MINI REVIEW

# Why do spacecraft always experience a black-out area that disrupts communications when they return to Earth?

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ABSTRACT

In this paper, Lorentz factor and Lorentz transformations are modified based on the new ether theory, and the blackout which leads to communication interruption of high-speed moving objects is analyzed by using the modified Lorentz electromagnetic field transformation formula. It is concluded that blackout is caused by the change of wave form of electromagnetic wave from stationary energy space (etheric reference frame) to moving medium (etheric reference frame) or from moving medium to stationary energy space.

**Key Words:** *Blackout; Blackout zone; Blackout area; Plasma sheath; Maxwell equations; Maxwell equations of moving media*

## INTRODUCTION

When satellites and spacecraft re-enter the atmosphere and return to the earth at a high speed, communication with the ground will be completely interrupted at a certain height, this is the blackout. The blackout appears between 35 km and 80 km above the earth. How is the blackout formed? The current scientific consensus is that all aircraft re-enter the atmosphere at such high speeds that the friction with the atmosphere causes the surface of the aircraft to be so hot that it ionizes both the gas and the ablated heat-resistant material. As a result, a sheath of hot plasma forms around the aircraft, which causes radio waves to decay or reflect, disrupting radio communication between the ground and the aircraft. Since the 1950s, people began to study the blackout and its elimination. However, until today, blackout is still a difficult problem to the scientific community.

When spacecraft land on Mars, they will also generate blackout that disrupt communications [1]. Because the Atmosphere of Mars is very thin, with a density less than 1% of the Earth's atmosphere, the velocity of the Mars lander that generated the blackout entering the atmosphere of Mars is 5.9 km/s and 7.26 km/s respectively [1], which is smaller than 7.9 km/s the initial velocity of the Earth's re-entry capsule entering the blackout- area. So, the idea that the blackout is caused by a plasma sheath created by the spacecraft's rapid friction with the atmosphere is questionable.

The purpose of this study is to find out the real cause of the blackout. In this study, Lorentz factor and Lorentz transformations are modified based on the new ether theory, and the blackout which leads to communication interruption of high-speed moving objects is analyzed by using the modified Lorentz electromagnetic field transformation formula. It is concluded that blackout is caused by the change of wave form of electromagnetic wave from stationary energy space (etheric reference frame) to moving medium (etheric reference frame) or from moving medium to stationary energy space.

**The modifications of Lorentz factor and Lorentz transformations**

In the modification of special relativity [2], the author attributed the shrinkage of the ruler, the slowness of the clock and the mass increase to the etheric (energy) effect, namely, the physical effects of the ether on the object when the object moves in the ether. These physical effects exist objectively and have nothing to do with the choice of the observer's reference frame. Since the energy (ether) density of space is different everywhere in the universe, and the strength of ether effect produced by objects moving at the same speed in space with different energy (ether) density should be different.

Therefore, the Lorentz factor must be modified to reflect the effect of spatial energy (ether) density:

$$\gamma' = \frac{1}{\sqrt{1-\beta'^2}} \quad (1)$$

$$\beta' = f(\rho)v/c \quad (2)$$

In formula (2), $f(\rho)$ is a function of $\rho$, which is a dimensionless number.

$$f(\rho) = k(\rho/\rho_0)^{\alpha} \quad (3)$$

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In formula (3), $\alpha$ and k are constants, $\rho_0$ is the standard space energy density set, such as the space energy density at a point 0 meters above sea level of the earth, ρ is the energy density of the space in which the moving object resides. The values of α and k are determined by experiment.

