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Review Article

Can Manned Planetary Exploration be Realized by the Present Rocket Method?! -Changes and Prospects of Propulsion Principles of Space Propulsion Systems-

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Abstract

Until now, many unmanned probes have been launched and manned lunar explorations have been carried out using chemical rockets. However, due to the slow speed of chemical rockets, manned planetary exploration is limited to Mars at most, and manned planetary exploration beyond Mars is impossible. Manned planetary exploration cannot be realized by the present rocket method. From the point of view of propulsion theory, a propulsion system different from that of chemical rockets is required. This paper introduces a propulsion system that far surpasses the performance of chemical rockets, obtained from the nature of the field as a continuum of vacuum space. It is a propulsion system that is indispensable for humankind to advance into planet.

Keywords: Chemical Rockets; Manned Planetary Exploration; Field Propulsion; Space Drive; Pressure Thrust

Introduction

It was from the late 19th century to the 20th century that modern rockets, that is, rockets capable of going into space, were researched and developed. Konstantin Tsiolkovsky (1857-1935) calculated that rockets could go into space and invented the liquid rocket. Tsiolkovsky built the theory of space travel, but in practice he never built a rocket. Robert Hutchins Goddard launched the world's first liquid rocket in 1926. In 1969, the United States launched Apollo 11 on a Saturn V rocket, making it the first man to reach the moon. From the 1960s to the 1970s, Japan and Europe launched advanced space probes and satellites, advancing into the era of space development.

Tsiolkovsky discovered in 1883 that propulsion was possible by action of reaction and that rockets could fly even in a vacuum of Outer Space, and derived the motion of rockets in 1898. It concluded the basic rules for space travel. We admire the profound insight into the application of the action-reaction principle of conservation of momentum to rocket propulsion for the first time.

The propulsion principle of existing chemical rockets, electric propulsion (ion rockets, plasma rockets, etc.), and nuclear rockets are all based on the principle of action and reaction based on the law of conservation of momentum which expels mass to induce a momentum thrust (reaction thrust). Since the maximum speed is limited by the product of the gas effective exhaust velocity and the natural logarithm of mass ratio, its speed is too slow for the spaceship to achieve the interplanetary travel and interstellar travel. Thus, the breakthrough of propulsion method has been required until now. The maximum velocity that a rocket can reach is limited to the velocity of the gas that the rocket jets backward, and it cannot exceed the velocity of the gas that it jets. This indicates that rocket velocity limit and performance limitations of this method.

Chemical rockets are the only current rockets launched directly from the Earth's surface. A thrust exceeding 1G of the earth's gravity is indispensable for direct launch from the earth's surface. It cannot be launched from the ground unless the thrust-to-weight ratio exceeds "1".

However, how long will mankind continue to rely on these conventional rockets? 10 years, 30 years, 50 years, 100 years from now? In comparison, the method of carrying only a few people onboard and exploding a huge amount of exhaust gas explosively at the time of launch is by no means efficient. A rocket as a spaceship must be small and compact like a passenger car.

We will understand how impossible it is for manned planetary exploration with the current rocket method, which has a speed limit. It's easy to go to the moon, but at most Mars is the limit.

First, consider the principle of propulsion. Although it doesn't seem to be generally explained, there are two types of propulsion principles. One is momentum thrust (reaction thrust) based on the law of conservation of momentum mentioned above, and the other is pushed from behind and move forward, i.e, pressure thrust.

Since the momentum thrust has already been described, the pressure thrust will be described next.

Propulsion principle (pressure thrust)

An example of pressure thrust is a solar sail or a laser sail, in which photons from behind hit the sail and push the sail. Alternatively, a ping-pong ball in water is pushed up by the pressure difference between the upper and lower surfaces. Also, since the pressure in the nozzle behind the jet or rocket is higher than the atmospheric pressure in front of the aircraft, the pressure thrust that is pushed from behind contributes about 10%.

