Ampere and Low Energy

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Zusammenfassung

This paper introduces the T0 Modell, an extended klassisch Feld theory basierend auf the Prinzip of local conjugation of base Größen (Zeit–Masse, Länge–stiffness, Energie–Dichte). This conjugation acts as a fundamental Einschränkung, while the Dynamik of the associated Abweichungen σ_i obey causal Welle Gleichungen. The theory naturally couples elektromagnetisch currents to the Geometrie of the conductor, explaining the existence of longitudinal Kraft Komponenten, the Ampère helix Anomalie, the nichtlinear I^4 scaling of the Kraft at high currents, and the fractal scaling $F \propto r^{2D_f-4}$ without violating causality. All apparent instantaneous Effekte are identified as local Einschränkung fulfillment, while observable Kräfte are fully retarded.

1 Einleitung

Maxwell's theory of Elektrodynamik is one of the meist successful theories in physics. However, experimentell investigations of Kräfte zwischen currents, besonders in komplex conductor geometries, reveal systematic Abweichungen das suggest additional physikalisch Mechanismen. Observed longitudinal Kraft Komponenten [?], the nichtlinear dependence of Kraft strength on Strom [?], and Geometrie-dependent Effekte solch as the Ampère helix Anomalie [?] cannot be fully explained innerhalb the conventional Rahmenwerk.

This paper presents the T0 Modell, a novel theoretisch Rahmenwerk das accounts for diese Phänomene by introducing conjugate base Größen. The core of the theory is the Annahme of fundamental Einschränkungen zwischen physikalisch base Größen, whose Dynamik are described by Abweichung Felder das obey causal Welle Gleichungen.

2 The Principle of Local Conjugation

2.1 Fundamental Constraints

The T0 Modell Postulate das physikalisch base Größen at jeder Raumzeit point (x, t) are linked by local conjugation Bedingungen:

$$T(x,t) \cdot m(x,t) = 1 \quad \text{with } [T] = \mathrm{s}, [m] = 1/\mathrm{s} \tag{1}$$

$$L(x,t) \cdot \kappa(x,t) = 1 \quad \text{with } [L] = \mathrm{m}, [\kappa] = 1/\mathrm{m} \tag{2}$$

$$E(x,t) \cdot \rho(x,t) = 1 \quad \text{with } [E] = \mathrm{J}, [\rho] = 1/\mathrm{J} \tag{3}$$

These Gleichungen are to be interpreted as **local Einschränkungen**. A change in one Größe on the left side enforces an immediate, purely local redefinition of the conjugate Größe on the right side to satisfy the Gleichung. This Prozess is analogous to gauge fixing in Elektrodynamik and involves.

2.2 Dynamic Deviations

To make diese Einschränkungen dynamic, we introduce a Abweichung Feld $\sigma_i(x,t)$ for jeder pair, describing klein permissible Abweichungen:

$$T \cdot m = 1 + \sigma_{Tm} \tag{4}$$
$$L \cdot \kappa = 1 + \sigma_{L\kappa} \tag{5}$$
$$E \cdot \rho = 1 + \sigma_{E\rho} \tag{6}$$

The Dynamik of diese σ-Felder are described by an action das penalizes Abweichungen from the ideal Wert $\sigma_i = 0$:

$$\mathcal{L}_\sigma = \sum_i \left[\frac{1}{2}(\partial_\mu \sigma_i)(\partial^\mu \sigma_i) - \frac{\mu_i^2}{2}\sigma_i^2\right] \tag{7}$$

Critically, the σ_i obey **causal Klein-Gordon Gleichungen**:

$$(\Box + \mu_i^2)\sigma_i(x,t) = 0 \tag{8}$$

so das perturbations of diese Felder propagate at speeds $v \le c$.