In all Lorentz transformations (Lorentz coordinate transformations, velocity transformations, electromagnetic field transformations), change the speed v to f(ρ)v, and change the Lorentz factor γ to the modified Lorentz factor γ', we obtain the modified Lorentz transformations:

Modified Lorentz coordinate transformations

$$\begin{cases} x = \gamma'[x' + f(\rho)vt'] \\ y = y' \\ z = z' \\ t = \gamma'[t' + f(\rho)vx'/c^2] \end{cases} \quad (4)$$

And the modified Lorentz co-ordinate inverse transformation,

$$\begin{cases} x' = \gamma'[x - f(\rho)vt] \\ y' = y \\ z' = z \\ t' = \gamma'[t - f(\rho)vx/c^2] \end{cases} \quad (5)$$

Modified Lorentz velocity transformations

$$\begin{cases} u_x = \frac{u'_x + f(\rho)v}{1+f(\rho)vu'_x/c^2} \\ u_y = \frac{u'_y}{\gamma'[1+f(\rho)vu'_x/c^2]} \\ u_z = \frac{u'_z}{\gamma'[1+f(\rho)vu'_x/c^2]} \end{cases} \quad (6)$$

And the modified Lorentz velocity inverse transformations,

$$\begin{cases} u'_x = \frac{u_x - f(\rho)v}{1-f(\rho)vu_x/c^2} \\ u'_y = \frac{u_y}{\gamma'[1-f(\rho)vu_x/c^2]} \\ u'_z = \frac{u_z}{\gamma'[1-f(\rho)vu_x/c^2]} \end{cases} \quad (7)$$

Modified Lorentz electromagnetic field transformations

$$E'_x = E_x \quad (8.1)$$
$$E'_y = \gamma'\left[E_y - f(\rho)vB_z\right] \quad (8.2)$$
$$E'_z = \gamma'\left[E_z + f(\rho)vB_y\right] \quad (8.3)$$
$$B'_x = B_x \quad (8.4)$$
$$B'_y = \gamma'[B_y + \frac{f(\rho)v}{c^2}E_z] \quad (8.5)$$
$$B'_z = \gamma'[B_z - \frac{f(\rho)v}{c^2}E_y] \quad (8.6)$$

Modified Lorentz electromagnetic field inverse transformations

$$E_x = E'_x \quad (9.1)$$
$$E_y = \gamma'\left[E'_y + f(\rho)vB'_z\right] \quad (9.2)$$
$$E_z = \gamma'\left[E'_z - f(\rho)vB'_y\right] \quad (9.3)$$
$$B_x = B'_x \quad (9.4)$$
$$B_y = \gamma'[B'_y - \frac{f(\rho)v}{c^2}E'_z] \quad (9.5)$$
$$B_z = \gamma'[B'_z + \frac{f(\rho)v}{c^2}E'_y] \quad (9.6)$$

**In-depth analysis of the cause of the blackout**

Due to the earth's gravitational field, there exists a relatively static etheric (space energy) layer on the earth's surface [1]. Therefore, on the Earth, the space layer at a certain height on the earth's surface can be regarded as a relatively static medium. In the earth etheric layer, electromagnetic waves emanating from antennas at rest relative to the earth etheric layer obey maxwell's equations of the stationary medium. Because the etheric space formed by the superposition of all nuclear etheric layers inside the antenna (wire) is static relative to the wire, it can be regarded as a medium that is completely static relative to the wire, therefore, the electromagnetic waves generated by the free electron motion in the wire obey the Maxwell equations of the stationary medium inside the wire and in the very thin space layer on the surface of the wire. This study involves the antenna of the return capsule, the Earth etheric layer and the ground antenna. In the case of a spacecraft reentry capsule returning to Earth at a high speed, what happens when the capsule receives the radio signal from the ground antenna, and when the ground antenna receives the radio signal from the capsule antenna? Let's analyze separately.

When the antenna of the capsule receives the radio signal from the ground antenna

Since the ground antenna is stationary relative to the ground, the ground antenna can be regarded as the earth ether reference system. In this case, the Earth etheric layer can be regarded as the stationary medium relative to the earth, and the antenna of the re-entry capsule can be regarded as the medium moving relative to the Earth etheric layer.