As compared with momentum thrust, pressure thrust principle is to be pushed from the back and thus move forward. Solar sails or Light sails use this principle (Figure 1). Pressure thrust also partly contributes to rocket and jet aircraft. That is, since the engine nozzle pressure at the rear of the rocket is larger than the atmospheric pressure at the front of the rocket, the rocket is pushed out from behind. As another example, the swimmer turns to push the wall of the pool with a foot; a car tire pushes the ground of the Earth.

In other words, all the existing advance principles are action-reaction principles based on the law of conservation of momentum. There is a low-speed limit to the propulsion speed, and it is not promising. A new propulsion principle is required.

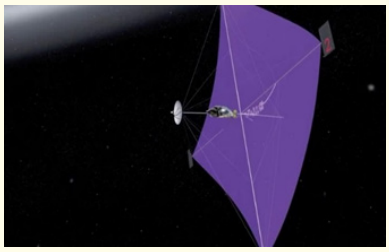


Figure 1: Solar Sail, Light Sail.

In the next, the new propulsion principle will be explained.

New propulsion principle (Field propulsion system)

From the point of view of continuum mechanics of space called vacuum, the concept of field propulsion proposed by the author is considered to be a promising propulsion theory (Field propulsion system) in terms of propulsion principle and performance [1-4].

The concept and performance are introduced below.

The propulsion of a spaceship is based on the action through medium of the field generated by the interaction of spacetime around the spaceship with the spaceship itself, and the spaceship is propelled against the structure of spacetime.

As a representative Field propulsion system, space drive propulsion system is the concept of propulsion theory of spaceship not based on momentum thrust but based on pressure thrust derived from an interaction of the spaceship with external fields. Space drive propulsion system is propelled without mass expulsion.

The propulsive force is a pressure thrust which arises from the interaction of space-time around the spaceship and the spaceship itself. The propulsive force of a spaceship is based on the action through medium of the field generated by the interaction of space-time around the spaceship and spaceship itself, and the spaceship is propelled against the structure of spacetime.

Based on the supposition that space is an infinite continuum like elastic body, space drive propulsion theory induced by space curvature can be possible.

Without the advanced theory that explains the mechanism of gravity generation in the background, such an advanced propulsion theory cannot be realized. The cause of gravity is the acceleration field generated in the curved space region, and the object falls on the Earth because it is pushed toward the Earth from the curved space region.

It is important to apply the acceleration due to this curved spatial region to the propulsion system. The curvature of space plays an important role not only in the mechanism of gravity but also in the new propulsion theory.

Typical field propulsion: Space drive propulsion system

A space drive propulsion system considered comparatively well is introduced in detail.

The space drive propulsion system proposed here is one of field propulsion system utilizing the action of the medium of the strained or deformed field of space, which is based on the propulsion principle of a kind of pressure thrust. Figure 2 shows the basic propulsion principle of common to all kinds of field propulsion system.

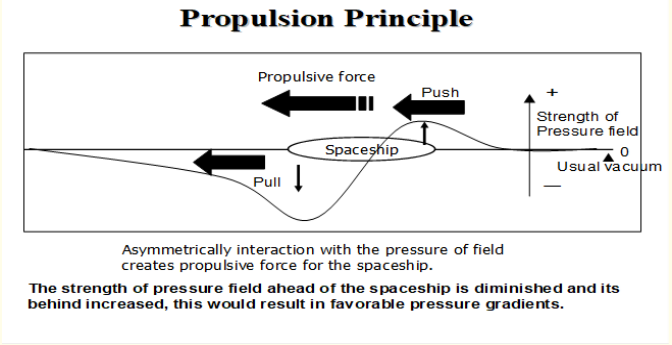


Figure 2: Fundamental propulsion principle of Field propulsion.

