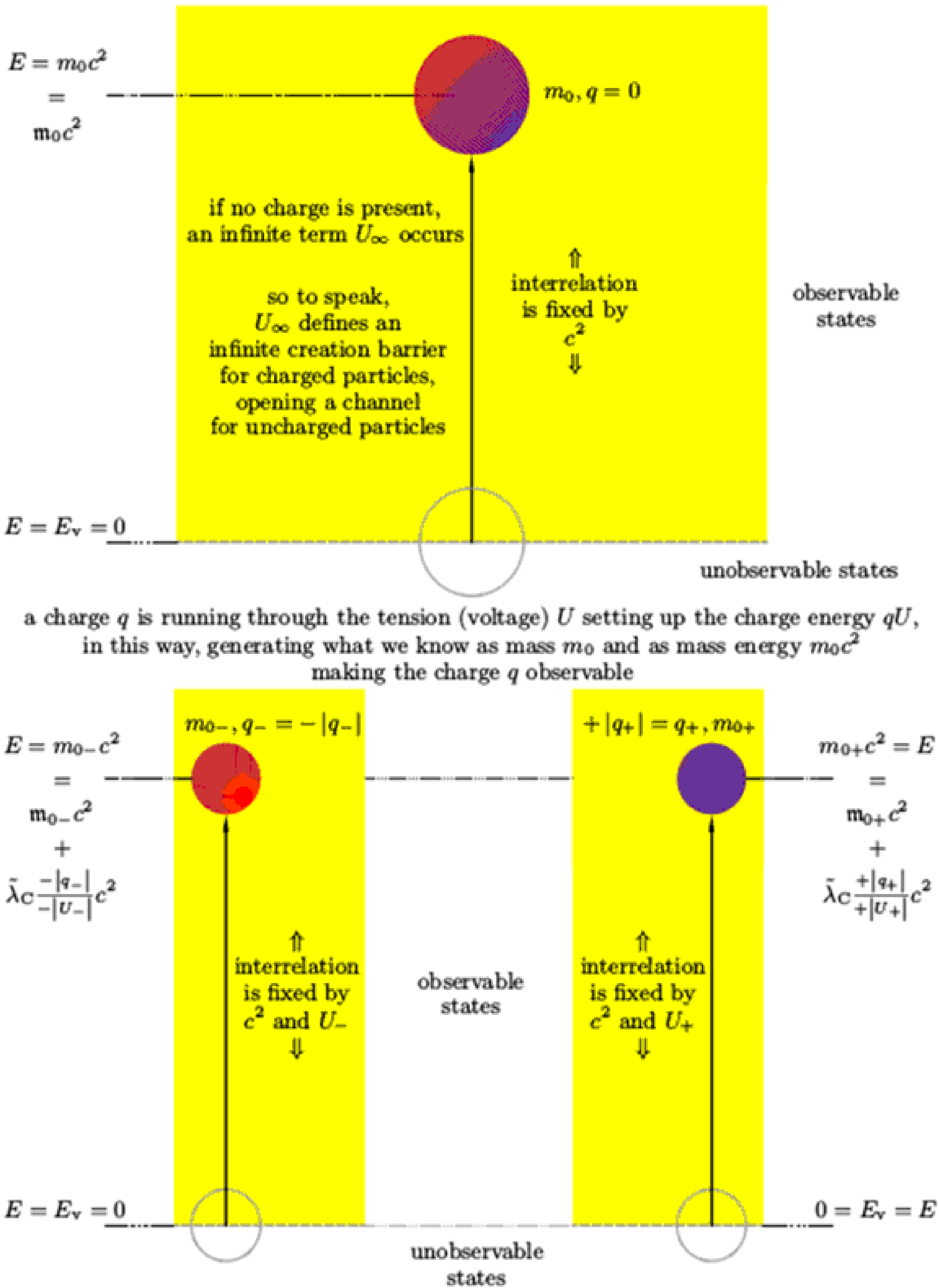
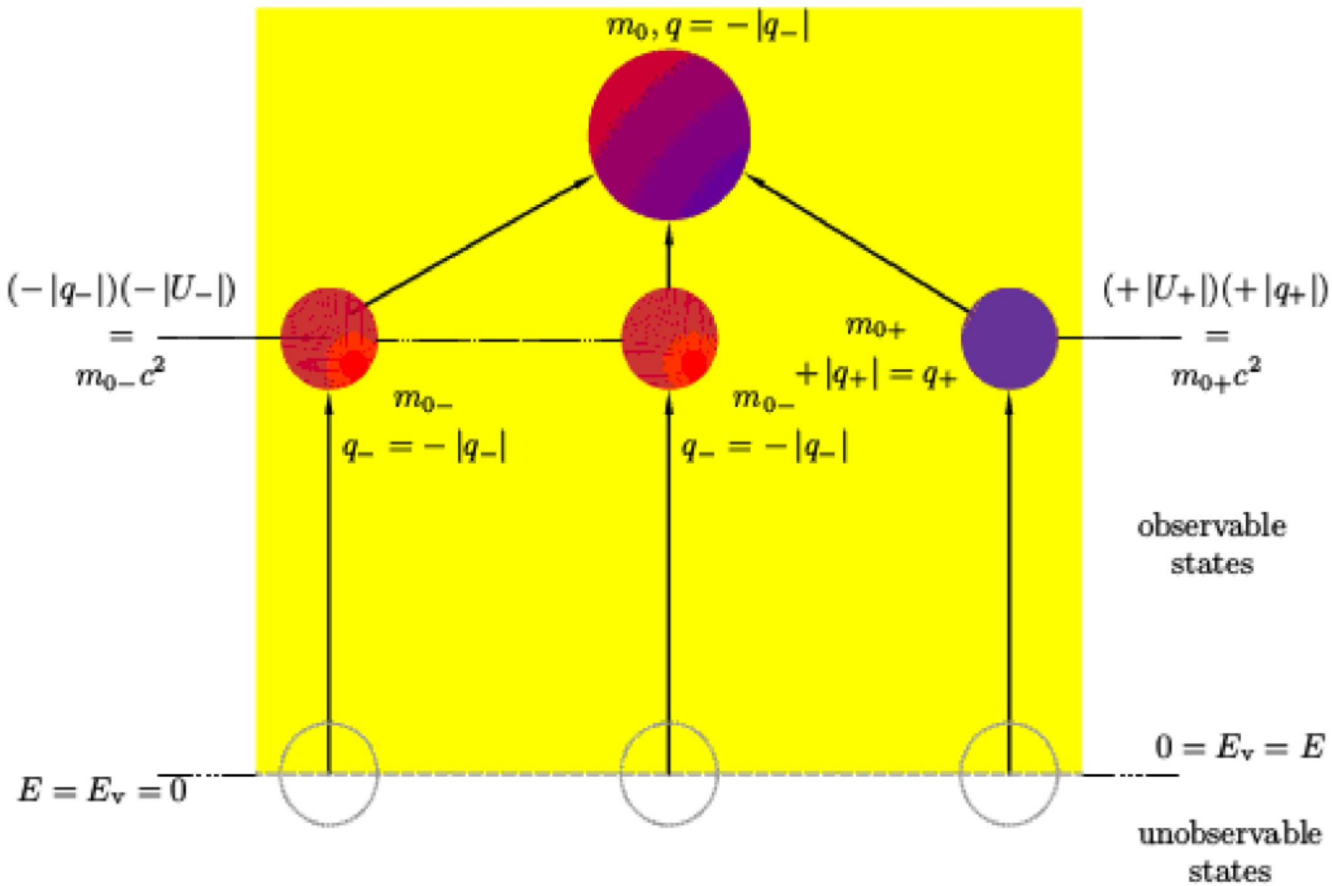


