

# Redefining Electricity: Unveiling Novel Fundamentals and Field Constants

## The Natural Definition of the Current

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**Abstract:** *Previously undiscovered fundamentals of electricity are revealed. The elementary charge is defined with the help of the basic units meter, kilogram and second, which as a consequence results in the elimination of an SI unit. This innovative approach leads to a new way of looking at electricity as a natural cause and natural effect. As a result, field constants emerge with new values. Permittivity becomes an inverse of pressure, and permeability manifests as density! This discovery will undoubtedly change forever the view of electricity in particular and of the world of physics. All statements were derived exclusively over logic and under consideration of the basic physical laws, without the need for new theories. These findings are also consistent with the real - philosophical approach that a real effect requires a real cause. These statements can be refuted neither physically nor mathematically nor philosophically.*

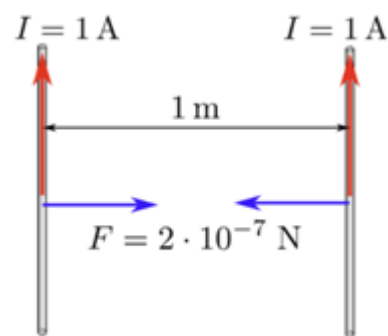
**Keywords:** electricity, fundamentals, elementary charge, SI unit elimination, innovative approach

### 1. Theoretical abstraction or natural reality?

Electricity is a fundamental phenomenon of nature that forms the basis of our modern society. However, it is insufficiently researched and is defined only theoretically and abstractly. The consequences of accepting this abstract definition as the final explanation are worrisome, as it hinders further research in this field. A real force requires a real and natural explanation, so there must be a real explanation for the current in terms of cause and effect. The natural basis of the current was subsequently successfully explored by recognizing the natural properties of the elementary charge.

#### 1.1 Evaluation of the definition of the 1948 stream

Suitable for a derivation is the old ampere definition from 1948 ["Geschichte Der Definition Der Basiseinheit Ampere | LEIFIphysik"], which goes back to the **magnetic effect of the electric current**.



The unit 1A is the strength of a time invariant electric current that, flowing through two rectilinear infinitely long conductors of negligibly small cross - section arranged parallel in vacuum at a distance of 1m from each other, would electro-dynamically produce a force of  $2 \cdot 10^{-7} \text{N}$  (Newton) between these conductors for each 1m of conductor length.

This definition of the current still had a reference to nature, which allows an analysis. The force for the definition was determined with **F\_Def**. The relation for the size of the definition force depending on the distance is based on the circumference of the circle; therefore, there must be an invisible basic force of **F\_0** in the center.

$$F_{\text{Def}} := \frac{\mu_0 \cdot (1\text{m}) \cdot \text{A} \cdot \text{A}}{2 \cdot \pi \cdot (1\text{m})} = 2 \times 10^{-7} \text{ N} \quad F_0 := 2 \cdot \pi \cdot F_{\text{Def}} = 1.2566370614 \times 10^{-6} \text{ N} \quad \mu_0 = 1.2566370614 \times 10^{-6} \frac{\text{m} \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2}$$

The value of permeability **mu0** ["Permeability"] can also be represented by the fundamental force **F\_0**, the number of electrons per second **N\_C/s** and the elementary charge **e**. The remaining conventional properties of the vacuum, the permittivity **eps0** and the impedance **Z0** result from the usual relationship.

$$\mu_0 := \frac{F_0}{\left(e \cdot \frac{\text{N}_C}{\text{s}}\right)^2} = 1.2566370614 \times 10^{-6} \frac{\text{m} \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2} \quad \epsilon_0 := \frac{1}{\mu_0 \cdot c^2} = 8.854 \times 10^{-12} \frac{\text{A}^2 \cdot \text{s}^4}{\text{m}^3 \cdot \text{kg}} \quad Z_0 := \sqrt{\frac{\mu_0}{\epsilon_0}} = 376.73 \Omega$$

1.2 The approach for deriving the definition of the elementary charge with m, kg, and s

The point is to understand the current as cause and effect. This can only be done if a definition of the elementary charge with the natural basic units meter, kilogram and second is found. This definition can be found with simple mathematical derivation and logic. The derivation is based on the formula for the force  $F_{pe}$  on the electron on the first orbit of the Bohr atomic model<sup>1</sup>.

