A LER Model

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Abstract: Those who imagine a future era in which advances in computer science will allow the study of physical phenomena involving very large amounts of particles also by means of simulation techniques, including their gravitational effects, might find interesting a theory oriented towards that, which aids to define objects and methods underlying elementary particles.

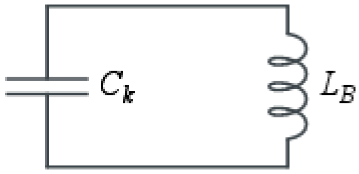
The LER model that I illustrate in this short essay could be part of such a theory.

The LER models describe some behaviors of objects so-called "vibes"; LER stands for localized electromagnetic resonance.

For simply figure out it, think at the periodic table of the chemical elements... Each element in the table relates to the structure of one observed atom; each LER, in one specific LER model, relates to the structure of one vibe.

Indeed, a vibe has an electrodynamic structure, or it can be said to be a structured electrodynamic object.

Part of this model can be presented by analogy of the shown ideal electrical circuit...



In such a circuit the energy, if any, periodically flows, without dispersion, from the ideal capacitor of capacitance C_k to the ideal inductor of inductance L_B, and back to the capacitor, at frequency

$$f = \frac{1}{\sqrt{C_k \cdot L_B} \cdot \pi \cdot 2}$$

At any time the amount of energy in the circuit is equivalent to the sum of the energy in the electric field of the capacitor and the energy in the magnetic field of the inductor.

It's also well known that in such a circuit both, the voltage on the capacitor and the current in the inductor, have sinusoidal time courses with fixed phase displacement, so that

$$I = V \cdot C_k \cdot f \cdot \pi \cdot 2$$

I stands for peak current and *V* for peak voltage.

In that context a reactive power *P* is defined, too...

$$P=\frac{I\cdot V}{2}$$

Of course the electric current denotes here a flow of ideal electric charges (they're not electrons). When all the positive charges, for the amount q, are on the capacitor also the same amount of negative ones are on it (so constituting a system of charges), and all the energy U is in the electric field of the capacitor, too.

$$U=\frac{q^2}{C_k\cdot 2}$$

Being

$$C_k=\frac{q}{V}$$

it is also

$$I=V\cdot C_k\cdot f\cdot\pi\cdot 2=f\cdot q\cdot\pi\cdot 2$$

$$P=\frac{I\cdot V}{2}=\frac{f\cdot q^2\cdot\pi}{C_k}=U\cdot f\cdot\pi\cdot 2$$

In a LER model U is the amount of observed electromagnetic energy, so it is a "relativistic variant" quantity, function of the observed translational velocity (of a reference point in the LER structure) of magnitude v...

$$\beta = \frac{v}{c}$$

$$U = \frac{U_0}{\sqrt{1-\beta^2}}$$

c stands for speed-of-light-in-vacuum, while U_0 is the "rest energy" of a LER, that is U for v=0.

f is relativistic variant, too...

$$f = \sqrt{1-\beta^2} \cdot f_0$$

as directly derived from the so-called "time dilation" if f_0 is f for v=0.

Being

$$P = U \cdot f \cdot \pi \cdot 2 = U_0 \cdot f_0 \cdot \pi \cdot 2$$

it is supposed that P is a "relativistic invariant" quantity; so it represents a meaningful characteristic of a LER; as well as q, that's known as relativistic invariant, too.

For the particular LER model presented here we postulate

$$f_0 = \frac{1}{t_P \cdot \pi \cdot 2}$$

true for all vibes (t_P stands for Planck-time). So it is

$$P = U_0 \cdot f_0 \cdot \pi \cdot 2 = \frac{U_0}{t_P}$$

and, by defining C_0 as C_k for v=0,

$$U_0 = \frac{q^2}{C_0 \cdot 2}$$

that also represents an electrostatic potential energy of a specific system of charges, with placements according to a geometry "summarized" by C_0.

Note that a vibe at rest (v=0) is yet a structured electrodynamic object; the concept of electrostatic potential energy is only introduced for binding rest energy to q and calculating U_0 in the instant of time for which all the vibe energy resides in the electric field of the capacitor.

