Method for Interstellar Flight

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Abstract

The basis of any Universe is energy. Energy may be positive or negative. Negative energy produces negative matter. Negative matter repels our (positive) matter. Using this effect the author offers a space propulsion system which allows reaching by space ship a speed close to light speed and to enable massive retrieval of extraterrestrial materials to construct works in space

Introduction

In works [1]-[4] author showed the basis of the Universe: Time, Matter, Charge, Distance (dimensions), Volume, is energy. Energy may be positive and negative. All particles are only different forms; collections of energy units. Author offered new artificial forms of matter having gigantic strength, heat resistance (millions times more than steel) and other awesome properties [5]-[6]. He also offered method for conversion any matters in energy and using than in aerospace [6]-[8].

The concept of negative energy explains the main riddle of the Universe: From where did the vacuum take a huge amount of energy for creation of our Universe? If we include the equal virtual pair positive and negative energy in vacuum, the total (sum) energy in vacuum equals zero.

- It may help to explain the dark energy and dark matter in the current model of the Universe. If there exist two Universes (positive and negative), embedded one (positive) Universe into the other (negative) Universe. As shown in [9] the negative Universe is full identical to our positive Universe because the choice of sign is arbitrary.

Negative energy generates negative matter. But the relationship of negative matter to positive matter is different. Positive matter attracts positive matter but repels negative matter and the negative matter attracts the negative matter but powerfully repels the positive matter. They fly away one from other with a speed close to light speed. If they are connected, the positive and negative matters are annihilated (the sum of energy became zero).

Main idea. Negative Matter Engine. Theory and Estimations.

In the author's works [4]-[5] the author showed: how an artificial micro black hole can create **new** positive and negative energy (matter), separate positive and negative energy (matter) and how this engine may be used for producing a thrust. Typical photon engine is shown in fig. 1.

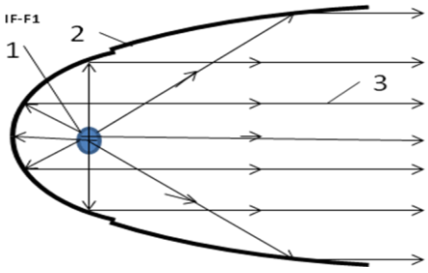

Fig.1. Interstellar space propulsion on vacuum energy. Notations: 1 – micro black hole, 2 – reflector, 3 – radiation.

We consider three cases:

1) The obtained positive matter accretes on the space ship; the negative matter leaves (flies away) with a speed close to light speed.
2) The obtained positive matter is discarded in space with zero speed (relative to space ship).
3) The obtained positive matter is fully converted into thrust by rocket (or photon) engine.

If the ship crew using a local watch and measuring the self-acceleration computes time, speed and distance of the space ship, their readings will be different from measurements of an Earthbound observer.

Estimations and computations flight data by a ship crew (without relativistic effect)

1. The obtained positive matter accretes on the space ship

From impulse theory we can compute the speed of our space ship by equation

$$V \approx \frac{mc}{M+m}, \quad \overline{m} = \frac{m}{M}, \quad V \approx \frac{\overline{m}c}{1+\overline{m}}, \tag{1}$$

where V is non-relativistic final speed, m/s; M is ship mass, kg; m is mass (module $|m|$) spent in flight, kg; m/M is relative consumption of vacuum mass, kg.

2. The obtained positive matter is discarded in space with zero speed (relative to space ship).

In this case the final speed is computed by equation

$$V \approx \frac{mc}{M}, \quad \overline{m} = \frac{m}{M}, \quad V \approx \overline{m}c\ . \tag{2}$$

In this case as you see the final speed is significantly more than in case 1. One may be more that the light speed (from computation only impulsive acceleration without relativistic effect).

3. The obtained positive matter is full converted into thrust by rocket (or photon) engine.

In this case the ship speed is (m_s and w are const):

$$V \approx \frac{m_s(c+w)}{M}T = \overline{m}_s(c+w)T = \overline{m}\,(c+w), \tag{3}$$

where m_s is second consumption of the obtained positive matter, kg/s; w is the exhaust speed from engine, m/s; T is time of engine work, sec.

If we use the photon engine, $w = c$.

The results of computation of equations (1)-(3) are presented in fig.2.