The goal of the following derivation is to eliminate the unit ampere from the definition of the elementary charge and replace it with the units meter, kilogram, and second.

$$F_{pe} := \frac{1}{\epsilon_0} \cdot \frac{e_e \cdot e_e}{a_0^2 \cdot 4 \cdot \pi} = 8.239 \times 10^{-8} \text{ N}$$

1.3 Derivation of the natural value of the elementary charge with m, kg, and s

The force on the electron in the first orbit of the Bohr atomic model is  $F_{pe}$ .

$$F_{pe} := \frac{1}{\epsilon_0} \cdot \frac{e_e \cdot e_e}{a_0^2 \cdot 4 \cdot \pi} = 8.239 \times 10^{-8} \text{ N}$$

In equation  $F_{pe}$ ,  $\epsilon_0$  is replaced by the expression  $\epsilon_{0\_repl}$ , which with transformation (prefixing the charges) leads to  $F_{pe\_b}$ .

$$\epsilon_{0\_repl} := \frac{1}{\mu_0 \cdot c^2} = 8.854 \times 10^{-12} \frac{\text{A}^2 \cdot \text{s}^4}{\text{kg} \cdot \text{m}^3} \quad \frac{\epsilon_{0\_repl}}{\epsilon_0} = 1 \quad F_{pe\_b} := e_e^2 \cdot \mu_0 \cdot c^2 \cdot \frac{1}{a_0^2 \cdot 4 \cdot \pi} = 8.239 \times 10^{-8} \text{ N}$$

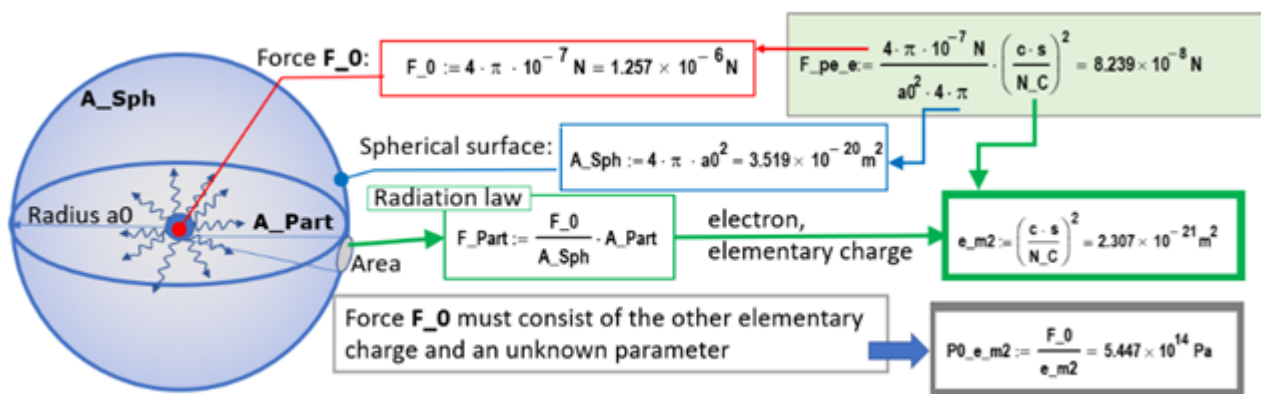
The value for the two charges squared can be equivalently replaced by  $e_e\_quad\_repl$ , which gives  $F_{ep\_c}$ .