As shown in Figure 2, the propulsion principle of field propulsion system is not momentum thrust but pressure thrust induced by a pressure gradient (or potential gradient) of the space-time field (or vacuum field) between bow and stern of a spaceship. Since the pressure of the vacuum field is high in the rear vicinity of the spaceship, the spaceship is pushed from the vacuum field. The pressure of vacuum field in the front vicinity of the spaceship is low, so the spaceship is pulled from the vacuum field. In the front vicinity of the spaceship, the pressure of vacuum field is not necessarily low but the ordinary vacuum field, that is, there exist just only a high pressure of vacuum field in the rear vicinity of the spaceship. The spaceship is propelled by this distribution of pressure of the vacuum field. Vice versa, it is the same principle that the pressure of vacuum field in the front vicinity of the spaceship is just only low and the pressure of vacuum field in the rear vicinity of the spaceship is ordinary. In any case, the pressure gradient from the vacuum field (potential gradient) is formed over the entire range of the spaceship, so that the spaceship is propelled by the pressure gradient.

A condensed summary of the propulsion principle of space drive propulsion system is shown as Figure 3.

Based on the supposition that space is an infinite continuum like elastic body, space drive propulsion theory induced by space curvature can be possible.

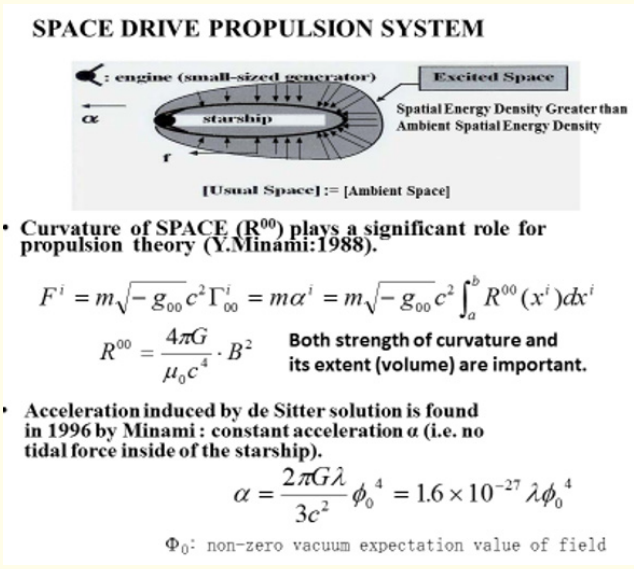


Figure 3: A condensed summary of Space Drive Propulsion.

Without the advanced theory that explains the mechanism of gravity generation in the background, such an advanced propulsion theory cannot be realized. The cause of gravity is the acceleration field generated in the curved space region, and the object falls on the Earth because it is pushed toward the Earth from the curved space region.

It is important to apply the acceleration due to this curved spa-

tial region to the propulsion system. The curvature of space plays an important role not only in the mechanism of gravity but also in the new propulsion theory.

Another field propulsion: ZPF field propulsion system

As mentioned previously, the propulsion principle of field propulsion is not momentum thrust but pressure thrust induced by a potential gradient arising from space or vacuum field between the bow and the stern of starship. The propulsive force as a pressure thrust arises from the interaction of space around the starship, which is propelled against the space-time structure. As H. D. Froning shows Figure 4, the pressure gradient of the vacuum field is formed over the entire range of starship, so that starship is propelled by being pushed from the pressure gradient of the vacuum field.

Since above stated propulsion systems have an excellent theo-

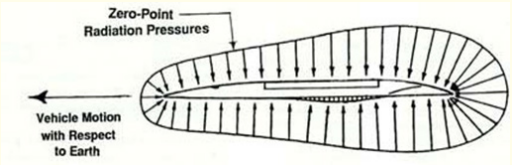


Figure 4: Overview of ZPF field propulsion.

retical performance and have the following flight performance characteristics, it will finally be possible for mankind to realize planetary exploration in a short time as a next-generation propulsion system.

Spaceship flight performance and feature

The spaceship equipped with space drive propulsion system has the following features.