Figure 2 : Mass-charge evolution described by the charge-corrected mass.



$$(-|q_-|)(-|U_-|) = m_{0-}c^2\,,\ (-|q_-|)(-|U_-|) = m_{0-}c^2\,,\ (+|q_+|)(+|U_+|) = m_{0+}c^2$$

$$\Downarrow$$

$$2(-|q_-|)(-|U_-|) + (+|q_+|)(+|U_+|) = (2m_{0-} + m_{0+})\,c^2$$

(decoupled, two tensions needed)

$$\Downarrow$$

$$2(-|q_-|)U_{\text{sys}} + (+|q_+|)U_{\text{sys}} = (2m_{0-} + m_{0+})\,c^2$$

(coupled, one tension U_{sys} needed)

$$\Downarrow$$

$$\big[2(-|q_-|) + (+|q_+|)\big]U_{\text{sys}} = (2m_{0-} + m_{0+})\,c^2$$

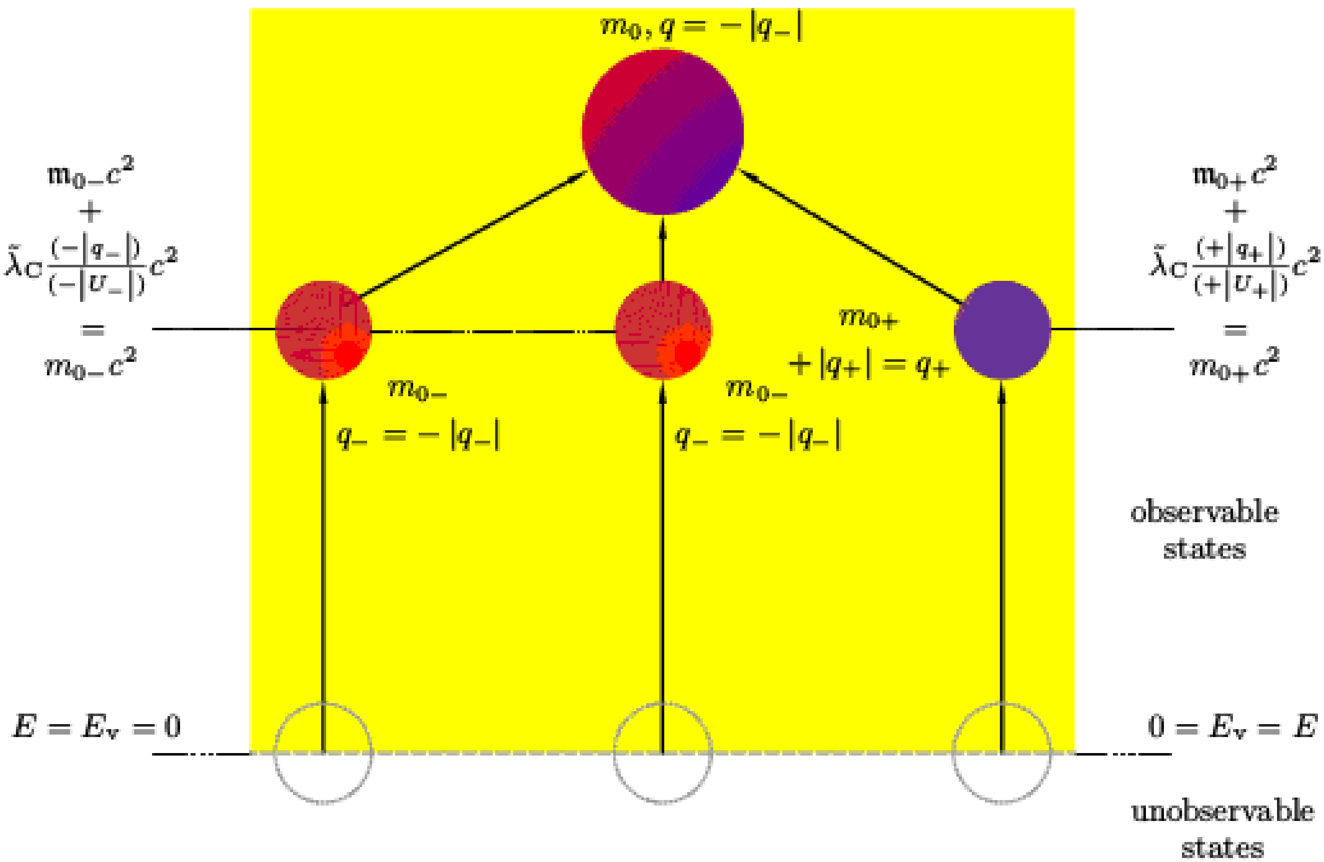
$$\Downarrow$$

$$(q = -|q_-|)U_{\text{sys}} = m_0c^2$$

$$\Updownarrow$$

$$(q = -|q_-|)(-|U_-|) = m_0c^2$$

Figure 3 : How mass-charge composition is described by the mass–charge exchange relation.



