Laser and Hull Properties based on Schwinger Limit

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Abstract

In this brief outline the magnetic field strength of the laser-plasma generated by the hypothetical Unitel spacecraft is calculated along with the magnetic field strength of the proposed smart-skin hull. The author however makes no claims regarding the physical accuracy of the claims made by Unitel (in fact the author is quite skeptical of many of their claims). The equations within are simply based on the assumption that the Unitel laser-plasma beam could somehow reach the Schwinger Limit in its intensity and all other properties are simply deduced from classical physics along with the dimensions of Unitel's proposed spacecraft.

1 Laser

Using the Schwinger Limit for electrons virtual vacuum electrons would become physical at an electric field strength of order

$$E_{\text{Schw}} = 2\pi \left(\frac{m_e^2 c^3}{e\hbar} \right) = 8.3 \times 10^{18} V/m \,. \tag{1.1}$$

Now solving for r in terms of a point charge electric field lends us to the conclusion that the laser-plasma beam must be confined to a radius of

$$r_{\text{Schw}} = \sqrt{\frac{e}{4\pi\varepsilon_0 \cdot E_{\text{Schw}}}} = 1.32 \times 10^{-14} m \tag{1.2}$$

which is an order of magnitude larger than the classical (non quantum) electron radius $r_e = 2.82 \times 10^{-15} m$ (the quantum radius is often taken to be the Compton wavelength $\lambda_C = \hbar/m_e c = 3.86 \times 10^{-13} m$ and hence larger than eq. 1.2).

The magnitude of a Schwinger point charge force if carried by a single rotating electron as claimed by Untiel would thus be $F_{\text{Schw}} = \text{eE}_{\text{Schw}} = 1.3N$. Therefore the maximum magnetic strength of Unitel's proposed plasma-beam would be

$$B_{\text{las}} \approx \frac{F_{\text{Schw}}}{e \cdot (c \cdot \sin(\pi/2))} = 2.77 \times 10^{10} T = 2.77 \times 10^{14} G \tag{1.3}$$

where it is noted that this is a ridiculously high magnetic field strength (which also falls rapidly from the source) as the magnetic strength of neutron stars top off at around $10^{15} G$.

It is also noted the rotation speed velocity of the electron plasma-beam would be less than the speed of light c due to relativistic effects. However c is a good quick approximation if you assume that the electron is accelerated at energies at a GeV or above, though it is noted that it would require the energy output of an entire city to accelerate an electron at such energies (for interested parties the relativistic corrected velocities are given by $v = \mathrm{pc}/(p^2 + m_e^2 c^2)^{1/2}$).

2 Hull

The hull has a teardrop shape so excluding the forward lens a cone gives a good approximation of the surface area in question. The equation of a cone (whose base radius is 1.83 m or 6 ft) can be represented differentially as $\nabla f = (x\sqrt{x}x^{-2}) + (y\sqrt{y}y^{-2})$ as such its surface area can then be calculated through

$$A_{\text{hul}} = \int\int_D \sqrt{1 + (x\sqrt{x}x^{-2})^2 + (y\sqrt{y}y^{-2})^2}\mathrm{dA} \tag{2.1}$$

$$= \int\int_D \sqrt{3}\mathrm{dA} = \int_0^{2\pi} d\theta \int_0^{1.83} r\sqrt{1 + r^2}\mathrm{dr} \tag{2.2}$$

$$= 2\pi(1/2)\frac{2}{3}(1 + r^2)^{3/2}]_0^{1.83} = 143m^2 \tag{2.3}$$

So that the hull surface charge should in principle be

$$Q_{\text{hul}} = \oint \overrightarrow{E}_{\text{Schw}} d\overrightarrow{A}_{\text{hul}} \varepsilon_0 \approx 1.05 \times 10^{10} C \tag{2.4}$$

as such the force experienced on the hull would then be $F_{\text{hul}} = (\mathrm{e}Q_{\text{hul}}/[4\pi\varepsilon_0(10^{-9}m)^2]) = 1.51 \times 10^{19} N$. Since the "speed of sound" for electrons at 4 Kelvin would in principle be about

$$v_s = \sqrt{\frac{(3/5)(1.38 \times 10^{-23} J/K)(4K)}{2m_e}} = 4.27 \times 10^3 m/s \tag{2.5}$$

requires that the magnetic field strength on the hull roughly be

$$B_{\text{hul}} \approx \frac{F_{\text{hul}}}{Q_{\text{hul}} \cdot (v_s \cdot \sin(\pi/2))} = 3.37 \times 10^5 T = 3.37 \times 10^9 G\,. \tag{2.6}$$