- There is no action of inertial force because the thrust is a body force. Since the body force they produce acts uniformly on every atom inside the spaceship, accelerations of any magnitude can be produced with no strain on the crews,
- The flight patterns such as quickly start from stationary state to all directions in the atmosphere, quickly stop, perpendicular turn, and zigzag turn are possible,
- The final maximum velocity is close to the velocity of light,
- Since the air around the spaceship is also accelerated together with the spaceship, the aerodynamic heating can be reduced even if the spaceship moves in the atmosphere at high speed (10km/s - 100km/s). However, it is expected that a plasma (ionized air) envelops the spaceship,
- Since it is an electromagnetic propulsion engine, there is no heat source, noise or exhaust gas associated with combustion,
- The engine and power source are installed in the spaceship. Therefore, it can fly in the atmosphere of a planet as well as in cosmic space,
- By pulse control of magnetic field, the acceleration varies from 0G to an arbitrary high acceleration (e.g., 6000G),
- Deceleration is easy for re-entry into the atmosphere,
- Similar to 4th item above, the seawater around the spaceship is also accelerated together with the spaceship, so the resistance of the seawater is reduced and it is possible to move at high speed in the sea. It is possible to smoothly enter the sea from the atmosphere without splashing water due to a sea surface collision.

Here, we explain the motion of the spaceship in detail using computer graphics as shown in Figure 5. For the sake of simplicity, the shape of the spaceship is an omni directional disk type.

As shown in Figure 5 (a), the spaceship is able to permeate its local space with a huge amount of energy in a certain direction; this energy should be injected at zero total momentum (in the spaceship-body frame) to excite the local space. Then the excited local space expands instantaneously (Figure 5 (a), (b)). Space including the spaceship is pushed from the expanded space and moves forward (Figure 5 (b)).

The expression of "moves by being pushed from the expanded space" indicates that the spaceship produces a curved space region and moves forward by being subjected to the thrust from the acceleration field of the curved space. The space including the spaceship is propelled to the forward (Figure 5 (c)). Thus, this spaceship is accelerated to the quasi-speed of light by repeating the pulse-like on/off a change of permeating its local space with a huge amount of energy operation (Figure 5 (d), (e)). Changing a place to blow up, the spaceship can move with flight patterns such as quick start from a stationary state to all directions, quickly stop, perpendicular turn, and zigzag turn (Figure 5 (f), (g)). There is no action of iner-

tial force, because the thrust is a body force. Since the body force, they produce acts uniformly on every atom inside the spaceship, accelerations of any magnitude can be produced with no strain on the crews inside the spaceship (i.e., same as free fall). Namely, spaceship moves with the whole space around the spaceship, then, even if the spaceship flies about it very intensely, the spaceship holds the stopping state in moving space, and the crews are not shocked at all (Figure 5 (h)).

Here, the operation of the spaceship in Figure 6 (a), (b), which

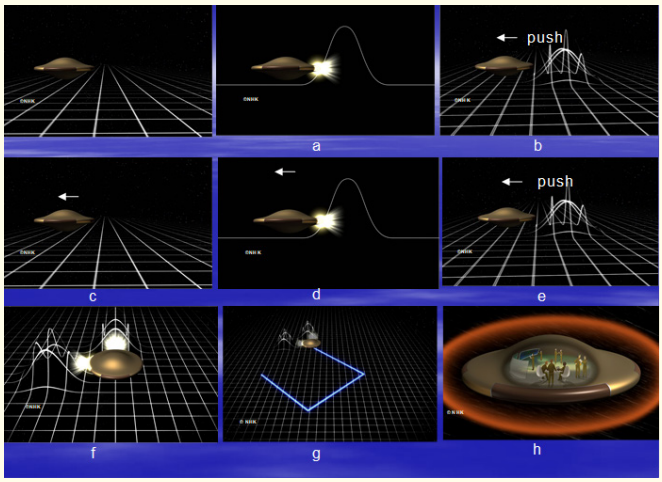
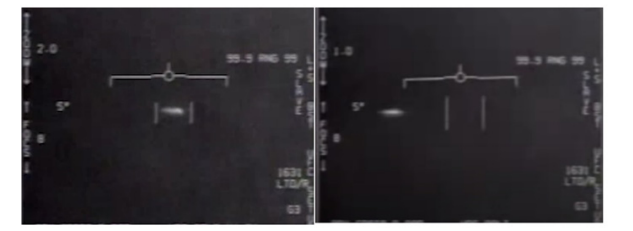


Figure 5: A description of the flight operation of a spaceship (© NHK).

is a video of a flying object (UAP) released by the US Department of Defense, is presumed to be the operation in Figure 5 (a), (b), (c) [5].