$$m_{0-} = (\mathfrak{m}_{0-}) + \tilde{\lambda}_C \frac{(-|q_-|)}{(-|U_-|)}, \; m_{0-} = (\mathfrak{m}_{0-}) + \tilde{\lambda}_C \frac{(-|q_-|)}{(-|U_-|)}, \; m_{0+} = (\mathfrak{m}_{0+}) + \tilde{\lambda}_C \frac{(+|q_+|)}{(+|U_+|)}$$

$$\Downarrow$$

$$2m_{0-} + m_{0+} = (2\mathfrak{m}_{0-} + \mathfrak{m}_{0+}) + \Delta\mathfrak{m}_0 + \tilde{\lambda}_C \frac{(-|q_-|)}{(-|U_-|)},$$

$$\Delta\mathfrak{m}_0 = \tilde{\lambda}_C \frac{(-|q_-|)}{(-|U_-|)} + \tilde{\lambda}_C \frac{(+|q_+|)}{(+|U_+|)}$$

$$\Downarrow$$

$$2m_{0-} + m_{0+} = (2\mathfrak{m}_{0-} + \mathfrak{m}_{0+} + \Delta\mathfrak{m}_0) + \tilde{\lambda}_C \frac{(-|q_-|)}{U_{sys}} + \tilde{\lambda}_C \frac{(+|q_+|)}{U_{sys}} + \tilde{\lambda}_C \frac{(-|q_-|)}{U_{sys}}$$

(additionally summing up all charges with respect to the "system" tension (voltage) U_{sys} formally establishes the charge correction term)

$$\Downarrow$$

$$2m_{0-} + m_{0+} = (2\mathfrak{m}_{0-} + \mathfrak{m}_{0+} + \Delta\mathfrak{m}_0) + \tilde{\lambda}_C \frac{(-|q_-|) + (+|q_+|) + (-|q_-|)}{U_{sys}}$$

$$\Downarrow$$

$$m_0 = \mathfrak{m}_0 + \tilde{\lambda}_C \frac{(q = -|q_-|)}{U_{sys}} \Leftrightarrow m_0 = \mathfrak{m}_0 + \tilde{\lambda}_C \frac{(q = -|q_-|)}{(-|U_-|)}$$

Figure 4 : How mass-charge composition is described by the charge-corrected mass.