$$e_e^2 = 2.567 \times 10^{-38} \text{ C}^2 \quad e_e\_quad\_repl := \frac{\text{A}^2 \cdot \text{s}^2}{\text{N} \cdot \text{C}^2} = 2.567 \times 10^{-38} \text{ C}^2 \quad F_{ep\_c} := \frac{\text{A}^2 \cdot \text{s}^2}{\text{N} \cdot \text{C}^2} \cdot \mu_0 \cdot c^2 \cdot \frac{1}{a_0^2 \cdot 4 \cdot \pi} = 8.239 \times 10^{-8} \text{ N}$$

The equivalent replacement of the magnetic field constant  $\mu_0$  by the numerical definition value  $\mu_{0\_repl}$  gives the unchanged result  $F_{ep\_d}$ . The equation presented in this way still represents the original situation with the correct result. Thus, a first goal is achieved. The unit for Coulomb ( $\text{A} \cdot \text{s}$ ) can be shortened.

$$\mu_{0\_repl} := 4 \cdot \pi \cdot 10^{-7} \cdot \frac{\text{m} \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2} \quad \frac{\mu_{0\_repl}}{\mu_0} = 1 \quad F_{ep\_d} := \left( \frac{\text{A}^2 \cdot \text{s}^2}{\text{N} \cdot \text{C}^2} \right) \cdot \left( 4 \cdot \pi \cdot 10^{-7} \frac{\text{m} \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2} \right) \cdot c^2 \cdot \frac{1}{a_0^2 \cdot 4 \cdot \pi} = 8.239 \times 10^{-8} \text{ N}$$

By specific simplification (leave 4 Pi, because this is both times the natural relation) and reshaping of this equation, the result  $F_{ep\_e}$  is obtained.



From a distance, this equation is recognizable as point radiation onto a surface<sup>2</sup>. The basic force  $F_0$  radiates (shields) onto a spherical surface  $A_{Sph}$ . A part of the sphere surface  $A_{Part}$  experiences the corresponding force  $F_{Part}$ . Thus, the real properties of the electron are recognizable. The real value for the electron with natural units results in  $e_{m2}$ . Logically (since the result is the force between two charges), the basic force  $F_0$  must come from another parameter and the counter charge (same quantity). From this, the second parameter must result by dividing the force  $F_0$  by the charge  $e_{m2}$ . The result shows a pressure  $P0\_e\_m2$ .

<sup>1</sup> [3] "Atomic Unit of Force."  
<sup>2</sup> [4] "Abstandsgesetz Eines Punktförmigen Strahlers."

$$F_{pe_e} := \frac{4 \cdot \pi \cdot 10^{-7} \text{ N}}{a_0^2 \cdot 4 \cdot \pi} \cdot \left(\frac{c \cdot s}{N_C}\right)^2 = 8.239 \times 10^{-8} \text{ N}$$

$$e_{m2} := \left(\frac{c \cdot s}{N_C}\right)^2 = 2.307 \times 10^{-21} \text{ m}^2$$

$$F_0 := 2 \cdot \pi \cdot (F_{Def}) = 1.257 \times 10^{-6} \text{ N}$$

$$P0_{e_{m2}} := \frac{F_0}{e_{m2}} = 5.447 \times 10^{14} \text{ Pa}$$

With the new value of the elementary charge  $e_{m2}$ , the natural field constants result in the form of a density  $\mu_0_{m2}$  and as reciprocals of a pressure  $\epsilon_{ps0}_{m2}$ . The impedance of the vacuum appears as a momentum density  $Z0_{m2}$ .

permeability of free space

$$\mu_0_{m2} := \frac{(F_0)}{\left(e_{m2} \cdot \frac{N_C}{s}\right)^2} = 6.06 \times 10^{-3} \frac{\text{kg}}{\text{m}^3}$$

permittivity of free space

$$\epsilon_{ps0}_{m2} := \frac{1}{\mu_0_{m2} \cdot c^2} = 1.836 \times 10^{-15} \frac{1}{\text{Pa}}$$