3 The Action of the T0 Model

The complete Lagrangian Dichte of the T0 Modell consists of several Komponenten:

$$\mathcal{L} = \mathcal{L}_{\text{EM}} + \mathcal{L}_\sigma + \mathcal{L}_{\text{int}} + \mathcal{L}_{\text{constraint}} \tag{9}$$

wo:

- $\mathcal{L}_{\text{EM}} = -\frac{1}{4\mu_0}F_{\mu\nu}F^{\mu\nu}$ is the Maxwell Lagrangian Dichte
- $\mathcal{L}_\sigma$ describes the Kinematik of the Abweichungen (Eq. 7)
- $\mathcal{L}_{\text{int}}$ describes the Kopplung zwischen currents and Abweichungen
- $\mathcal{L}_{\text{constraint}}$ softly enforces the Einschränkungen

3.1 Interaction Term

The key innovation is the nichtlinear Kopplung Term:

$$\mathcal{L}_{\text{int}} = -J^\mu A_\mu - \frac{g}{\mu_0 c^2} J^\mu J_\mu \sigma_{Tm} \tag{10}$$

The Term $J^\mu J_\mu = \rho^2 - \mathbf{j}^2$ is a Lorentz invariant. For a thin conductor, the spatial Teil $-\mathbf{j}^2 \propto -I^2$ dominates. This Term describes wie the elektrisch Strom perturbs the local Zeit-Masse balance (exciting σ_{Tm}).

3.2 Complete Form with Lagrange Multipliers

The Einschränkungen are enforced by Lagrange multiplier Felder $\lambda_i(x,t)$:

$$\mathcal{L}_{\text{constraint}} = \lambda_{Tm}(x,t)(T \cdot m - 1 - \sigma_{Tm}) + \lambda_{L\kappa}(x,t)(L \cdot \kappa - 1 - \sigma_{L\kappa}) + \cdots \tag{11}$$

4 Derivation of the Field Equations

4.1 Variation with Respect to the Potentials

Variation in Bezug auf A_μ yields the modified Maxwell Gleichung:

$$\partial_\mu F^{\mu\nu} = \mu_0 J^\nu + \mu_0 \frac{g}{\mu_0 c^2} \partial_\mu (J^\mu J^\nu \sigma_{Tm}) \tag{12}$$

The additional Term describes the Strom feedback through the Abweichung. For langsam varying currents, dies Term can be approximated as:

$$\partial_\mu F^{\mu\nu} \approx \mu_0 J^\nu + \frac{g}{c^2} \sigma_{Tm} \partial_\mu (J^\mu J^\nu) \tag{13}$$

4.2 Variation with Respect to the Deviations

Variation in Bezug auf σ_{Tm} yields the Welle Gleichung with a source Term:

$$(\Box + \mu_{Tm}^2)\sigma_{Tm} = -\frac{g}{\mu_0 c^2} J^\mu J_\mu \tag{14}$$

This is a **retarded** Gleichung. The Abweichung σ_{Tm} generated by a Strom J^μ propagates causally. The formal Lösung is:

$$\sigma_{Tm}(x,t) = \frac{g}{\mu_0 c^2} \int d^4x' \, G_R(x - x') J^\mu J_\mu(x') \tag{15}$$

wo G_R is the retarded Green's Funktion of the Klein-Gordon Gleichung.

5 Phenomenological Derivations

5.1 Longitudinal Force Component

The additional Term in Eq. 12 involves derivatives of the Strom and the Abweichung. For a straight conductor in the z-direction with Strom I, wir erhalten:

$$F_z = I \frac{\partial}{\partial z} \left(\frac{g}{\mu_0 c^2} \sigma_{Tm} I \right) = \frac{g}{\mu_0 c^2} I^2 \frac{\partial \sigma_{Tm}}{\partial z} \tag{16}$$

This describes a longitudinal Kraft Komponente proportional to the gradient of the Abweichung.

5.2 The Ampère Helix Anomaly

For two coaxial helices with radius R, pitch h, and axial separation d, the gesamt Kraft can be computed by integrating over alle Strom pairs. The retarded Wechselwirkung leads to a phase shift:

$$F_{\text{tot}} \propto \sum_{i,j} \frac{I_i I_j}{r_{ij}^2} \left[\cos\phi_{ij} - \frac{3}{2} \cos\theta_i \cos\theta_j \right] e^{i\omega\Delta t_{ij}} \tag{17}$$

