

# The Flight of the Balloon and the Daily Rotation of the Earth

Yuri Pivovarenko

Research and Training Centre 'Physical and Chemical Materials Science' Under Kyiv Taras Shevchenko University and NAS of Ukraine, Kiev, Ukraine

**Email address:**

y.pivovarenko@gmail.com

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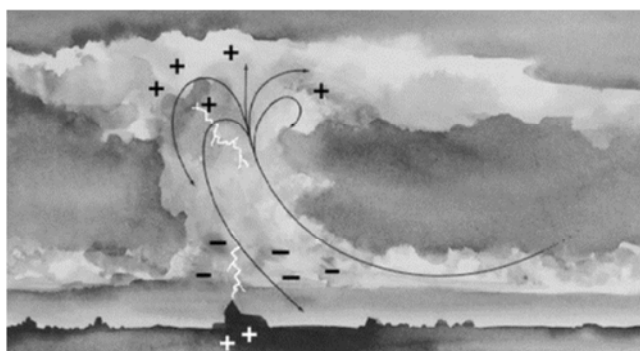
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**Abstract:** At the Earth's surface acts the electromagnetic force, which distributes charges. Under the action of this force the positive charges move upward and the negative charges down. Here we tried to demonstrate the possible influence of this force on the flight of the balloon.

**Keywords:** Balloon, Hot-Air Balloon, Thermal Aerostat, Flame Charges, Flame Plasma, Geomagnetic Field

## 1. Introduction

There is data showing that near the earth's surface there is a force under which the positive charges move upward and the negative charges down. This force causes a negative charge to the earth surface and the positive charge of the upper atmosphere [1, 2]. This force causes also the polarization of the clouds: it is known that the lower part of the typical cloud has a negative charge, and its upper part has a positive charge (Figure 1) [2].



**Figure 1.** Polarization of clouds: the lower part of a typical cloud has a negative charge and the upper part has a positive charge.

The action of such force also determines the distribution of charges in the flame: as is known, the lower part of the flame has a negative charge and its upper part has a positive charge [3], – this distribution of charges of the flame shows the

flame shape, which is in a horizontal electric field (Figure 2).



**Figure 2.** Candle flame under the influence of a left directed electric field: the upper part of the flame is directed to the left, and the lower part is directed to the right.

Not being able to analyze here all the manifestations of the existence of this power, we, however, want to say that it determines not only the appearance of jets of steam [4] (Figure 3, left), but smoke (Figure 3, right). Thus, jets of steam and smoke represent the flow of positive charges, i.e. electric currents in the classic sense.

As we have shown earlier [5, 6], described force is the Lorenz force that appears due to the daily rotation of the

Earth relative to the geomagnetic field. As you can see (Figure 4), the objects on the Earth's surface or in earth's atmosphere cross the horizontal lines of the geomagnetic field during such movement.



**Figure 3.** Steam rising over a cup of coffee (left) and cigar smoke (right). It is obvious that the particle density of steam and smoke is greater than the density of the air.

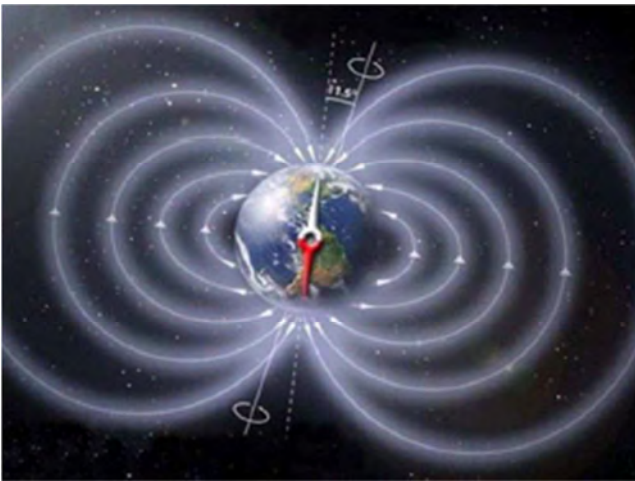
Obviously, in such conditions on the Earth's surface and in the near-earth atmosphere appears as a Lorentz force  $F_L$ , directed upwards (1):

$$F_L = q \cdot [v, B],$$

where:  $q$  – electric charge,

$v$  – the linear speed of earth's surface,

$B$  – geomagnetic induction [7].



