


## Why does the motion of the Pioneer Satellite differ from theory?

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Information from Science journal shows that the motion of the Pioneer satellite, which was launched in 1970 is anomalous. The distance of satellite's travel is shorter than theory. Nobody has understood this problem. Tia sang has posted the following:

**TiaSang**  
BỘ KHOA HỌC VÀ CÔNG NGHỆ

 [In trang](#) 35 bài toán nan giải - C C

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Vừa qua, tờ báo thông tin khoa học hàng đầu của Pháp và thế giới, *La Recherche* đã cho công bố 35 bài toán nan giải trong các ngành khoa học, từ toán học, tin học đến vật lý, sinh học... Sau đây là một số trong các bài toán nan giải đó.

### **8/ Quỹ đạo kỳ lạ của những trạm thăm dò PIONEER** *Jacques-Olivier Baruch*



Đây là trạm thăm dò Pioneer 10, phóng ngày 02/03/1972 hiện nay cách xa trái đất hơn 12 tỷ km. Từ năm 1980, các kỹ sư đã đo được một độ lệch khó hiểu so với quỹ đạo tính toán

Những trạm thăm dò Mỹ Pioneer 10 & 11 được phóng vào năm 1970 đã đi một quãng đường nhỏ hơn tính toán. Điều gì đã xảy ra?

Các kỹ sư đã truy tìm các nguyên nhân: dò nhiên liệu? Phát xạ nhiệt do phân rã plutonium của máy phát nhiệt điện? áp lực từ phía gió vũ trụ giữa các sao? Sai số trong các tính toán quỹ đạo? Mọi công tác truy tìm đều không dẫn đến kết quả.

Vậy chỉ còn lại một nguyên nhân: có thể cần phải thay đổi định luật hấp dẫn!

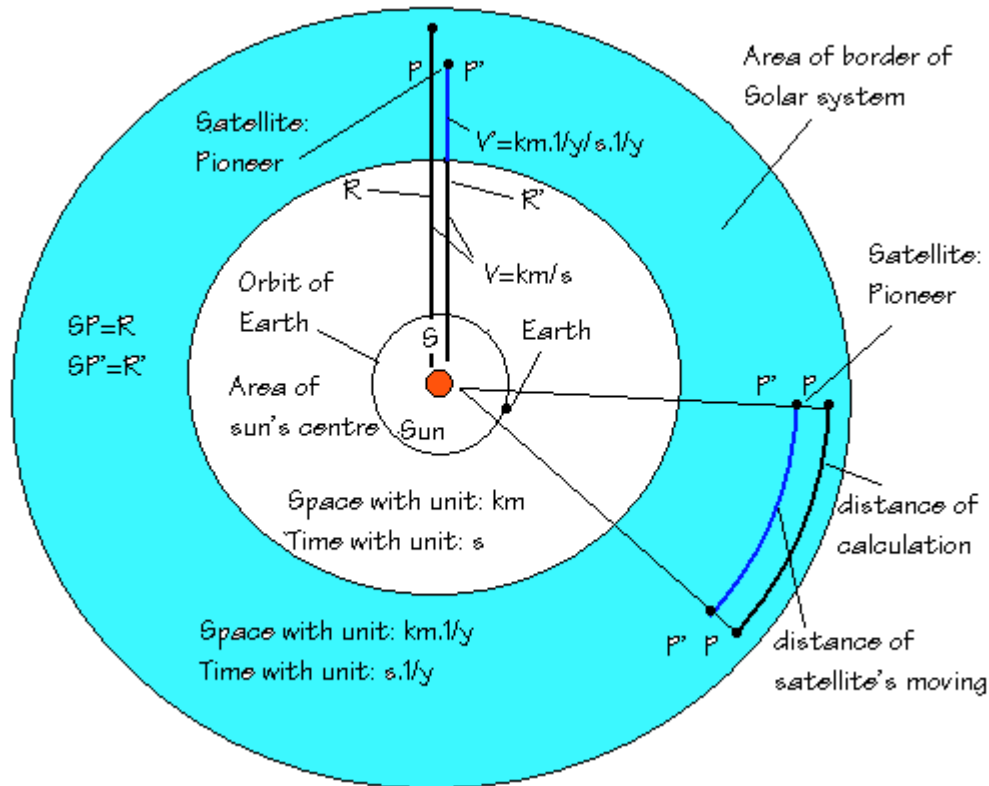
Marc-Thierry Jaekel, Cao đẳng Sư phạm Pháp (Ecole Normale Supérieure) cùng với cộng sự Serge Reynaud đã giải thích hiện tượng “dị thường