Fix coordinate system oxyz on reference frame K (Earth) and coordinate system o' x' y' z' on reference frame K' (re-entry module antenna). For convenience, assume that the corresponding coordinate axes of the two coordinate systems are parallel to each other, and assume that K' moves in the positive direction of the x axis with respect to K at velocity V, and that the origin o and o' of the two coordinate systems coincide when t=t'. According to the modified relativity principle [2], the physical theorems are of the same form in all etheric systems. Therefore, when observed in the K system (the earth ether layer) at rest, the electromagnetic wave emitted by the ground antenna satisfies Maxwell's equations of stationary medium:

$$\nabla \cdot E = \frac{\rho}{\varepsilon_0} \quad (10.1)$$
$$\nabla \cdot B = 0 \quad (10.2)$$
$$\nabla \times E = -\frac{\partial B}{\partial t} \quad (10.3)$$
$$\nabla \times B = \mu_0 J + \varepsilon_0 \mu_0 \frac{\partial E}{\partial t} \quad (10.4)$$

According to the modified Lorentz transformations of electromagnetic field (8.1) to (8.6), we can get the electromagnetic field components measured in K' system (re-entry capsule antenna) as follows:

$$E'_x = E_x \quad (11.1)$$
$$E'_y = \gamma'[E_y - f(\rho)vB_z] \quad (11.2)$$
$$E'_z = \gamma'[E_z + f(\rho)vB_y] \quad (11.3)$$
$$B'_x = B_x \quad (11.4)$$
$$B'_y = \gamma'[B_y + \frac{f(\rho)v}{c^2}E_z] \quad (11.5)$$
$$B'_z = \gamma'[B_z - \frac{f(\rho)v}{c^2}E_y] \quad (11.6)$$

In the above formula, ρ is the energy (etheric) density of the space in which the re-entry capsule resides. From equations (11.2), (11.3), (11.5), (11.6), (1) and (2), it can be seen that when V → C, we can get γ'→ ∞, Ez' → ∞, and By'→ ∞. Therefore, the higher the velocity v is, the greater the deformation of electromagnetic wave received by the antenna of the re-entry capsule will be (i.e., the greater the difference between Ey' and Ey, By' and By, Ey' and Ez', By' and Bz'), thus resulting in a lower signal-to-noise ratio of the signal, so the signal received By the antenna of the re-entry capsule will be worse.

When the ground antenna receives the radio signal from the antenna of the capsule

Since the ground antenna is stationary relative to the ground, the ground antenna can be regarded as the earth ether reference system. Fix coordinate system oxyz on reference frame K (Earth) and coordinate system o'x'y'z' on reference frame K' (re-entry module antenna). For convenience, assume that the corresponding coordinate axes of the two coordinate systems are parallel to each other, and assume that K 'moves in the positive direction of the x axis with respect to K at velocity V, and that the origin o and o' of the two coordinate systems coincide when t=t'. Therefore, when observed in the K' system (re-entry module antenna) at rest, the electromagnetic wave emitted by the re-entry module antenna satisfies Maxwell's equations of stationary medium:

$$\nabla \cdot E' = \frac{\rho'}{\varepsilon_0} \quad (12.1)$$
$$\nabla \cdot B' = 0 \quad (12.2)$$
$$\nabla \times E' = -\frac{\partial B'}{\partial t} \quad (12.3)$$
$$\nabla \times B' = \mu_0 J' + \varepsilon_0 \mu_0 \frac{\partial E'}{\partial t} \quad (12.4)$$

According to the modified Lorentz transformations of electromagnetic field (9.1) to (9.6), we can get the electromagnetic field components measured in K system (the earth ether layer) as follows:

$$E_x = E'_x \quad (13.1)$$
$$E_y = \gamma'[E'_y + f(\rho)vB'_z] \quad (13.2)$$
$$E_z = \gamma'[E'_z - f(\rho)vB'_y] \quad (13.3)$$
$$B_x = B'_x \quad (13.4)$$
$$B_y = \gamma'[B'_y - \frac{f(\rho)v}{c^2}E'_z] \quad (13.5)$$
$$B_z = \gamma'[B'_z + \frac{f(\rho)v}{c^2}E'_y] \quad (13.6)$$

