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ПРОЕКТ КОСМІЧНОГО КОРАБЛЯ НА ЕЛЕКТРОМАГНІТНИХ ПОЛЯХ

ПРОЕКТ КОСМИЧЕСКОГО КОРАБЛЯ НА ЭЛЕКТРОМАГНИТНЫХ ПОЛЯХ

PROJECT OF SPACECRAFT PROPELLED BY ELECTROMAGNETIC FIELDS

Анотація. *Представлено конструктивне рішення по побудові космічного корабля, що рухається з опором на електромагнітні поля Сонячної системи і Галактики з прискоренням. Проведено розрахунки необхідної сили току по контуру і величини заряду на корисній поверхні об'єкту для отримання прискорення в 1g в довільному напрямку у просторі.*

Ключові слова: *електромагнітні поля Галактики, магнітна левітація, космічний корабель, сила Лоренца, залежність маси від швидкості, перерозподіл зарядів на поверхні.*

Аннотация. *Представлено конструктивное решение по построению космического корабля, движущегося с опорой на электромагнитные поля Солнечной системы и Галактики с ускорением. Проведен рассчет необходимой силы тока по контуру и величины заряда на полезной поверхности оъекта для получения ускорения в 1g в произвольном направлении в пространстве.*

Ключевые слова: *электромагнитные поля Галактики, магнитная левитация, звездолет, сила Лоренца, зависимость массы от скорости, перераспределение зарядов на поверхности.*

Summary. *Subject of interstellar flights remains actual taking into account limitedness of the terrestrial resources, overpopulation of the planet, and demographic, sociopolitical and ecological problems at the planet. A constructive solution is submitted of the construction of a spacecraft moving with acceleration resting upon electromagnetic fields of the Solar system and the Galaxy. Calculation of the current intensity within the circuit and charge value at the object's useful surface necessary for the achievement of acceleration equal to* $1g$ *at arbitrary direction in the space is conducted.*

Key words: *electromagnetic fields of the Galaxy; magnetic levitation; spacecraft; Lorentz force; dependence of mass on velocity; redistribution of charges by surface.*

Subject of interstellar flights remains actual taking into account limitedness of the terrestrial resources, overpopulation of the planet, and demographic, sociopolitical and ecological problems at the planet. A constructive solution is submitted in this paper of the construction of a spacecraft [Fig. 1] moving with acceleration resting upon electromagnetic fields of the Solar system and the Galaxy. Similar constructions were described earlier in the papers prepared by Lemeshko A.V. [6] and Gayduk A.N. [7, 8], but they were not published in reviewed scientific journals.

Solution method

As is known [4], Earth has electromagnetic field induction of which equals to $30\times10^{-6}\,T$ (this is averaged value, it is somewhat different at various areas of the planet). Sun, too, has electromagnetic field of $4000\,Gs = 4000\times10^{-4}T = 0.4\,T$, and so the Solar system and the Galaxy (averaged value is $3\times10^{-6}Gs = 3\times10^{-10}T$).

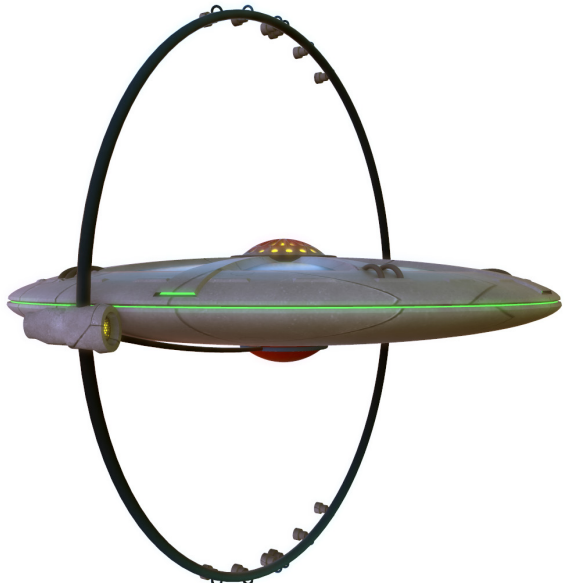

Fig. 1. Spaceship [author's development]

An idea appears of the creation of a spacecraft to rest upon magnetic fields of planets/stellar systems/galaxy.

Let we have some disk-shaped radio model of a spacecraft of 0.1 kg mass and circuit of 0.1 m useful diameter.

