Marinov's Longitudinal Force
An Analysis from a Design Standpoint

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The following is an attempt to analyze Marinov's law from a design standpoint. The objective is to extract an expression for Marinov's longitudinal force that may be useful to form longitudinal force accelerator design concepts,and to briefly consider some design consequences. An alternate objective was to derive an absurdity and thus disprove Marinov's derivation, however that has not been sufficiently achieved. Some unusual consequences have been derived that raise some doubts, however. Any assistance in finding my errors or an error of Marinov's would be appreciated.

It seems desirable to find the longitudinal component directly from the Marinov formula, which he published in an advertisment.

Fm = (u0 q q')/(8 Pi r^3) {V'*R)V + (V*R)V' - 2(V*V')R} (1)

or more simply, substituting k = (u0 q q')/(8 Pi r^3):

Fm = k {V'*R)V + (V*R)V' - 2(V*V')R} (2)

Here Fm, V, V' and R are all vectors. Since I personally find it difficult to visualize the above, converting everything into the longitudinal components also has the advantage to me of eliminating the vectors. The original text by Marinov, defining the above equation, is included at the end of this post for the sake of clarity.

In the above equation * means dot product, an operation on two vectors. For the sake of convenience and to avoid the use of Greek letters for angles, let us denote the cosine of the angle between two vectors V and V' as cos(V,V'). If we denote the length of a vector V by |V|, then we have the definition of the dot product being given by:

V*V' = |V| |V'| cos(V,V') (3)

Applying (3) to (2) we have:

Fm = k { [|V'| |R| cos(V',R)] V
+ [|V| |R| cos(V,R)] V'
-2[|V| |V'| cos(V,V')] R } (4)

Now, the magnitude of vector V in the V direction is |V|. The magnitude of the component of V' in the direction of V is cos(V,V') |V'|. Similarly the magnitude of the component of R in the direction of V is cos(V,R) |R|. Substituting into (4) to get the component of each term in the V direction, i.e. the longitudinal direction, we then get an equation for the scalar longitudinal force component Fl:

$$
\begin{aligned}
Fl = k \{ & |V'|\ |R|\ \cos(V',R)\ |V| \\
& + |V|\ |R|\ \cos(V,R)\ \cos(V,V')\ |V'| \\
& -2|V|\ |V'|\ \cos(V,V')\ \cos(V,R)\ |R| \} \quad (5)
\end{aligned}
$$

$$
\begin{aligned}
Fl = k\ |V|\ |V'|\ |R|\ \{ & \cos(V',R) + \cos(V,R)\cos(V,V') \\
& -2\cos(V,V')\cos(V,R) \} \quad (6)
\end{aligned}
$$

Noting that |R| = r, simplifying (6) we have:

$$Fl = (u0\ q\ q')/(8\ Pi\ r^2)\ |V|\ |V'|\ \{\cos(V',R) - \cos(V,R)\cos(V,V')\} \quad (7)$$

It is now clear that the key to understanding Marinov's longitudinal force lies in the understanding of the dimensionless scalar term:

$$h = \{\cos(V',R) - \cos(V,R)\cos(V,V')\} \quad (8)$$

because given scalar speeds v, v' of two charges q and q' at scalar distance r we have from (7) and (8):

$$Fl = v\ v'\ (h\ u0\ q\ q')/(8\ Pi\ r^2) \quad (9)$$

Note that $-2 < h < 2$.

Equation (9) may be useful for a finite element analysis, and converts readily into a form for current segment (ilB) analysis. Equation (9) seems to indicate that Marinov's longitudinal force can be related almost purely to the electrostatic attraction of the two charges, q and q'!

Knowing the identity:

$$u0\ e0 = 1/c^2 \quad (10)$$

we have:

$$u0 = 1/(c^2\ e0) \qquad (11)$$

Substituting (11) into (9):

$$Fl = v\ v'\ (h\ 1/(c^2\ e0)\ q\ q')/(8\ Pi\ r^2) \qquad (12)$$

Recalling that the scalar force between two charges is:

$$Fe = (q1\ q2)/(4Pi\ e0\ r^2) \qquad (13)$$

We can rearrange (9) to show the scalar longitudinal force Fl in terms of Fe:

$$Fl = (v\ v'\ h/2)/c^2\ \ (q1\ q2)/(4Pi\ e0\ r^2) \qquad (14)$$

$$Fl = (h\ v\ v')/2c^2\ \ Fe \qquad (15)$$

It is important to recall that the vector longitudinal force was defined to be in the direction of V, by definition of "longitudinal".

The units of Fe clearly represent a force (the electrostatic force), so the term (h v v')/2c^2 in (15) should be dimensionless, which it clearly is. At least the units appear to be correct.

This is a really bizarre notion of reality, that a longitudinal force exists and is a function of the electrostatic force and velocity vectors relative to the frame of reference where energy is extracted. Due to the critical energy producing regions being at velocities near c, a relativistic analysis is warranted. However, it is believed that practical use may be made of devices operating at 0.1 c. It is possible such a force has not been readily observed or identified because it is so small unless both v and v' are near c, and q' is large.

Given only the dimensionless directional scalar term:

$$h = \{\cos(V',R) - \cos(V,R)\ \cos(V,V')\} \qquad (8)$$

and the scalar longitudinal force Fl in terms of the scalar electrostatic force Fe:

$$Fl = (h\ v\ v')/2c^2\ \ Fe \qquad (15)$$

and knowing, $-2 < h < 2$, we can readily see that increasing v is beneficial, but is bounded by c, the speed of light, so the majority of the remaining limitation on Fl is the ratio v'/c. This sets an upper limit on the size of the longitudinal force at v'/c Fe, which means the primary limit to the force magnitude from a permanent magnet is determined by the speed of the permanent magnet's orbital electrons v'.