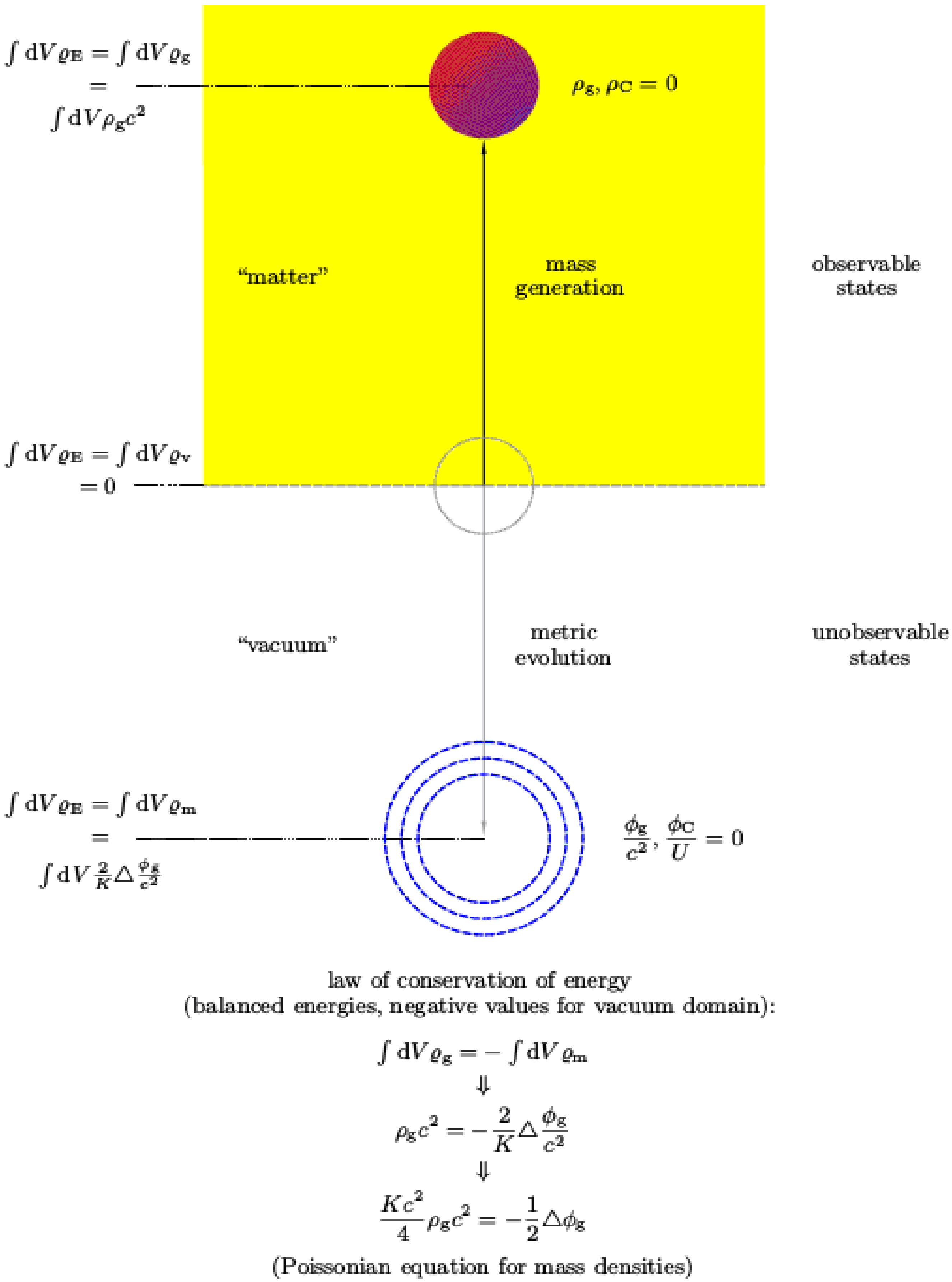


Figure 5 : Mass generation and metric field evolution. We here only consider field equations of type "Poisson", defining limiting cases of field equations of type "Einstein".