Pioneer” bằng cách đưa thêm vào một thông số thứ hai liên quan đến vận tốc xuyên tâm bên cạnh hằng số hấp dẫn trong phương trình Einstein. Đường như mọi việc đều ổn. Song các cơ quan vũ trụ dự định phải bỏ nhiều trăm triệu euro để kiểm nghiệm tính đúng đắn của giả thuyết. Liệu “dị thường Pioneer” có mở ra một chương mới của hấp dẫn?

I think this problem is not difficult to understand if we have an understanding of space and time as well as Einstein’s relativity theory. The travel distance of the satellite is shorter because space and time in the Solar system is not homogeneous whereas the formula used for calculation is homogeneous. As per Einstein’s relativity theory, space and time depend on the gravitational potential where in fact, the gravitational potential near the Sun’s centre is stronger than at a distance. So, space and time near the sun’s centre is condensed more than at the border of the Solar system. If we call the measurement unit of space and time near the sun’s centre as km and s, the measurement unit where it is at the border of the Solar system will be  $km' = km \cdot 1/\gamma$  and  $s' = s \cdot 1/\gamma$ , (with  $1 < \gamma < \infty$ ). This means that the measurement unit: km and s of space and time near the sun’s centre where the gravitational potential is stronger, is larger than near the border of the Solar system. Here, the gravitational potential is less strong. ( $km' = km \cdot 1/\gamma < km$  and  $s' = s \cdot 1/\gamma < s$ ).

In fact, the satellite: Pioneer has moved from the Earth where is near area of the sun’s centre and the gravitational potential which is stronger to the area of the border of Solar system where the gravitational potential is weaker. It means that the Pioneer satellite has moved in the space and time with measurement’s unit: km; s and the space and time with measurement’s unit:  $km' = km \cdot 1/\gamma$  ;  $s' = s \cdot 1/\gamma$ . Please see **Figure 1**:

**Figure 1**



In **Figure 1**,  $SP=R$  and  $PP$  is distance calculated;  $SP'=R'$  and  $P'P'$  is distance of the satellite's actual motion.

From Newton's formula of the Gravitational force: 
$$F = G \frac{M.m}{R^2} \quad (1)$$

$F$  : Gravitational force

$G$  : Gravitational constant

$M$  : The mass of the Sun

$m$  : The mass of the satellite: Pioneer

$R$  : A distance between the Sun and satellite

We find that in Newton's formula for gravitational force, space and time do not change, (a unit of distance:  $R$  is km). In this case of the Pioneer satellite,

I think we have to revise it to make it more suitable. How is it revised?  
 Using Einstein's discovery of space and time which is changed by the gravitational potential, **if we accept Einstein's formula of energy of the moving frame with extreme velocity:  $E_{re}=m_o.\gamma.c^2$  and it has to be revised by  $E_r=m_o.\gamma.c_o^2.\gamma^2$  (please seeing the paper: "Is Einstein's formula true?"), we can write Newton's formula for gravitational force as follows:**

$$F = G \frac{M.m'}{R'^2} = G \frac{M.\left(\frac{m + m.1/\gamma}{2}\right)}{\left(\frac{R + R.1/\gamma}{2}\right)^2} = G \frac{M.m\left(\frac{1+1/\gamma}{2}\right)}{R^2.\left(\frac{1+1/\gamma}{2}\right)^2} = G \frac{M.m}{R^2.\left(\frac{1+1/\gamma}{2}\right)} \quad (2)$$

Of which  $\gamma$  is dilate coefficient of space and time, and  $(1 \leq \gamma \leq \infty)$ .