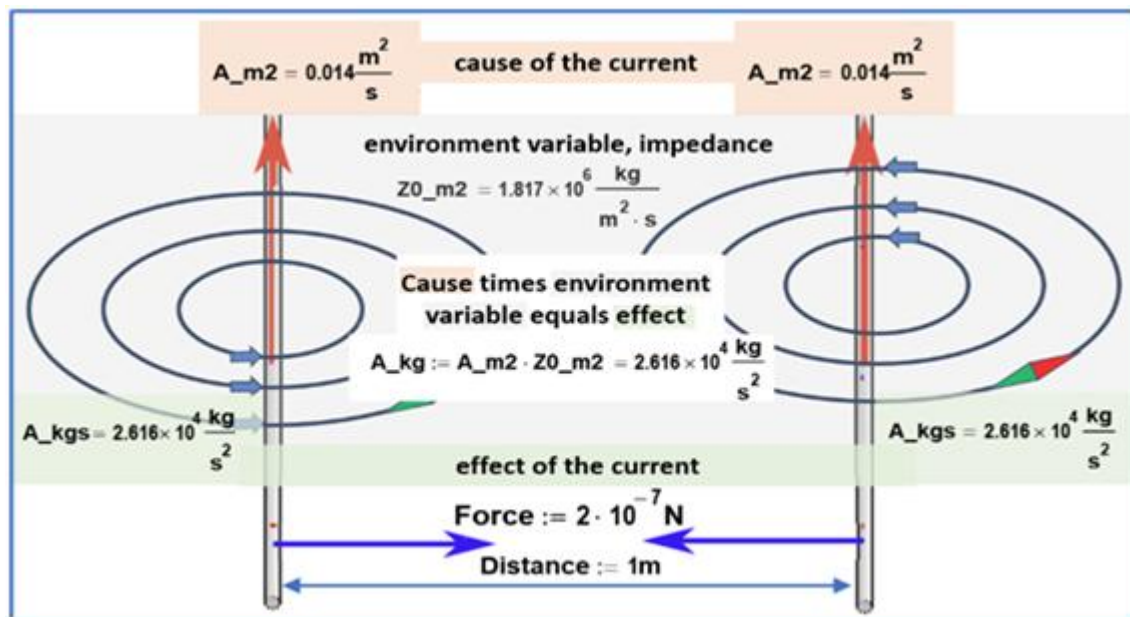
impedance of free space

$$Z0_{m2} := \sqrt{\frac{\mu_0_{m2}}{\epsilon_{ps0}_{m2}}} = 1.817 \times 10^6 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$$

#### 1.4 Viewing the stream in detail

This leads to a real explanation of the cause and effect of the current and to new and logically explainable values for all quantities of electrical engineering. The mechanism of the current is as follows: In the conductor flows the current  $A_{m2}$  as a **cause** (a surface), the conductor is in the momentum environment  $Z0_{m2}$  and therefore around it arises the circular mass flow  $A_{kgs}$  as an **effect**. The value corresponds to the sum of the invisible mass accelerated around the current - carrying conductor. The current as the cause is therefore  $A_{m2}$ , and the current as the effect is  $A_{kgs}$ . Consequently, current is a real and natural interaction of cause and effect. Therefore, the **effect of elementary charge** can be recognized as  $e_{kgs}$ .

$$A_{m2} := N_C \cdot \frac{e_{m2}}{s} = 0.01 \frac{\text{m}^2}{\text{s}} \quad Z0_{m2} = 1.82 \times 10^6 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}} \quad A_{kgs} := A_{m2} \cdot Z0_{m2} = 2.62 \times 10^4 \frac{\text{kg}}{\text{s}^2} \quad e_{kg} := \frac{A_{kgs}}{\left(\frac{N_C}{s}\right)} = 4.19 \times 10^{-15} \frac{\text{kg}}{\text{s}}$$



The effect due to the cause is circular perpendicular to the direction of motion of the electron. For this the explanation and a mathematical operator would have to be found.