Let us place the conductor carrying current along the circuit [*Fig. 2*]:

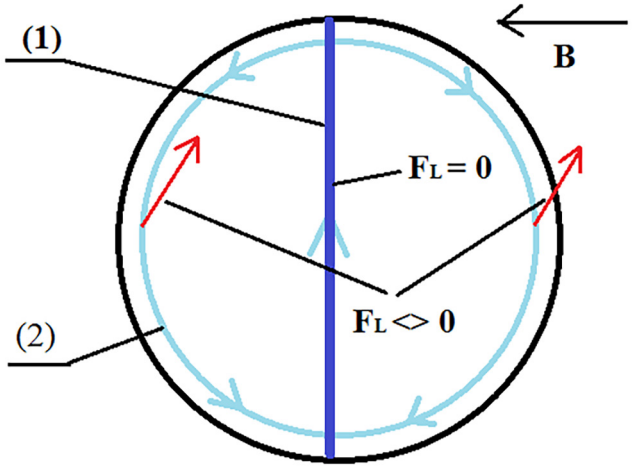

Fig. 2. Circle conductor with electricity [author's development]

Key to *Fig. 2*:

B — magnetic induction vector, F_L — Lorentz force, (1) — part of the conductor with running current shielded with ferromagnetic, (2) — conductor with running current.

In this way we obtain Lorentz force directed "upward", and this is to allow our spacecraft levitating in the Earth's magnetic field/moving along the cosmic space at some current intensity.

Rotating the circuit shown on Fig. 2 in the plane perpendicular to B magnetic induction vector we are to reach possibility of obtaining some arbitrary acceleration vector, but it is to lie but in the plane perpendicular to B magnetic induction vector. We are not in a position to reach acceleration at the remaining two coordinate planes.

Let us calculate current intensity necessary for the levitation in the Earth's magnetic field.

Lorentz force [1] is as follows:

$F_L = B \times I \times L = B \times I \times \pi \times D = m \times g$ = Newton force (gravitation).

It follows from it that

$$I = \frac{m \times g}{B \times \pi \times D} = \frac{0.1 \times 10}{30 \times 10^{-6} \times 3.1415 \times 0.1} = 10^5 \, [A].$$

Therefore, current intensity equal to $2 \times 10^5 \, A$ is necessary to reach vertical acceleration of $1g$.

Current intensity being equal to the mentioned value, acceleration being steady and equal to $1g$ and initial velocity being nil, the spacecraft's velocity following a day is to be equal to

$$V_1 = V_0 + a \times t = 0 + 10 m/s^2 \times 60 s \times 60 \times 24 = 864 \, [km/s].$$

Let us conduct the same calculations for the magnetic field beyond the Solar system (the Galaxy's magnetic field and averaged induction value of $3 \times 10^{-10} \, T$).

We'll assume conventionally Newton force (gravitation) of the Galaxy in this case equal to nil that is unreal in general case.

At that current intensity within the circuit necessary for the achievement of $1g$ steady acceleration is as follows:

$$I = \frac{10^5 \times 30 \times 10^{-6}}{3 \times 10^{-10}} = 10^6 \times 10^4 = 10^{10} \, [A]$$ or 10 billion Amperes.

This current intensity can be achieved in case of taking 100 thousand parallel conductors carrying $10^5 \, A$ current each. In space as explorers it is possible to take superconductors.

At nil initial velocity the latter of such the craft is to be the same i.e. $864 \, km/s$, but following half a terrestrial year it is to reach $864 km/s \times 183 = 158{,}112 \, km/s$ or, roughly speaking, half light speed.

At this velocity astronaut's mass being inside the craft is to be [3]

$$m = \frac{m_0}{\sqrt{1 - \frac{\upsilon^2}{c^2}}}.$$

This is nearly 1.15 times his mass at the Earth. I.e. a man whose mass equals to 75 kg on Earth is to weigh 86 kg in the craft which is acceptable in whole.

Thus, assuming half a year for the acceleration to 0.5 light speed and half a year for the deceleration, one way to Proxima Centauri is to take about 9 years.

The problem for moving any direction within R^3 remains unsolved for, as is known, Lorentz force is strictly perpendicular to the lines of the magnetic field.

Magnetization of the craft's casing (creation of "+" and "–" potentials at its surface) and introduction of any sources of magnetic fields into it is not to solve the problem for moving any direction within R^3 due to breach of Newton's third law.