In the above formula, ρ is the energy (etheric) density of the space in which the re-entry capsule resides. From equations (13.2), (13.3), (13.5), (13.6), (1) and (2), it can be seen that when V → C, we get γ' → ∞, Ez → ∞, and By → ∞. Therefore, the higher the velocity v is, the greater the deformation of the electromagnetic wave received by the ground antenna is (i.e., the greater the difference between Ey and Ey', By and By', Ey and Ez, By and Bz), thus resulting in the lower the signal-to-noise ratio of the signal received by the ground antenna, and the worse the signal received by the ground antenna.

Therefore, when the re-entry capsule quickly enters the Earth ether layer, the signal-to-noise ratio of the radio signals received by the antenna of the re-entry capsule from the ground antenna and the radio signals received by the ground antenna from the antenna of the re-entry capsule will be very low, resulting in communication interruption. After the re-entry capsule enters the atmosphere, due to the resistance of the atmosphere, the speed of the re-entry capsule will be constantly reduced. Since f(ρ) will increase with the decrease of altitude, the re-entry capsule will not immediately get out of the blackout- area even though the speed of the re-entry capsule decreases with the decrease of altitude under the resistance of air. When the velocity of the re-entry capsule is less than a certain value, the SNR of the radio signals received by the antenna of the re-entry capsule and the ground antenna will be greater than a certain threshold, so that the antenna of the re-entry capsule can receive the radio signals from the ground antenna, and the ground antenna can receive the radio signals sent by the antenna of the re-entry capsule. That's why the re-entry capsule experiences a blackout- area when it returns to Earth.

Due to the gravity of the planet, the surface of any planet (Mars, Jupiter, moon, etc.) has the etheric (space energy) layer which is stationary relative to the planet and moves with the planet. Therefore, the space layer at a certain height on the surface of the planet can be regarded as the stationary medium relative to the planet. So we can predict that when a spacecraft enters the ether (space energy) layer of any planet, whenever it is fast enough, it will experience a blackout-area that disrupts radio communication.

## DISCUSSION

**Although the capsule moves faster in orbit than the return capsule returns to Earth, why does it not cause the radio communication interruption when it moves in orbit?**

Answer: The closer to the center of the earth, the stronger the earth's gravitational field [3], the higher the density of space energy (ether), the stronger the ether effect (such as time dilation effect) on the moving object, so the closer to the center of the earth, the greater the f(ρ), the smaller the velocity v needed to cause communication interruption.

The fact that the velocity (about 7900 m/s) from the re-entry capsule entering the blackout- area is much higher than the velocity (about 200 m/s) from leaving the blackout-area also indicates that the closer the moving object is to the ground, the lower the speed required for communication interruption.

Because the space capsule orbits far from the Earth, the density of space energy (ether) is low, that is, f(ρ) is small. Therefore, although the space capsule is moving very fast, the ether effect (such as time effect) on the capsule is not strong enough. So the distortion of the radio waves picked up by the space capsule's antenna and the ground antenna is not large enough to disrupt communications.

Of course, if a spacecraft is moving fast enough, radio communication can be disrupted even in orbit or elsewhere far from the planets.

**Compared with the re-entry capsule, the speed of high-speed train is not so fast. Why does it also cause the interruption of mobile phone signal?**

Answer: Because the train is much closer to the ground than the re-entry capsule, the energy (ether) density of the space in which high-speed train sits is much higher, so, the speed needed to cause a communication blackout is much lower. This is why high-speed trains can cause cell phone signals to drop even though they are not moving as fast as the re-entry capsule.

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