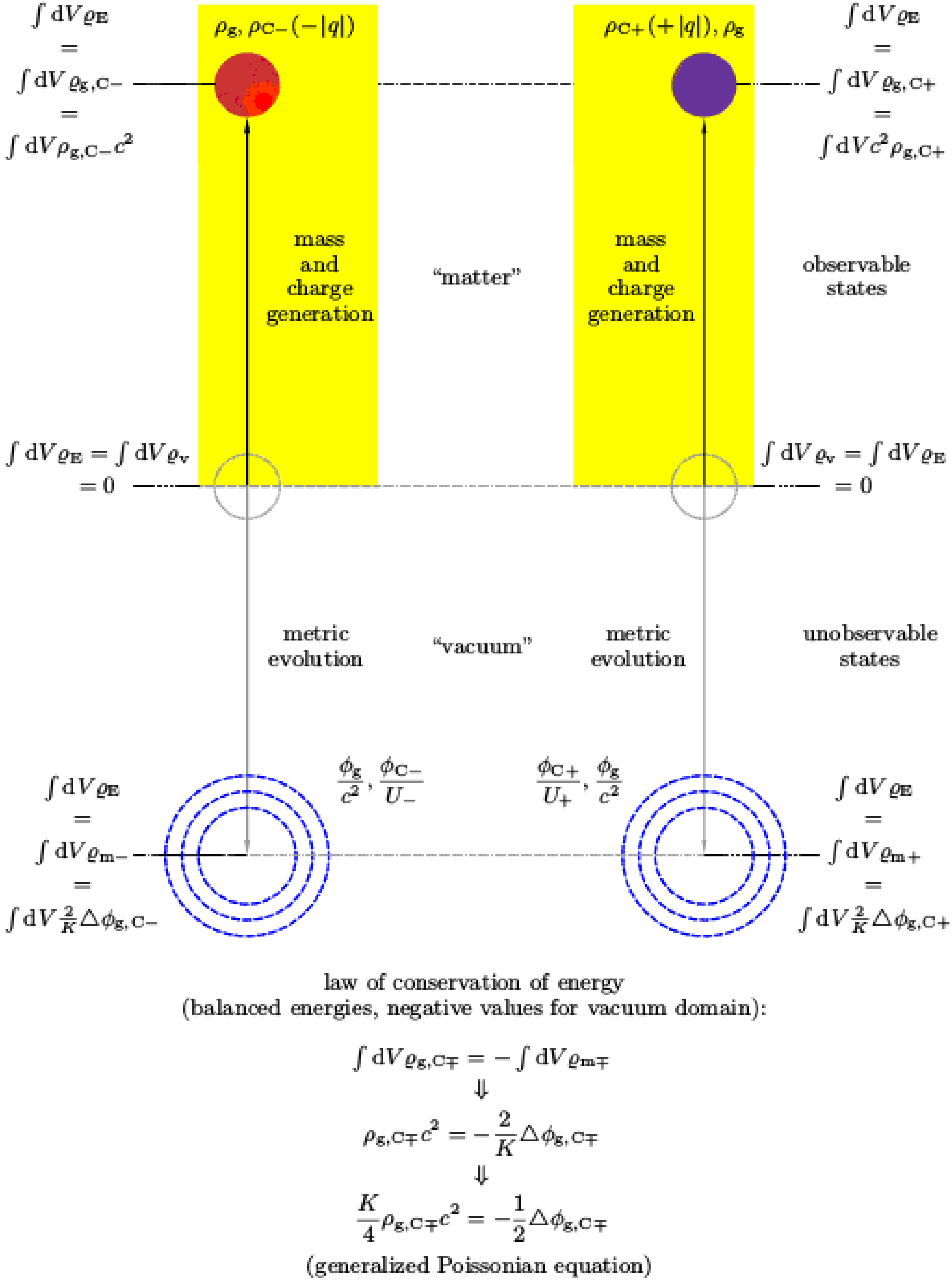


Figure 6 : Mass-charge generation and metric field evolution. We here only consider field equations of type "Poisson", defining limiting cases of field equations of type "Einstein".