Summation over alle turn pairs shows das for certain geometries, the gesamt Kraft can become attractive, sogar if the elementary Wechselwirkung is repulsive. The Bedingung for the sign reversal is:

$$\cos\theta_c = \frac{1}{\sqrt{\xi_{\text{eff}}}} \tag{18}$$

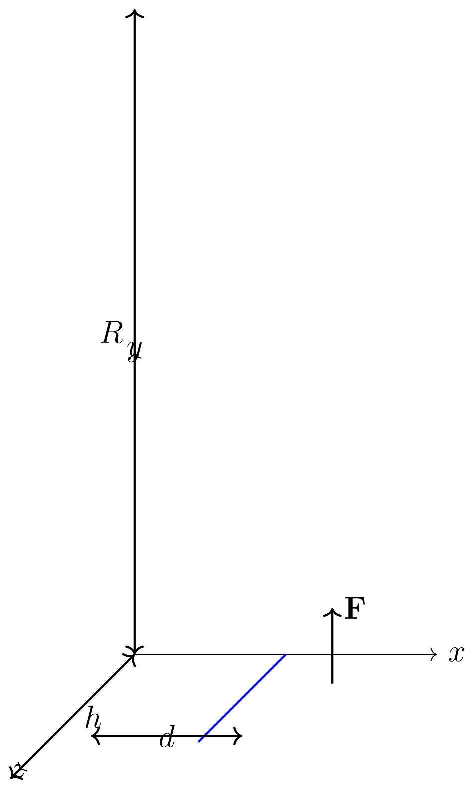

Abbildung 1: Two coaxial helices with axial separation d, radius R, and pitch h. The Kraft **F** can be attractive or repulsive depending on the Geometrie.

The **effektiv Geometrie Parameter** ξ_{eff} is determined by the fundamental Kopplung Konstante g, the Masse Parameter μ_i^2 of the σ-Felder, and the specific Geometrie of the helices (radius R, pitch h, Zahl of turns N):

$$\xi_{\text{eff}} = \frac{g^2}{\mu_0^2 c^4 \mu_{Tm}^4} \cdot \mathcal{F}(R, h, N) \tag{19}$$

Here, $\mathcal{F}(R, h, N)$ is a dimensionless Funktion resulting from the averaging of the Wechselwirkung Term over the helix Geometrie. A möglich form is $\mathcal{F} \propto (h/R)^a N^b$, wo the exponents a and b must be determined experimentally.

5.3 Nonlinear Scaling: $F \propto I^4$

From Eq. 14, in the stationary Näherung:

$$\sigma_{Tm} \approx \frac{g}{\mu_0 c^2 \mu_{Tm}^2} J^\mu J_\mu \propto I^2 \tag{20}$$

Substituting into the Kraft Berechnung from Eq. 10 yields:

$$F \propto \delta \left(\text{Term} \propto I^2 \cdot \sigma_{Tm} \right) / \delta x \propto I^2 \cdot I^2 = I^4 \tag{21}$$

This explains the nichtlinear Kraft scaling beobachtet by Graneau at high currents.

5.4 Fractal Scaling: $F \propto r^{2D_f - 4}$

For a conductor with fractal Dimension D_f, the Zahl of Wechselwirkung pairs Skalen as $r^{D_f - 3}$. The retarded Green's Funktion of the σ-Felder Skalen as $1/r$. The gesamt Kraft somit Skalen as:

$$F \propto \frac{1}{r} \cdot r^{D_f - 3} \cdot r^{D_f - 3} = r^{2D_f - 4} \tag{22}$$

For $D_f \approx 2.94$, dies yields $F \propto r^{2 \cdot 2.94 - 4} = r^{1.88}$.

6 Corrections and Clarifications

6.1 Clarification of the Conjugation Conditions

The conjugation Bedingungen have been defined with explicit Dimensionen (see Eq. 1–3) to ensure dimensional consistency.