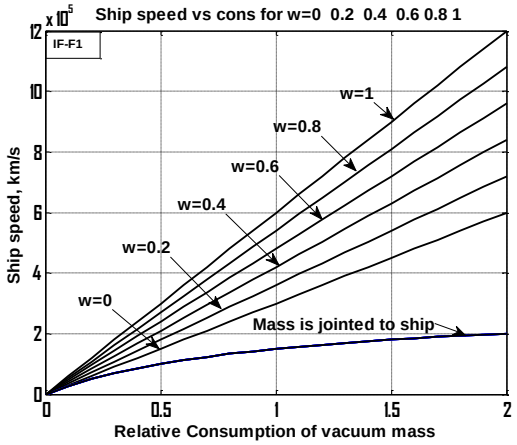

Fig.2. Final ship speed in three cases:
1) The obtained positive matter accretes on the space ship, the negative matter leaves (flies away) with a speed close to light speed.
2) The obtained positive matter is discarded in space with zero speed (relative to space ship). Exhaust speed $w = 0$.
3) The obtained positive matter is full converted into thrust by rocket (or photon) engine: w = 0.2, 0.4, 0.6, 0.8, 1.

The ship speed V and distance S of non relativistic acceleration flight is

$$V = at, \quad S \approx \frac{a\,t^2}{2}, \tag{5}$$

where V is speed, m/s; a acceleration, m/s^2; t is acceleration time, sec.
Results of computations are in figs. 3 – 4 (1 year = 364·24·60·60 ≈ 31.45·10^6 sec.).

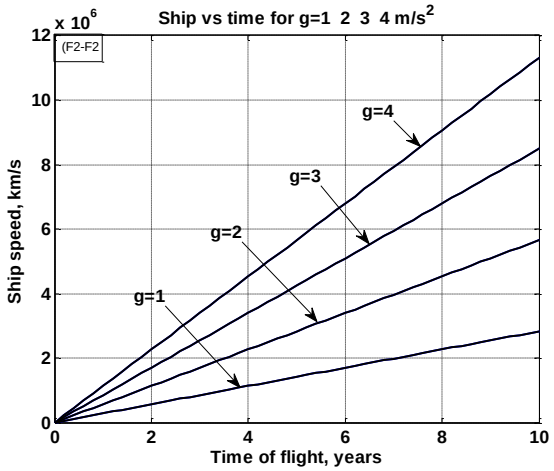

Fig.3. Ship speed via time of flight (years) for different accelerations g.

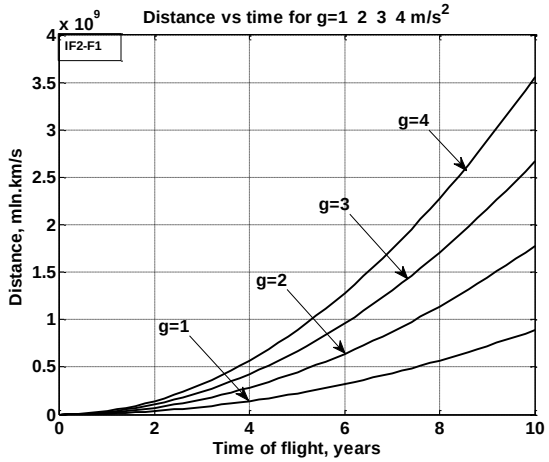

Fig.4. Distance (millions km) via the flight time (years) for different accelerations g.

Theory, computations and estimation of a flight the space ship with relativistic effects.

1. Common relations. The relativistic theory [8] asserts the measurement of time *t*, speed *v* and distance *S* of moving object made a immobile observer (on Earth) and observer located in object (astronaut of space ship) gives the different result. The theory gives the following relations between them

$$\frac{v}{c}=th\left(\frac{v_e}{c}\right),\quad \frac{dt}{dt_e}=ch\left(\frac{v_e}{c}\right),\quad \frac{ds}{ds_e}=\left[ch\left(\frac{v_e}{c}\right)\right]/\left(\frac{v_e}{c}\right)^2, \qquad (6)$$

where $c = 3\cdot10^8$ m/s is light speed; *v* is speed of the moving object measured by immobile observer, m/s; v_e is speed measured by astronaut by calculation the acceleration and self time, m/s; *t* is time, sec; *s* is length, m. The subscript '$_e$' means the value is measured by astronaut. The other values are measured by Earth observer. The *th, ch, sh* are hyperbolic tangent, cosine and sine. Note the speed v_e calculated by astronaut may be any, in particular, $v_e > c$. The hyperbolic $th\, x \le 1$.