(a) (b)

Figure 6: A video of a flying object released by the US Department of Defense (Quoted from net news).

Spaceship acceleration

A curved space around the spaceship is created by the spaceship engine.

The spaceship is propelled in one direction by the acceleration of the field generated in the curved space. The magnitude of acceleration α is proportional to the curvature of space R^{00} and the range of the curved space region "s" (a-b).

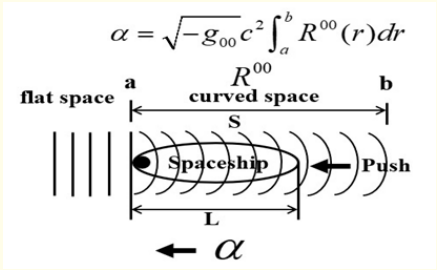


Figure 7: Propulsion principle and acceleration generated by curved space.

$$\alpha_{NET} = \frac{1}{2}\alpha\tau N = \frac{1}{2}\cdot\sqrt{-g_{00}}c^2\int_a^b R^{00}(r)dr\cdot\frac{L}{c}N = \frac{1}{2}\cdot\sqrt{-g_{00}}c^2\int_a^b\frac{4\pi G}{\mu_0 c^4}\cdot B^2 dr\cdot$$

$$\cdot\frac{L}{c}N \simeq \frac{1}{2}c^2\cdot\frac{4\pi G}{\mu_0 c^4}B^2\cdot S\cdot\frac{L}{c}N$$

, where $S = b - a$, $g_{00} \approx -1$.

Namely, propulsion acceleration is controlled by magnetic field B and repetition pulse frequency N.

spaceship acceleration:

$$\alpha_{NET} = \frac{1}{2}c^2\times 8.2\times 10^{-38}B^2\times S\times\frac{L}{c}\times N$$

It should be noted, these stars such as white dwarfs, neutron stars, and black holes have a strong magnetic field (10^8Tesla—10^{11}Tesla). Since the black hole itself does not generate and maintain a magnetic field, the magnetic field is generated by the plasma current of the accretion disk around the black hole.

<Example> L=5m, S=10m

$$\alpha_{NET} = \frac{1}{2}c^2\times 8.2\times 10^{-38}B^2\times S\times\frac{L}{c}\times N = 6\times 10^{-28}B^2 N$$

In case of B=10^{10}Tesla:

$\alpha_{NET} = 6\times10^{-28}\times10^{20}N = 6\times10^{-8}N$

N=1THz=10^{12}Hz $\alpha_{NET} = 6\times10^{-8}\times10^{12} = 6\times10^{4}m/s^2 = 6122G$

N=200GHz $\alpha_{NET} = 6\times10^{-8}\times2\times10^{11} = 12\times10^{3}m/s^2 = 1224G$

N=2GHz $\alpha_{NET} = 6\times10^{-8}\times2\times10^{9} = 120m/s^2 = 12G$

(1G=9.8m/$s^{2)}$

Conclusion

Current rockets based on the law of conservation of momentum cannot, in principle, achieve a velocity higher than the velocity of the gas they are ejecting backwards, so exploration of planets beyond Mars would take time and would be impossible due to it's too slow velocity. Therefore, manned planetary exploration cannot be realized by the present rocket method. A propulsion system based on pressure thrust, not momentum thrust, is essential. The new propulsion theory as the space drive propulsion system has already been completed.

Above stated space drive propulsion system, ZPF Field Propulsion System have an excellent theoretical performance and flight performance characteristics, it will finally be possible for mankind to realize planetary exploration in a short time as a next-generation propulsion system.

With these propulsion systems, mankind will have the propulsion technology for manned planetary exploration and will be able to advance into space.

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