Newton's Laws, Electromagnetism, and Relativity

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The Relativistic Unit Circle

Newton's Force Law

(Imaginary numbers are specified in red. The scalar product of a real number and an imaginary nuber or a pair of numbers is imaginary; $i^2 \neq -1$, but is an imaginary area in an imaginary plane. (a "mirror" reflection that doesn't interact with a real area (e.g., Russell's Barber).

Imaginary numbers are complex only for physicists who think they may be real. Mathematicians are occasionally confused. Engineers don't care… ☺

$$\varphi = \psi = \left(\sqrt{m}\right)v_1 + \left(\sqrt{m}\right)v_2 = \left(\sqrt{m}\right)\left(v_1 + v_2\right)$$
$$\varphi^2 = m\left(v_1 + v_2\right)^2 = m\left[\left(v_1\right)^2 + \left(v_2\right)^2 + 2v_1v_2\right]$$
$$\psi\psi^* = m\left(v_1 + iv_2\right)\left(v_1 - iv_2\right) = m\left(v_1\right)^2 + m\left(v_2\right)^2 \Leftrightarrow \left(v_1 \perp v_2\right) \wedge \left(i^2 = -1\right)$$
$$\text{Let } v = v_1 = v_2$$
$$F = 2mv^2 = 2v_1v_2$$

(Forces are equal and opposite.)

Note that iv_2 is imaginary, while $(1)v_1$ remains real. The terms $(v_1 + iv_2)$ and $(v_1 - iv_2)$ are "complex" only if one imagines that their product is somehow a real number; however the product of a real number and an imaginary number is always imaginary, the product of a real number with a real number is always real, and the product of an imaginary number and an imaginary number remains an imaginary area in the imaginary plane.

That is, $\left(i^2 = -1\right)$ is an (imaginary) reflection ("area"/"energy") from the complex plane back into the real plane (a "mirror" image); Bertrand Russell shaving himself in a mirror. Actually, this cannot be the case, since it implies that the terms $\pm iv_2 = \pm i\sqrt{-1}$ are somehow real so that $\pm iv_1v_2 + \mp iv_2v_1$ vanishes at the intersection of the imaginary and real line velocities 0 instead of the imaginary center 0 of all possible imaginary velocities.

The interaction between the momenta is the equal and opposite forces on the real line at the center 0 of all possible real velocities $\left[\overleftrightarrow{0}\right]$ (i.e., the null vector)

$F_{ij} = mA$

$A = 2(v_1 v_2) = \overrightarrow{v_1} + \overleftarrow{v_2} = \overrightarrow{v_2} + \overleftarrow{v_1} = (v_1 v_2)\overleftrightarrow{0}$

For $v_1 = v_2 = c$, $F = E_0 = mc^2$, where $\psi\psi^* = \psi^*\psi \neq \varphi^2$

Newton's Force Law

Assume $m > 0$ and $A > 0$

$\varphi_m = \psi_A = m + A$

$\varphi_m{}^2 = m^2 + A^2 + 2mA$

$\psi_m \psi_m{}^* = (m + iA)(m - iA) = m^2 + A^2$

$\varphi_m = \psi_A = m + A$

$\varphi_m{}^2 = A^2 + m^2 + 2mA = 2F,\ F = mA$

$\psi_m \psi_m{}^* = (A + im)(A - im) = A^2 + m^2$

Note that m and A commute.

Electromagnetism

Consider the relation

$\varphi_{EB} = \psi_{EB} = \varepsilon_0 E + \mu_0 B$ where B is a time dependent perturbation to a static E field, where ε_0 and μ_0 are the permittivity and permeablity of the "vacuum" (at sea level), established experimentally from Coulomb's and Ampere's laws.

Then

$\varphi_{EB^2} = (\varepsilon_0 E + \mu_0 B)^2 = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2(\varepsilon_0 E)(\mu_0 B) = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + \varepsilon_0 \mu_0 (EB)$

Then $\psi_E \psi_E{}^* = (\varepsilon_0 E + i\mu_0 B)(\varepsilon_0 E - i\mu_0 B) = (\varepsilon_0 E)^2 + (\mu_0 B)^2$, (the Poynting Vector)

The E field is primary here, because it is not time dependent (If the static E field doesn't exist, then neither does the B field, which is derived from "moving" charges in time).

Unification

From Maxwell's result, $c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$

$$\varphi_{EB} = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2\frac{1}{c^2}(EB)$$

Then $A = 2\frac{1}{c^2}(EB)$ is the equal and opposite interaction between the E and B fields.