##### 1.4.1 The new units of electrical engineering

As a consequence of the new definition of the elementary charge (new definition of ampere), new units and new numerical values result for all physical quantities of electrical engineering. Of course, all previous field theories remain valid for electrical engineering and electrostatics. The difference from the definition via ampere results in the

fact that a real background can be assigned to the fields. The thus far abstract fields now obtain real properties consisting of kg, m, and s. In the following, the new properties of some units of the conventionally defined units (\*\_k) are contrasted. The property of the units is represented either as a cause (\*\_m2) in the momentum environment or directly as an effect (\*\_kgs). On closer inspection, it becomes visible that all quantities obtain an understandable and plausible unit. First, the functional unit of resistance and conductance catches the eye. Likewise, the capacity becomes so logical.

		abstract conventional	Cause in the impulse medium	Effect observed
Elemental charge:	$e_e = 1.602 \times 10^{-19} \text{ C}$	$C = 1 \text{ A} \cdot \text{s}$	$e_{m2} = 2.307 \times 10^{-21} \text{ m}^2$	$e_{kgs} = 4.192 \times 10^{-15} \frac{\text{kg}}{\text{s}}$
Charge:	$C_{ek} \Rightarrow C = 1 \text{ C}$	$1 \text{ C} = 1 \text{ A} \cdot \text{s}$	$C_{em2} \Rightarrow N_C \cdot e_{m2} = 0.014 \text{ m}^2$	$C_{kgs} \Rightarrow N_C \cdot e_{kgs} = 2.616 \times 10^4 \frac{\text{kg}}{\text{s}}$
Current:	$I_k \Rightarrow \frac{C_{ek}}{s} = 1 \text{ A}$	$1 \text{ A} = 1 \text{ A}$	$I_{m2} \Rightarrow \frac{C_{em2}}{s} = 0.014 \frac{\text{m}^2}{\text{s}}$	$I_{kgs} \Rightarrow \frac{C_{kgs}}{s} = 2.616 \times 10^4 \frac{\text{kg}}{\text{s}^2}$
Tension:	$U_k \Rightarrow \frac{W}{I_k} = 1 \text{ V}$	$1 \text{ V} = 1 \frac{\text{m}^2 \cdot \text{kg}}{\text{A} \cdot \text{s}^3}$	$U_{m2} \Rightarrow \frac{W}{I_{m2}} = 69.446 \frac{\text{kg}}{\text{s}^2}$	$U_{kgs} \Rightarrow \frac{W}{I_{kgs}} = 3.822 \times 10^{-5} \frac{\text{m}^2}{\text{s}}$
Resistance:	$R_k \Rightarrow \frac{U_k}{I_k} = 1 \Omega$	$1 \Omega = 1 \frac{\text{m}^2 \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^3}$	$R_{m2} \Rightarrow \frac{U_{m2}}{I_{m2}} = 4.82 \times 10^3 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$	$R_{kgs} \Rightarrow \frac{U_{kgs}}{I_{kgs}} = 1.46 \times 10^{-9} \frac{\text{m}^2 \cdot \text{s}}{\text{kg}}$