The hyperbolic *th, ch, sh* may be computed through conventional function e^x

$$sh\, x=\frac{e^x-e^{-x}}{2},\quad ch\, x=\frac{e^x+e^{-x}}{2},\quad th\, x=\frac{e^x-e^{-x}}{e^x+e^{-x}}. \qquad (7)$$

For small $v_e/c \ll 1$ the $v \approx v_e$, $t \approx t_e$, $s \approx s_e$. The computations of magnitudes (6) are presented in fig.4.

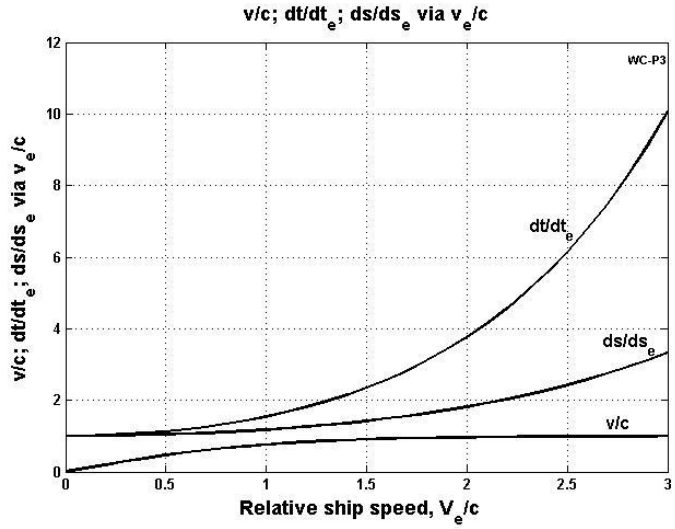

Fig.5. Ratio speeds, times and lengths measured by astronaut and Earth observer.

2. Case of constant acceleration *a.* In this case the relativistic equations may be integrated and we get the next relations between the time, speed and distance measured by Earth observer and astronaut:

$$t=2\left[\frac{S}{a}\left(1+\frac{aS}{4c^2}\right)\right]^{0.5},\quad t_e=\frac{2c}{a}\left[ch^{-1}\left(1+\frac{aS}{2c^2}\right)\right],\quad t=\frac{2c}{a}\ln\left[\frac{at_e}{c}+\sqrt{1+\left(\frac{at_e}{c}\right)^2}\right], \qquad (8)$$

where *a* = const acceleration of space ship measured by astronaut, m/s^2. *S* is distance, m.

The speed and distance are (in $t_e = t = 0$, values $v(0) = S(0) = 0$):

$$v=\frac{at_e}{\sqrt{1+(at_e/c)^2}},\quad S=\frac{c^2}{a}\left[\sqrt{1+\left(\frac{at_e}{c}\right)^2}-1\right],\quad \overline{m}=\exp\left[2ch^{-1}\left(1+\frac{aS}{2c^2}\right)\right], \qquad (9)$$

where $\overline{m}=M/M_0$ is the rest of the relative mass of ship moved by the photon engine.

Let us consider the hypothetic flight to star system Alfa-Centaur (Alpha Centauri) located at a distance 4.3 light years from Earth with constant Earth acceleration *a* = 10 m/s. The first half of distance the ship accelerates, the second it brakes. Then the maximum speed of ship will be *v/c* = 0.95, the astronaut time of flight will be 7.3 years, the Earth time will be 12 years. The radioed (beamed) information sent by astronauts about Alfa-Centaur (Alpha Centauri) will reached the Earth after 4.3 years.

3. Relative consumption of mass by rocket engine is

$$\overline{m} = \left(\frac{1-\overline{v}}{1+\overline{v}}\right)^{1/\overline{u}}, \qquad (10)$$

where $\overline{v} = v/c$ is relative ship speed; $\overline{u} = u/c$ is relative speed of an exhaust mass (gas, photons, protons) measured by astronaut; $\overline{m} = M/M_0$; M_0 –initial mass of rocket, kg.

The photon engine having $\overline{u} = u/c = 1$ spends about 40% of rocket mass for reaching relative speed $\overline{v}$ = 0.5*c* = 150 000 km/s.

For *v/c* << 1 the equation (10) became as the well-known equation $\overline{m} = e^{-v/u}$. Computations of the equation (10) are presented in fig.8.