In other words, a given vibe can be observed having various energies and resonance frequencies (its structure supports those varieties) but if P and q are "the same" then it can be considered "the same vibe".

$$P = \frac{U_0}{t_P} = \frac{q^2}{C_0 \cdot t_P \cdot 2}$$

As already noted, P and q in a LER (that is a sort of description of a vibe type) don't change for increasing values of v; instead U increases and f decreases. Indeed it is

$$\frac{U}{f}=\frac{U_0}{(1-\beta^2)\cdot f_0}$$

The LER models originate from nature simulation purposes, so it is interesting to define (for the one introduced here) v_1 as the unique value of v for which U is equal to U_1 and f is equal to f_1 so that

$$\frac{U_1}{f_1}=h$$

(h stands for Planck-constant.)

$$\beta_1=\frac{v_1}{c}$$

$$f_1=\sqrt{1-\beta_1^2}\cdot f_0$$

$$U_1=\frac{U_0}{\sqrt{1-\beta_1^2}}=\frac{U_0\cdot f_0}{f_1}=\frac{P}{f_1\cdot\pi\cdot 2}$$

$$\beta_1=\sqrt{1-(\frac{f_1}{f_0})^2}=\sqrt{1-(f_1\cdot t_P\cdot\pi\cdot 2)^2}$$

For example, in "real nature" we observe photons with frequency f_1 very small with respect to f_0...

$$f_0=\frac{1}{t_P\cdot\pi\cdot 2}\,;\,f_0>\frac{2.9520\text{E}42}{s}$$

$$f_1=\frac{U_1}{h}\,;\,f_1<\frac{1\text{E}28}{s}$$

$$\beta_1=\sqrt{1-(f_1\cdot t_P\cdot\pi\cdot 2)^2}\,;\,\beta_1>0.99999999999999999999999999999$$

(s stands for second.)

Thus v_1 is supposed to be indistinguishable from c when f_1 is the frequency of experimented photons.

$$P=U_1\cdot f_1\cdot\pi\cdot 2=f_1^{\,2}\cdot h\cdot\pi\cdot 2=\frac{U_0}{t_P}=\frac{q^2}{C_0\cdot t_P\cdot 2}$$

If in some experiments a "particle of light" would be slowed down in free space ($v<c$) then this LER model could bind its observed frequency, energy and translational velocity...

$$U\cdot f=U_1\cdot f_1=f_1^{\,2}\cdot h$$

$$f=\frac{U_1^{\,2}}{U\cdot h}$$

$$\beta=\sqrt{1-(f\cdot t_P\cdot\pi\cdot 2)^2}=\sqrt{1-\frac{U_1^{\,4}}{(U\cdot f_0\cdot h)^2}}\,;\ v=\beta\cdot c$$

And virtually it would have (like any other LER in this model) rest energy

$$U_0=P\cdot t_P=U\cdot f\cdot t_P\cdot\pi\cdot 2=f_1^{\,2}\cdot t_P\cdot h\cdot\pi\cdot 2$$

$$\frac{U_0}{U_1}=\frac{U_1}{E_P}$$

$$E_P=\frac{U_1^{\,2}}{U_0}=\frac{h}{t_P\cdot\pi\cdot 2}=\frac{h}{\sqrt{\frac{G\cdot h}{c^5\cdot\pi\cdot 2}}\cdot\pi\cdot 2}=\sqrt{\frac{h\cdot c^5}{G\cdot\pi\cdot 2}}$$

E_P stands for Planck-energy and G for Newtonian-constant-of-gravitation.

With G in the scenario can also be derived

$$P=f_1^{\,2}\cdot h\cdot\pi\cdot 2=(1-\beta_1^{\,2})\cdot f_0^{\,2}\cdot h\cdot\pi\cdot 2=\frac{(c^2-v_1^{\,2})\cdot c^3}{G}$$

If characteristics and behaviors of particles could be successfully simulated by LER models describing electrodynamic structures then their matter would be thought composed of one or more interacting vibes. Simulating matter this way would lead to also simulate gravitational effects of localized electromagnetic resonances and their complexes.