From the other hand, potential creation ("+" and "–"/ free electrons) at the craft's surface can allow reaching acceleration within the Galaxy's electric field. This field is extremely poorly studied, but according to the measurements conducted within the Solar system its intensity fluctuates within unities to a number of thousands of micro volts per metre [5]. So, construction shown on Fig. 3 is to allow reaching acceleration along the direction of the electric field lines to the area of the potential raising (free electrons being on the surface) or to the contrary one (positive charge on the surface [*Fig. 3*]):

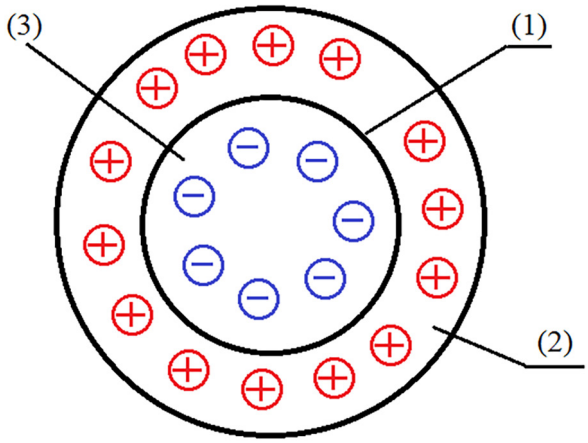

Fig. 3 Charge sphere [author's development]

Key to *Fig. 3*:
(1) — dielectric, (2) — positive charge on the surface, interacts with electric field, (3) — negative charge, does not interact with electric field due to availability of a shield manufactured of some dielectric.

In this case acceleration is to be equal to [2]:

$$a = q \times \frac{E}{m},$$

where q = total charge at the surface, m = craft's mass, E = intensity of the electric field (we are to assume it equal to $5 \times 10^{-6}\ V/m$ for our instance). Thus, total charge at the surface equal to

$$q = m \times \frac{a}{E} = 0.1 \times \frac{10}{5 \times 10^{-6}} = 2 \times 10^5 \cdot$$

C is to be necessary for our pilot spacecraft model so as to reach the necessary acceleration of $1g$.

Combining constructions shown on *Fig. 2* and *Fig. 3* in a single model we are to obtain a spacecraft flying within the cosmic space with the acceleration of $1g$ at any direction (except those points in space where the electric field lines are strictly perpendicular to the magnetic field induction vector) within R^3 resting on the Galaxy's electromagnetic fields.

Principal difficulties in construction

Let us consider principal difficulties to be encountered when constructing a spacecraft of this type.

1. A spacecraft shall be very light. This means that for the achievement of $1\ g$ acceleration in case of 10 billion amperes current and diameter of the circuit to carry it equal to 100 m as shown on *Fig. 2* weight of the entire spacecraft including effective load shall be 100 kg which is unrealistically low value. If we increase hypothetically the spacecraft weight to 10 tons then current running through all the parallel conductors shown on *Fig. 2* is to reach 1 trillion amperes. Maximum achievable current running through single conductor under superconductivity conditions equals to 10 million amperes at present. It follows from this that we shall provide at least 100 thousand similar conductors. Their total weight is to be approximately $100 \cdot \pi \cdot 0.05 \cdot 100 \cdot 10^3 \approx 1570$ tons in case that we assume their specific weight 50 grams per running meter which exceeds drastically declared 10 tons.

2. Traveling at $\frac{c}{2}$ speed the spacecraft is to fly nearly 150 million meters per second. This means that we shall perform up to a billion measurements per second in order to be able to recalculate vectors of magnetic field induction and electric field potential loss in the space for at least 5 to 6 times per meter of the way. These vectors changing, we shall in turn reposition again the circuit to carry current shown on *Fig. 2* in the space up to a billion times per second which is unrealizable at present stage of the techniques development.

Conclusions

A method of arrangement of a spacecraft resting upon the Galaxy's electromagnetic fields is proposed in this paper which, to the author's opinion, is to allow reaching velocities sufficient for interstellar flights within the acceptable time intervals at some current value in the device [*Fig. 2*] and some charge value in it [*Fig. 3*]. At that, complexity of the construction and high current intensity necessary for this constructive solution do not allow realization of the model at today's level of the engineering and production facilities development. Therefore the only purpose of the paper is to demonstrate to the reader that despite affirmations of numerous skeptics interstellar flights are realizable in theory. The question of the purposefulness of such flights when some crew present aboard is set apart bearing in mind their duration and difficulties related to it.

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