Conductance:	$G_k \Rightarrow \frac{1}{R_k} = 1 \frac{1}{\Omega}$	$\frac{1}{\Omega} = 1 \frac{\text{A}^2 \cdot \text{s}^3}{\text{m}^2 \cdot \text{kg}}$	$G_{m2} \Rightarrow \frac{1}{R_{m2}} = 2.07 \times 10^{-4} \frac{\text{m}^2 \cdot \text{s}}{\text{kg}}$	$G_{kgs} \Rightarrow \frac{1}{R_{kgs}} = 6.84 \times 10^8 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$
Capacity:	$C_k \Rightarrow \frac{C_{ek}}{U_k} = 1 \text{ F}$	$1 \text{ F} = 1 \frac{\text{A}^2 \cdot \text{s}^4}{\text{m}^2 \cdot \text{kg}}$	$C_{m2} \Rightarrow \frac{C_{em2}}{U_{m2}} = 2.07 \times 10^{-4} \frac{\text{m}^2 \cdot \text{s}^2}{\text{kg}}$	$C_{kgs} \Rightarrow \frac{C_{kgs}}{U_{kgs}} = 6.84 \times 10^8 \frac{\text{kg}}{\text{m}^2}$
magnetic flux:	$\Phi_k \Rightarrow U_k \cdot s = 1 \text{ Wb}$	$1 \text{ Wb} = 1 \frac{\text{m}^2 \cdot \text{kg}}{\text{A} \cdot \text{s}^2}$	$\Phi_{m2} \Rightarrow U_{m2} \cdot s = 69.446 \frac{\text{kg}}{\text{s}}$	$\Phi_{kgs} \Rightarrow U_{kgs} \cdot s = 3.82 \times 10^{-5} \text{ m}^2$
magnetic flux density	$B_k \Rightarrow \frac{\Phi_k}{\text{m}^2} = 1 \text{ T}$	$1 \text{ T} = 1 \frac{\text{kg}}{\text{A} \cdot \text{s}^2}$	$B_{m2} \Rightarrow \frac{\Phi_{m2}}{\text{m}^2} = 69.446 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$	$B_{kgs} \Rightarrow \frac{\Phi_{kgs}}{\text{m}^2} = 3.822 \times 10^{-5}$
Inductance:	$L_k \Rightarrow \frac{U_k \cdot s}{I_k} = 1 \text{ H}$	$1 \text{ H} = 1 \frac{\text{m}^2 \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2}$	$L_{m2} \Rightarrow \frac{U_{m2} \cdot s}{I_{m2}} = 4.82 \times 10^3 \frac{\text{kg}}{\text{m}^2}$	$L_{kgs} \Rightarrow \frac{U_{kgs} \cdot s}{I_{kgs}} = 1.46 \times 10^{-9} \frac{\text{m}^2 \cdot \text{s}^2}{\text{kg}}$
magnetic field strength:	$H_k \Rightarrow \frac{I_k}{m} = 1 \frac{\text{A}}{\text{m}}$	$\frac{1 \text{ A}}{\text{m}} = 1 \frac{\text{A}}{\text{m}}$	$H_{m2} \Rightarrow \frac{I_{m2}}{m} = 0.014 \frac{\text{m}}{\text{s}}$	$H_{kgs} \Rightarrow \frac{I_{kgs}}{m} = 2.616 \times 10^4 \text{ Pa}$
Electric field strength:	$E_k \Rightarrow \frac{N}{C} = 1 \frac{\text{m} \cdot \text{kg}}{\text{A} \cdot \text{s}^3}$	$\frac{1 \text{ V}}{\text{m}} = 1 \frac{\text{m} \cdot \text{kg}}{\text{A} \cdot \text{s}^3}$	$E_{m2} \Rightarrow \frac{N}{C_{em2}} = 69.446 \text{ Pa}$	$E_{kgs} \Rightarrow \frac{N}{C_{kgs}} = 3.822 \times 10^{-5} \frac{\text{m}}{\text{s}}$