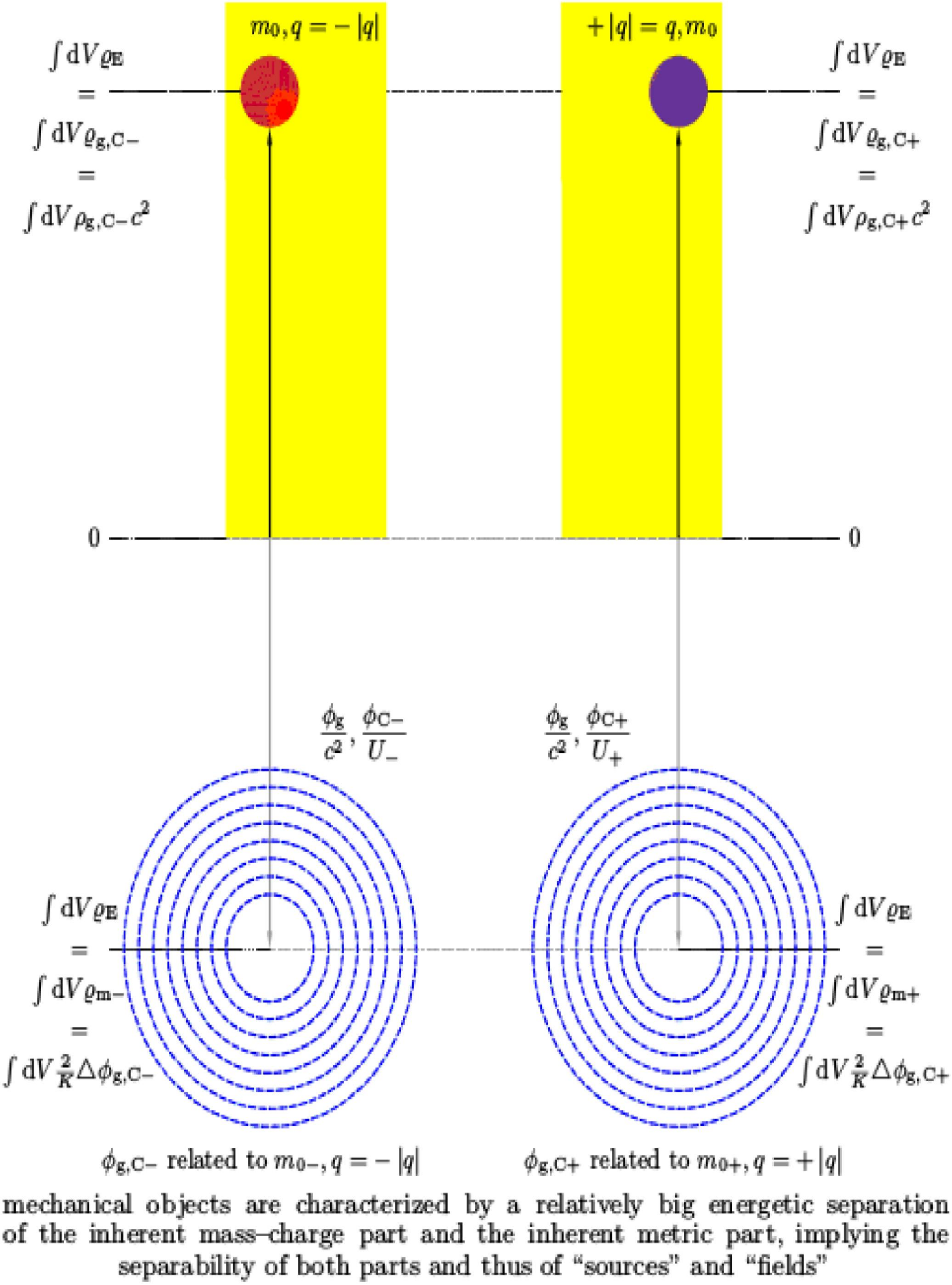


Figure 7 : Macroscopic entities defined by a relatively big separation of energy. We here only consider physical terms relating to the generalized Poissonian equation.

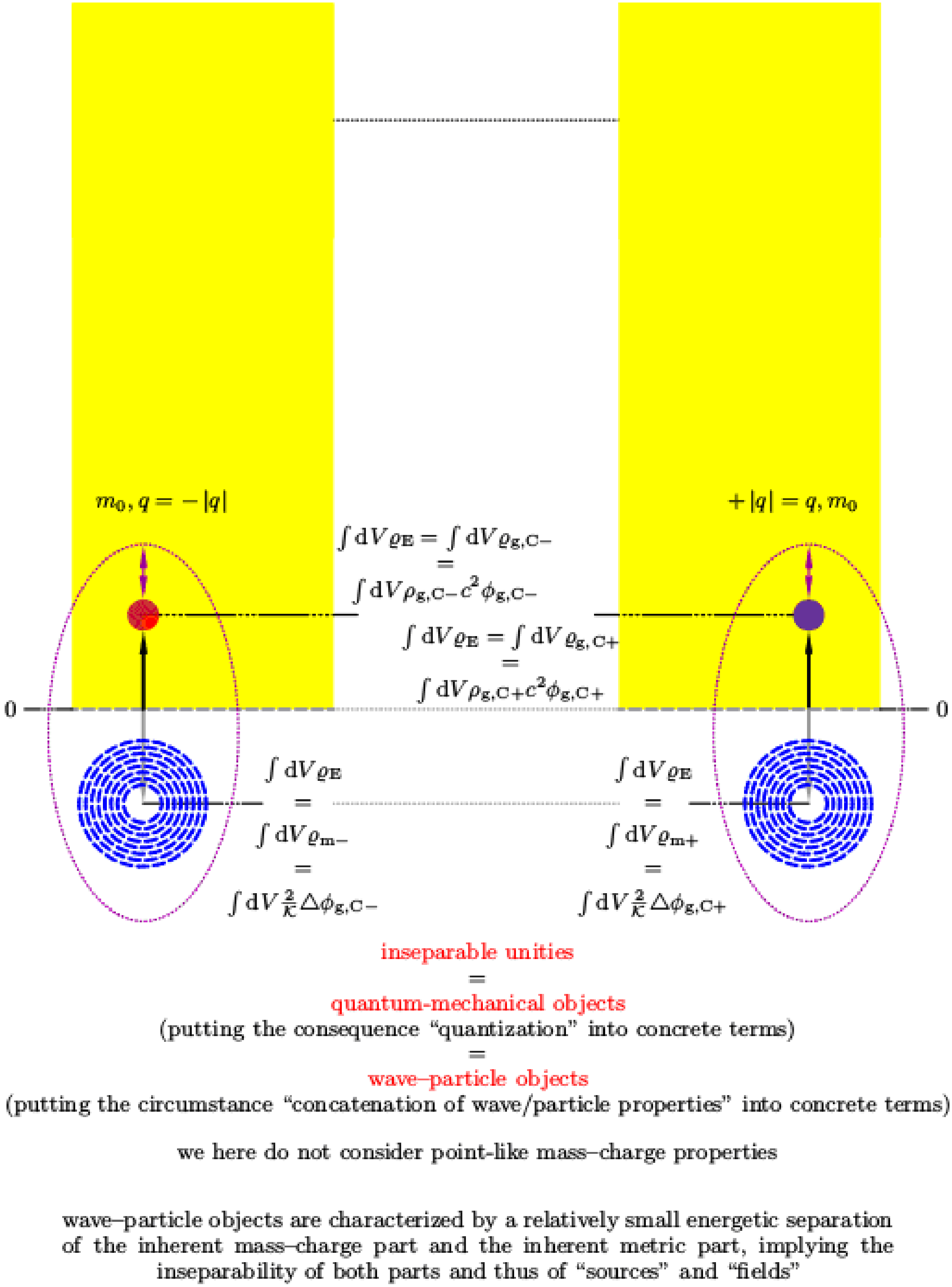


Figure 8 : Microscopic entities defined by a relatively small separation of energy. We here only consider physical terms relating to the generalized Poissonian equation.

with $\lambda_C = \lambda_C(U)$ defined by themass–charge exchange relation $m_0c^2 = qU$.