The highest coefficient of power (COP) implementation then is a longitudinal force accelerator using magnetic "coils" made from coiled long mean free path discharge tubes. Since the path of the accelerated particles might be naturally spiraled by local magnetic fields, the accelerator portion of the device might be made in a coil as well, and the geometry of this coil such that the electrons in the field driver coils are accelerated by the accelerator coil electrons. The distinction then between driver coils and accelerator coils might become dissolved, thus creating a single fully auto-actuated accelerator.

One implication of the above is that there may exist a self-sustaining or self enhancing discharge geometry to explian ball lightning.

If Marinov's equation is correct:

$$Fm = (u0\ q\ q')/(8\ Pi\ r^3)\ \{V'*R)V + (V*R)V' - 2(V*V')R\} \qquad (1)$$

and my derivation of that:

$$h = \{\cos(V',R) - \cos(V,R)\cos(V,V')\} \qquad (8)$$

$$Fl = (h\ v\ v')/2c^2\ \ Fe \qquad (15)$$

is correct, then one design influence is that what happens in wires is of almost no consequence to a near light speed longitudinal force accelerator. For this reason, it should be possible to build and test the longitudinal force (LF) principle derived here using segments constructed from evacuated tubes. Such accelerator tube segments could be hooked up in parallel or in series, as it does not matter what happens in the adjoining circuitry, except for the beam guiding influence of the magnetic fields. The segments can be assembled in any geometry of utility and could all be linear tubes. It is possible to make a kind of LF accelerator erector set from evacuated glass or quartz envelope tube diodes. At last Ampere's isolated current segment can have a reality of a kind, at least in regards to energy conservation, or non-conservation.

In that longitudinal force is proportional to velocity v, the free energy imparted is at least proportional to the average force squared. This implies that a near lightspeed current device compared to a current in wire driven device should produce a factor of about 10^20 more free energy. The longitudinal force is similarly symmetrically proportional to the energizing coil electron velocity v', so large gains are feasible there as well. As the velocities v and v' approach c, the factor (h v v')/2c^2 approaches unity, and the longitudinal force on an accelerated particle in the generator approaches the enormous summation of the combination of electrostatic potential energy between the accelerating particle and every energizing particle. Note that this is a volume effect, unlike surface charge forces utilized in a van deGraff accelerator. Because Fl is a function of both speeds v and v', the positive nuclei in permanent magnets, for example, have no effect, because for them v' = 0, yet all the charges with unbalanced motion, those responsible for B, are active in the longitudinal force on every accelerated particle.

If all the above conclusions are correct, an unlimited, non-polluting, and enormously robust and portable source of power is potentially available from a longitudinal force based accelerator.

Let us see if we can now glean some understanding of the scalar term:

h = {cos(V',R) - cos(V,R) cos(V,V')} (8)

so it can be applied to the longitudinal force equation:

Fl = v v' (h u0 q q')/(8 Pi r^2) (9)

repeated over a volume of a magnet, for example, to evaluate the force on a particle in the vicinity. If a convenient path can be found then a test can be devised.

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Let us assume we have a cubical magnet volume aligned to the x y and z axes, consisting of atoms all magnetically aligned in the x direction. If we want to analyze the longitudinal force on a particle in space near the magnet at point p with velocity V, we then can partition the magnet into small cubic segments and compute the Fl at p for each magnet segment and sum them. For each segment we have a vector R from p to the segment. We can use q' as the sum of charges of electrons aligned with B in the segment. Atoms are small, so the lateral motion of the electrons, changing R slightly as V' changes direction, can be ignored.

To account for electron orbiting in the magnet, we need to sum (integrate) the force Fl for each V' over all the 360 degrees of rotation about the local B vector that is performed by each of the electrons in our charge q'. For this reason, it would be convenient to look at the special case where V is aligned with B, so every V' is purpendicular to V and we thus have cos(V,V') = 0.

When:

$$\cos(V,V') = 0 \quad \text{for every } V' \qquad (16)$$

we have:

$$\cos(V,R)\,\cos(V,V') = 0 \quad \text{for every } V' \qquad (17)$$

however, if every R is approximately aligned with B, then also:

$$\cos(V',R) \sim 1.0 \text{ for every } V' \qquad (18)$$

thus:

$$h \sim 1.0 \qquad (19)$$

for every segment in the example magnet.

This implies that there exists a longtitudinal force even in a longitudinal portion of a permanent magnetic field directly in front of a magnetic pole:

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```
(e-)--Lf->          N---S          <-Lf--(e-)
```

This also means that one possible test of this theory is to do calorimetry on a diode tube both with and without a magnet near the collector plate with a nearby magnetic pole facing the plate from the back side:

```
|    |------------(-)
|    |
|    |
\/\/\/


------
   |
   ------------- (+)

------
| N  |
|    |
|    |
|    |
| S  |
------
```

One alternative is to form a ring of discharge tubes in plane XY and place on the z axis the vertical tubes - over the center of the ring:

```
    O -
    |
    |
    O +

0---OO---O   <---- ring of discharge tubes in plane xy

    O +
    |
    |
    O -
```

The discharge tubes could be connected in series. Wiring is not shown as it is irrelevant to the longitudinal force for large high speed discharges. Excess energy would show up primarily as heat and radiation at the + terminals of the z axis tubes.