Newtonian Force and Electromagnetism (combining Maxwell's and Newton's Laws

$$\varphi_m{}^2 = m^2 + A^2 + 2mA\left(\frac{\delta x'}{\delta x}\right) = \gamma$$
$$\varphi_{EB} = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2\frac{1}{c^2}(EB)$$

If the interactions are equal, then

$F = mA = \frac{1}{c^2}(EB)$, so that $A = \frac{1}{m_0 c^2}(EB) = \frac{1}{\Sigma_0}(EB)$, where Σ_0 is the rest mass of the Special Theory of Relativity. Setting the static field and the current field equal: $A = \frac{1}{\Sigma_0} E E_B$

Note that $(c^2 \to \infty) \vee (EB \to 0) \Rightarrow F \Rightarrow 0$ and that $c^2 = EB \Rightarrow F = 1$

Non-Linearity (Gravity)

Consider the relation

$$\varphi_\theta = \cos\theta + \sin\theta$$
$$(\varphi_\theta)^2 = \cos^2\theta + \sin^2\theta + \cos\theta\sin\theta$$
$$(\psi_{\cos})(\psi_{\cos})^* = \cos^2\theta + \sin^2\theta = 1^2$$

Identify $A = \frac{1}{\Sigma_0} E E_B = \frac{1}{\Sigma_0}\cos\theta\sin\theta$

The Relativistic Unit circle

The Relativistic Unit Circle

$$\tau' = \tau \Leftrightarrow \theta = 0$$
$$\Leftrightarrow \cos\theta = 1,\ \sin\theta = 0$$
$$\Leftrightarrow \cosh\theta = 1,\ \sinh\theta = 0$$
$$c\tau = c\tau'$$

Final State $\left(\frac{c\tau'}{c\tau'}\right)^2 = 1^2$

$$\frac{\tau'}{\tau} < 1$$
$$\cos\theta = \frac{1}{\gamma},\ \sin\theta = \beta$$
$$A = \frac{1}{\Sigma_0}\frac{1}{\gamma}\beta = \frac{1}{\Sigma_0}\cos\theta\sin\theta$$

$$\cos\theta = \frac{1}{\gamma},\ \sin\theta = \beta$$
$$\frac{\tau'}{\tau} < 1 \Leftrightarrow A = \frac{1}{\Sigma_0}\left(\frac{1}{\gamma}\beta\right) = \frac{1}{\Sigma_0}\frac{\beta}{\gamma}$$

$$\cos\theta = \frac{1}{\gamma},\ \sin\theta = \beta,\ \tau' = \tau \Leftrightarrow \theta = 0$$
$$\frac{\tau'}{\tau} < 1 \Leftrightarrow A = \frac{1}{\Sigma_0}\left(\frac{\beta}{\gamma}\right)$$

Linear Form (Imaginary)

$$\varphi_{\tau'<\tau} = \psi_{\tau'<\tau} = \frac{1}{\gamma} + \beta$$
$$\left(\varphi_{\tau'<\tau}\right)^2 = \left(\frac{1}{\gamma}\right)^2 + \beta^2 + 2\frac{\beta}{\gamma} = \cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta$$
$$\left(\psi_{\tau'<\tau}\right)\left(\psi_{\tau'<\tau}\right)^* = \left(\frac{1}{\gamma}\right)^2 + \beta^2 = \cos^2\theta + \sin^2\theta = 1^2$$

Initial State $\left(\frac{c\tau}{c\tau}\right)^2 = 1^2$

$$\varphi_{\tau'>\tau} = \psi_{\tau'>\tau} = \gamma = 1+\beta$$
$$\gamma = \cosh\theta,\ \beta = \sinh\theta$$
$$\cosh\theta = 1+\sinh\theta$$
$$\left(\varphi_{\tau'>\tau}\right)^2 = \cosh^2\theta = 1^2 + \sinh^2 + 2\cosh\theta\sinh\theta$$
$$\left(\psi_{\tau'>\tau}\right)\left(\psi_{\tau'>\tau}\right)^* \Rightarrow \cosh^2\theta = 1^2 + \sinh^2\theta$$
$$\therefore \left(\psi_{\tau'>\tau}\right)\left(\psi_{\tau'>\tau}\right)^* \Leftrightarrow 1^2 = \cosh^2\theta - \sinh^2\theta$$

$$\frac{\tau'}{\tau} > 1 \Leftrightarrow A = \frac{1}{\Sigma_0}\beta\gamma$$

Note that the system can only be imagined real if $i = \sqrt{-1}$ and $i^2 = -1$; i.e., the mirror image is taken to be real, so that

$$\cos^2\theta + \sin^2\theta = 1^2$$

$$\cosh^2\theta - \sinh^2\theta = 1^2$$

Physicists equate this conceptually with "reflection" so that a mirror image does not involved an exchange of energy. (See Russell's Paradox)

For two "fields", the entropy of the interaction Ω^n is $n = 2$ This concept can be expanded to higher powers of entropy via the multinomial theorem. The interactions then represents the force of real mass or real electromagnetism between the various particles, and if there is no interaction, $n = 0$ for each set of non-interacting particles (if a single particle has an entropy of 0, then it doesn't interact with any of the sets or other particles with entropies of 0.