Because coefficient:  $\gamma > 1$ , the gravitation force: (2) between the Sun and the satellite is in fact is stronger than the gravitational force: (1) which is calculated with Newton's formula. Thus the velocity of the satellite where it is near the border of the Solar system is slower than if it was near the Sun's centre.

It is easy to make a mistake for the observers when they use the units: km; s and calculate the velocity of the satellite which is moving in space and time with units: km.1/ $\gamma$  ; s.1/ $\gamma$ . The observers always see and calculate:

$$v = \frac{km}{s} = v' = \frac{km.1/\gamma}{s.1/\gamma}$$

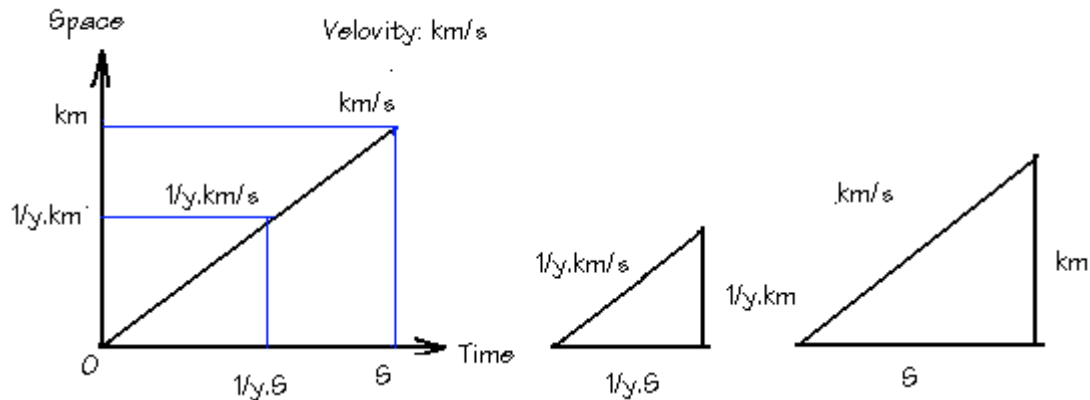
(Of which  $v$  is velocity using: km and s , and  $v'$  is velocity in the space and time using: km.1/ $\gamma$  and s.1/ $\gamma$ ) .

But the observers that are in the satellite in the space and time having units: km.1/ $\gamma$  and s.1/ $\gamma$  always realize that the velocity in their space and time is only  $v' = \frac{km.1/\gamma}{s.1/\gamma}$  , and not:  $v' = \frac{km}{s}$  . To compare the velocity in the space and time with units: km and s and the velocity in the space and time with a units: km.1/ $\gamma$  and s.1/ $\gamma$  , we find that they are similar, but not equal. So,

$$v' = \frac{km.1/\gamma}{s.1/\gamma} \neq v = \frac{km}{s} \quad v' = \frac{km.1/\gamma}{s.1/\gamma} = 1/\gamma.\frac{km}{s} \quad \rightarrow \quad v' < v$$

Please see a **figure 2**:

**Figure 2**



Seeing **figure 2**, we find that a clock in the satellite which is moving in space and time with units:  $1/\gamma.km$  and  $1/\gamma.s$  will be faster than a clock on Earth in space and time with units:  $km$  and  $s$ . But the light velocity will be slower than the light velocity on Earth by the coefficient:  $1/\gamma$ . This is because  $c=300,000.1/\gamma.km/s$ , (of which  $1/\gamma < 1$ ).

**Conclusion:** The motion of Pioneer satellite which is different from calculating of theory is evident to prove the variation of the light velocity in the universe.

The gravitational force: (2) between the Sun and the satellite is in fact stronger than the gravitational force: (1) which is calculated with Newton's formula and If calculating space and time with units:  $km$  and  $s$  near the Sun's centre is a standard of the measurement, the velocity of the Pioneer satellite in space and time with units:  $1/\gamma.km$  and  $1/\gamma.s$  where at the border of the Solar system will be slower than near the Sun's centre. That is why the distance of the satellite at the border of the Solar system is shorter than the distance of the calculation with the coefficient:  $1/\gamma$  of space and time.

Reference: "Is Einstein's formula true?"

Hanoi, June 25, 2007