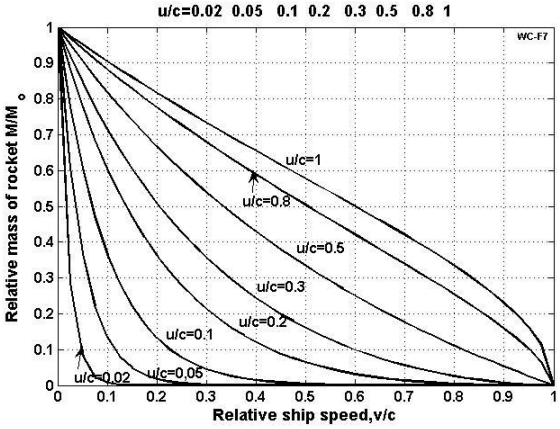

Fig.6. Relative mass of rocket via relative speed of rocket and relative speed of exhaust mass.

4. Drag of ship body.

The dynamic pressure (drag) of space ship equals

$$p_e = \rho_e c^2 sh^2(v_e/c), \quad for \quad v_{e/c} << 1 \quad p_e = \rho_e v^2, \quad for \quad v_e >> 1 \quad p_e = 0.25\rho_e c^2 e^{2v_e/c}, \quad (11)$$

where p_e is dynamic pressure, N/m^2; ρ_e is density of space medium, kg/m^3 (mass of proton is m_p=1,67·10^{-27} kg). The computation of equation (11) are presented in fig.7.

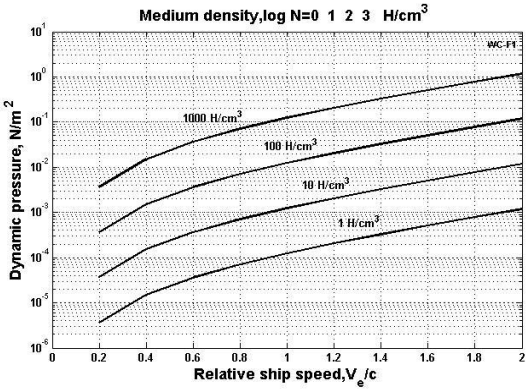

Fig.7. Dynamic pressure (drag) via relative space ship and media density.

Fig.8 shows the method for decreasing drag of the ship body 1 (fuselage of space ship). Relativistic particles cannot be deflected by sharp edges as can the conventional high-speed molecules in aviation. They penetrate into body matter and can produce hard radiation and radioactive isotopes. We can only deflect the charged particles by electric fields. There are two grids 2 and 3 having the electric field between them. The positive heavy particle 5 bends its trajectory between grids 2-3 and is deflected (see 7) before contacting the front part of the body in space. The negative particles (electrons) penetrate into the ship body and negatively charge the ship body. This negative charge may be used for charging the negative grid, or in the collector of positive particles, or for production of electricity.

The thin film 6 is used as ionizer of neutral particles. They lose the part of its kinetic energy (energy of ionization about 14 eV for hydrogen) but heavy positive particles avoid collision with the ship body.

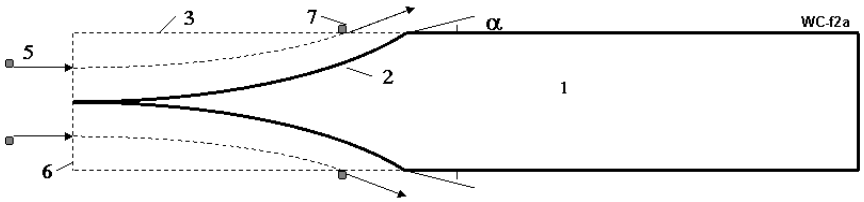

Fig.8.One design of body (fuselage) deflector of the charged particles (reducer of space drag). *Notations*: 1 – ship body (fuselage); 2, 3 – electric grids; 5 – flow of electric charges to a body entrance; 6 – thin film-ionizer. 7 – deflected positive charged particles.

The other design of fuselage deflector is shown in fig.9. Forward of body locates the ionizer from thin film and charged positive ball. The positive ball repels the protons and attracts the electrons. They avoid collision with the ship body.

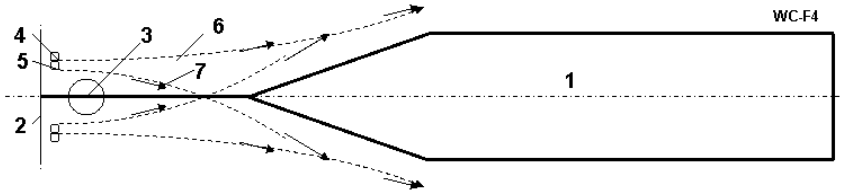

Fig.9. Another design of body (fuselage) deflector of the charged particles (reducer of space drag). *Notations*: 1 – ship body (fuselage); 2 – thin film ionizer; 3 – charged positive ball; 4 – charged positive particle (proton); 5 – charged negative particle (electron); 6 – trajectory of positive particle; 7 – trajectory of negative particle.