So to speak, the creation of a mass–charge object is energetically compensated by the creation of a metric field, on the classical stage, directly reflected by the generalized Poissonian equation, and this includes mass metrics and mass–charge metrics. The extension to the generalized Einstein field equations is straightforward.

Why is this interpretation important?

So to speak, the third theoretical notion "metric field energy density"/"metric field energy" $\varrho_m / \int dV \varrho_m$ postulates energy densities/energies related to "warpings" or "distortions" of the "vacuum" as a consequence of mass–charge generation such that the energy is conserved during the mass–charge generation starting from the vacuum energy density/vacuum energy $\varrho_v / \int dV \varrho_v = 0$ reflecting "unobservable states" not showing any kind of observable matter properties such as observable mass properties or observable charge properties. Dealing with macroscopic entities, the energetic distance between both energetic levels of considerationhas to be assumed as relatively big so that no overlay of mass–charge properties and metric field properties is to be expected. Dealing with microscopic entities, however, the energetic distance between both energetic levels of consideration has to be assumed as relatively small so that an overlay of mass–charge properties and metric field properties is to be expected, eventually providing a graphic access to quantum systems ("wave–particle systems"), explaining the inseparability of wave properties (→metric field properties) and particle properties (→mass–charge properties). In Figure 7 and Figure 8, these energetic circumstances are illustrated on the classical stage supplied by the generalized Poissonian equation. Due to the restricted space, the specifications that generate the transition to quantum systems ("wave–particle systems") have to be shifted into a subsequent publication.

SUMMARY

The simple ideas "charge-corrected mass", "mass–charge exchange relation", and "tension (voltage)" U, completed by the notion "metric field energy", define basic elements ofa proposal aiming at a unified treatment of masses and charges. We here mainly consider the classical stage supplied by relations of type "Poisson" and type "Newton". However, the extension to the general stage supplied by relations of type "Einstein" is straightforward. Moreover, the extension to microscopic masses and microscopic charges and therefore to quantum systems ("wave–particle systems") is straightforward. A "developer version" of a work that is still under construction[9], but already includes these further extensions as well as a lot of theoretical applications reaching from the hydrogen atom via superconductivity to the synergetics of electron–positron annihilation and also includes further blueprints of technological applications reaching from energy production via photon drives to the generation of chemical elements, can be requested from the author.

ACKNOWLEDGEMENTS

I would like to thank Dorothee Klink (Max-Planck-InstitutfürIntelligenteSysteme, Germany) for the helpful proofreading. I also would like to thank Jochem Hauser (Ostfalia University, Germany) for his support in publishing this work on generalized Einstein field theory and wave–particle theory.

REFERENCES

[1] A.Einstein; Die Grundlage der Allgemeinen Relativitätstheorie, Annalen der Physik, **49**, **(1916)**.

[2] A.Einstein; Zur Quantentheorie der Strahlung, Physikalische Zeitschrift, **18**, 47-62 **(1917)**.

[3] M.Planck; Zur Theorie des Gesetzes der Energieverteilung im Normalspektrum, Verhandlungen der Deutschen Physikalischen Gesellschaft 2, **17**, 237-245 **(1900)**.

[4] J.Ambjørn, J.Jurkiewicz, R.Loll; The self-organizing quantum, Scientific American, 42-49, July **(2008)**.

[5] B.Heim; Vorschlag eines Weges einer Einheitlichen Beschreibung der Elementarteilchen, Z. f. Naturforschung, **32a**, 233-243 **(1977)**.

[6] K.Becker, M.Becker, J.Schwarz; String Theory and M Theory, Cambridge University Press, **(2007)**.

[7] V.A.Weberruss; Nichtlineare Quantenphysik, Shaker-Verlag, **(2008)**.

[8] V.A.Weberruss; The Metric Field Gateway to Quantum Physics, AVM, **(2012)**.

[9] V.A.Weberruss; Unified Field Theory and Wave-Particle Theory, to be published.