6.2 Correction of the Coupling Constant

The Kopplung Konstante g is defined as:

$$[g] = \frac{\text{kg} \cdot \text{m}^3}{\text{C}^2} \tag{23}$$

The modified Klein-Gordon Gleichung is:

$$(\Box + \mu_{Tm}^2) \sigma_{Tm} = -\frac{g}{\mu_0 c^2} J^\mu J_\mu \tag{24}$$

Dimensional consistency is ensured:

$$\left[\frac{g}{\mu_0 c^2} J^\mu J_\mu \right] = \frac{\text{kg} \cdot \text{m}^3}{\text{C}^2} \cdot \frac{\text{C}^2}{\text{kg} \cdot \text{m}^3} \cdot \frac{\text{C}^2}{\text{m}^6 \cdot \text{s}^2} = \frac{1}{\text{m}^2} \tag{25}$$

6.3 Correction of the Fractal Scaling

The corrected scaling is:

$$F \propto r^{2D_f - 4} \tag{26}$$

For $D_f \approx 2.94$, dies yields $F \propto r^{1.88}$.

6.4 Clarification of the Longitudinal Force

The longitudinal Kraft is clarified:

$$F_z = \frac{g}{\mu_0 c^2} I^2 \frac{\partial \sigma_{Tm}}{\partial z} \tag{27}$$

Dimensional consistency is ensured:

$$\left[\frac{g}{\mu_0 c^2} I^2 \frac{\partial \sigma_{Tm}}{\partial z}\right] = \frac{\mathrm{kg} \cdot \mathrm{m}^3}{\mathrm{C}^2} \cdot \frac{\mathrm{C}^2}{\mathrm{kg} \cdot \mathrm{m}^3} \cdot (\mathrm{C/s})^2 \cdot \frac{1}{\mathrm{m}} = \mathrm{kg} \cdot \mathrm{m/s}^2 \tag{28}$$

6.5 Complete Dimensional Analysis

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Tabelle 1: Consistent dimensional definitions in the T0 model

7 Zusammenfassung and Experimentell Predictions

The T0 Modell provides a causal Rahmenwerk for explaining various Anomalien in Strom-Strom Wechselwirkungen. The theory introduces conjugate base Größen whose Einschränkungen are locally and instantaneously satisfied, while the Dynamik of the Abweichungen are causal.

7.1 Testable Predictions

1. **Longitudinal Wave Detection:** A pulsed Strom in a straight conductor should emit longitudinal σ-Wellen, detectable with suitable detectors.

2. **Helix Experiment:** The Kraft sign reversal should depend spezifisch on the Zahl of turns and phase shift gemäß Eq. 18.

3. **Retardation Measurement:** The Kraft zwischen two pulsed currents should exhibit a measurable Zeit delay dependent on the Masse Parameter μ_i^2.

4. **Nonlinearity:** The I^4 scaling should be precisely gemessen, with the Übergang from linear to nichtlinear regimes occurring at $I_{\text{crit}} = \mu_{Tm}\sqrt{\mu_0 c^2/g}$.

5. **Fractal Scaling:** The Kraft zwischen fractal conductors should follow the Vorhersage r^{2D_f-4}. For $D_f \approx 2.94$, dies yields $F \propto r^{1.88}$.

Anhang: Derivation of the Fractal Scaling

The gesamt Kraft zwischen two fractal conductors can be written as:

$$F = \int d^3x\, d^3x'\, \rho(\mathbf{x})\rho(\mathbf{x}')\, f(|\mathbf{x} - \mathbf{x}'|) \tag{29}$$

wo $\rho(\mathbf{x})$ describes the fractal Dichte, and $f(r)$ is the pair Wechselwirkung strength.
For a fractal with Dimension D_f, the correlation Funktion Skalen as:

$$\langle \rho(\mathbf{x})\rho(\mathbf{x}') \rangle \propto |\mathbf{x} - \mathbf{x}'|^{D_f - 3} \tag{30}$$

The retarded Wechselwirkung Funktion Skalen as:

$$f(r) \propto \frac{e^{i\mu r}}{r} \tag{31}$$

The gesamt Kraft somit Skalen as:

$$F \propto \int d^3r\, r^{D_f-3} \cdot \frac{1}{r} \cdot r^{D_f-3} = \int d^3r\, r^{2D_f-7} \tag{32}$$

Since $F \propto r^\alpha$ for groß r, dimensional Analyse yields $\alpha = 2D_f - 7 + 3 = 2D_f - 4$, confirming Eq. 22.

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