It is very efficient using the electrostatic field (fig.8, 9) to decrease the drag of ship body (fuselage). A proton is heavier by 1836 times than an electron. Theoretically we can decrease the drag by the same factor spending but a relatively small amount of electric energy.

Discussion

Ever since Newton first formulated his theory of gravity, there have been at least three conceptually distinct quantities called mass: inertial mass, "active" gravitational mass (that is, the source of the gravitational field), and "passive" gravitational mass (that is, the mass that is evident from the force produced in a gravitational field).

In 1957, Hermann Bondi suggested in a paper in Reviews of Modern Physics that mass might be negative as well as positive [15].

Although no particles are known to have negative mass, physicists (primarily Hermann Bondi and Robert L. Forward) [16]. have been able to describe some of the anticipated properties such particles may have. Assuming that all three concepts of mass are equivalent the gravitational interactions between masses of arbitrary sign can be explored.

For two positive masses, nothing changes and there is a pull on each other causing an attraction. Two negative masses would produce a pull on one another, but would repel because of their negative inertial masses. For different signs there is a push that repels the positive mass but attracts the negative mass.

Bondi pointed out that two objects of equal and opposite mass would produce a constant acceleration of the system towards the positive-mass object.

Forward used the properties of negative-mass matter to create the diametric drive, a design for spacecraft propulsion using negative mass that requires no energy input and no reaction mass to achieve arbitrarily high acceleration.

The diametric drive was a speculative proposal for an "engine" which would create a non-conservative gravitational field with non-zero curl. It was argued that in such circumstances, the side of the field which creates more force on the spacecraft will accelerate the spacecraft in the direction of the force.

One idea for realizing this concept involved hypothetical particles with negative mass, originally proposed by Robert Forward and Jamie Woodward. If one were to construct a block of negative mass, and then attach it to a normal "positive" mass, the negative mass would fall towards the positive as does any mass toward any other. On the other hand, the negative mass would generate "negative gravity", and thus the positive mass (the spaceship itself generally) would fall away from the negative mass. If arranged properly, the distance between the two would not change, while they continued to accelerate forever.

The negative mass propulsion offered in this article is in principal different from Forward’s engine. Forward believed that inertial, “active” and “passive” masses have different properties (an assumption not so far not supported by experiments).
He designs from them a rigid structure which produces a thrust despite the rigid linkage between them. His engine is a reactionless drive.

A reactionless drive (also known by many other names, including as an inertial propulsion engine, a reactionless thruster, a reactionless engine, a bootstrap drive or an inertia drive) is a fictional or theorized method of propulsion wherein thrust is generated without any need for an outside force or net momentum exchange to produce linear motion. The name comes from Newton's Third Law of Motion, which is usually expressed as, "[f]or every action, there is an equal and opposite reaction". Such a drive would necessarily violate laws of classical physics, the conservation of momentum and the conservation of energy. In spite of their physical impossibility, devices are a staple of science fiction, particularly for space propulsion. Devices and methods are still being proposed as working technologies only now they are based on the real or imagined principles from modern physics.

The author’s theory believes the inertial, active and passive positive matter are one positive matter (supported by experiments) and inertial, active and passive negative matter are also one (same) negative matter, which has but a single difference in properties (other than sign): that negative matter repels positive matter.

The Forward drive violates Newton's Third Law of Motion, violates laws of classical physics, the conservation of momentum and the conservation of energy. The suggested engine does not do this (the total energy and mass are zero!). The Forward engine is a reactionless drive, the offered engine works as a conventional reactive engine, sending away the negative mass with speed close to light speed.

The Forward drive has constant mass in during the entire flight. The offered drive increases its' positive mass in the flight and can use it for further increasing the speed, decreasing the flight time or creating an artificial space body i.e. tapping the matter influx for space construction.

Conclusion

If author assumption about existing of the negative energy is tried, the probability of negative matter existing and exhibiting repulsion from our positive matter is very high. In this case many problems of space flights (including interstellar), and obtaining matter for artificial space bodies are in principle solved.

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