Some of these units become so obviously understandable that this is a great indication that reality has thus been recognized.

By the new definition of the elementary charge both as cause  $e_{m2}$  and as effect  $e_{kgs}$ , a new quantity results for all nature constants that are defined with current, which can be represented by natural SI basic units. This will result in new insights and explanations about the functioning of these natural constants.

### 1.5 The constants defined with amperes with the new units

	electron conventionally defined	electron defined as a surface (cause)	electron defined as mass flow (effect)
elementary charge	$e = 1.602 \times 10^{-19} \text{ C}$	$e_{m2} = 2.307 \times 10^{-21} \text{ m}^2$	$e_{kgs} = 4.192 \times 10^{-15} \frac{\text{kg}}{\text{s}}$
magnetic permeability	$\mu_0 = 1.257 \times 10^{-6} \frac{\text{m} \cdot \text{kg}}{\text{A}^2 \cdot \text{s}^2}$	$\mu_{0m2} = 6.06 \times 10^{-3} \frac{\text{kg}}{\text{m}^3}$	$\mu_{0kgs} = 1.836 \times 10^{-15} \frac{1}{\text{Pa}}$
electric permittivity	$\epsilon_0 = 8.854 \times 10^{-12} \frac{\text{A}^2 \cdot \text{s}^4}{\text{m}^3 \cdot \text{kg}}$	$\epsilon_{0m2} = 1.836 \times 10^{-15} \frac{1}{\text{Pa}}$	$\epsilon_{0kgs} = 6.06 \times 10^{-3} \frac{\text{kg}}{\text{m}^3}$
impedance of vacuum	$Z_0 = 376.73 \Omega$	$Z_{0m2} = 1.817 \times 10^8 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$	$Z_{0kgs} = 5.504 \times 10^{-7} \frac{\text{m}^2 \cdot \text{s}}{\text{kg}}$
conductance quantum	$G_0 \Rightarrow \frac{(2e)^2}{h_0} = 7.748 \times 10^{-5} \frac{1}{\Omega}$	$G_{0m2} \Rightarrow \frac{(2e_{m2})^2}{h_0} = 1.607 \times 10^{-8} \frac{\text{m}^2 \cdot \text{s}}{\text{kg}}$	$G_{0kgs} \Rightarrow \frac{(2e_{kgs})^2}{h_0} = 5.303 \times 10^4 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$
von Klitzing constant	$R_K \Rightarrow \frac{h_0}{e^2} = 2.581 \times 10^4 \Omega$	$R_{Km2} \Rightarrow \frac{h_0}{e_{m2}^2} = 1.245 \times 10^8 \frac{\text{kg}}{\text{m}^2 \cdot \text{s}}$	$R_{Kkgs} \Rightarrow \frac{h_0}{e_{kgs}^2} = 3.771 \times 10^{-5} \frac{\text{m}^2 \cdot \text{s}}{\text{kg}}$
Josephson constant	$K_J \Rightarrow \frac{2e}{h_0} = 4.836 \times 10^{14} \frac{1}{\text{Wb}}$	$K_{Jm2} \Rightarrow \frac{2e_{m2}}{h_0} = 6.964 \times 10^{12} \frac{\text{s}}{\text{kg}}$	$K_{Jkgs} \Rightarrow \frac{2e_{kgs}}{h_0} = 1.265 \times 10^{19} \frac{1}{\text{m}^2}$
magnetic flux quantum	$\Phi_{0k} \Rightarrow \frac{h_0}{2e} = 2.068 \times 10^{-15} \text{ Wb}$	$\Phi_{0m2} \Rightarrow \frac{h_0}{2e_{m2}} = 1.436 \times 10^{-13} \frac{\text{kg}}{\text{s}}$	$\Phi_{0kgs} \Rightarrow \frac{h_0}{2e_{kgs}} = 7.904 \times 10^{-20} \text{ m}^2$
Bohr magneton	$\mu_B \Rightarrow \frac{e_e \cdot h_0}{2 \cdot m_e} = 9.274 \times 10^{-24} \text{ m}^2 \cdot \text{A}$	$\mu_{Bm2} \Rightarrow \frac{e_{m2} \cdot h_0}{2 \cdot m_e} = 1.335 \times 10^{-25} \frac{\text{m}^4}{\text{s}}$	$\mu_{Bkgs} \Rightarrow \frac{e_{kgs} \cdot h_0}{2 \cdot m_e} = 2.426 \times 10^{-19} \text{ J}$

**Overall picture of derivation**

The current presents itself as a natural phenomenon and is also subject to the law of cause and effect. With the all-pervading field constants, all physical basics of electricity and magnetism can be explained with mechanistic and descriptive models<sup>3</sup>. The results are logical and agree 100% with all observations and field equations, so no exception rule is necessary. All statements were derived exclusively over logic and under consideration of the basic physical laws, without the need for new theories. This finding is also consistent with the real - philosophical approach that a real effect requires a real cause. These statements can be refuted neither physically nor mathematically nor philosophically.

Galileo Galilei said approximately four hundred years ago:

**"All truths are easy to understand once discovered; it is discovering them that matters!"**

Switzerland, Schaffhausen, July 26, 2023 Walter Ruh

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