**Figure 4.** As the Earth has daily rotation all objects on its surface cross the horizontal lines of force of the geomagnetic field. The appeared Lorentz force distributes the charges located on the earth's surface. Wherein the positively charged particles move up and negatively charged – down.

It is also obvious that under the action of this force the positive charges move upward and the negative charges down.

As is evident, the described Lorentz force can distribute both electric charges generated in the flame of a candle (Figure 2) and the charges generated in the flame of a gas

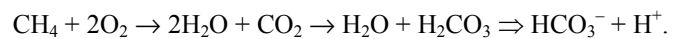
burner hot-air balloon (Figure 5).



**Figure 5.** Start a hot-air balloon.

## 2. Results

At present it is obvious that the gas burner of the balloon (Figure 5) generates not only heat but also charged particles [3, 8, 9]. For simplicity, consider their education in a flame of methane [10]:



As we showed earlier, only positively charged particles flame moving up (particles with a negative charge move down) [6]. As is clear from the construction of a hot air balloon (Figure 4), it will catch only particles with a positive charge. So actually the ball will acquire a positive charge. Here we have tried to define what a positive charge  $q$  is needed to the hot air balloon is in equilibrium under the action described Lorentz force  $F_L$  and gravity.

For this reason, we tried to analyze the possible impact of these forces on the flight of a balloon, is provided with a gas burner.

Assuming, that the whole mass of hot-air balloon (with a basket, but without air)  $M$  is  $\sim 1 \cdot 10^3$  kg, we got the equation (2):

$$M|g| = |F_L| \Rightarrow \\ M|g| = q|v_e| \cdot \mu\mu_0|H| \Rightarrow \\ 1 \cdot 10^3 \text{ kg} \cdot 9,8 \text{ m} \cdot \text{s}^{-2} = qAs \cdot 463 \text{ m} \cdot \text{s}^{-1} \cdot 1 \cdot 1,257 \cdot 10^{-6} \text{ kg} \cdot \text{m} \cdot \text{s}^{-2} \cdot \text{A}^{-2} \cdot 27,06 \text{ A} \cdot \text{m}^{-1},$$

and

$$qAs = 9,8 \cdot 10^3 \text{ kg} \cdot \text{m} \cdot \text{s}^{-2} / 463 \text{ m} \cdot \text{s}^{-1} \cdot 1 \cdot 1,257 \cdot 10^{-6} \text{ kg} \cdot \text{m} \cdot \text{s}^{-2} \cdot \text{A}^{-2} \cdot 27,06 \text{ A} \cdot \text{m}^{-1} = 9,8 \cdot 10^3 / 14,1 \cdot 10^{-3} \text{ A}^{-1} \cdot \text{s}^{-1} = \sim 9,7 \cdot 10^6 \text{ A} \cdot \text{s} = \sim 0,7 \cdot 10^6 \text{ C},$$

where:  $M$  ( $= 1 \cdot 10^3$  kg) – the accepted mass of the balloon (without internal air);

$|g|$  ( $= 9,8 \text{ m}\cdot\text{s}^{-2}$ ) – the gravity acceleration,  
 $|v_e|$  ( $= 463 \text{ m}\cdot\text{s}^{-1}$ ) – linear speed of earth's surface at equator,  
 $\mu$  ( $= 1.0$ ) – relative magnetic constant air;  
 $\mu_0$  ( $= 1,257\cdot 10^{-6} \text{ kg}\cdot\text{m}\cdot\text{s}^{-2}\cdot\text{A}^{-2}$ ) – magnetic constant;  
 $|H|$  ( $= 27,06 \text{ A}\cdot\text{m}^{-1}$ ) – intensity of geomagnetic field at equator [7].

Taking into account the number of Faraday  $F = 9,648456\cdot 10^4 \text{ C}\cdot\text{M}^{-1}$  [7] and equation (1), it can be concluded that this positive charge may be theoretically derived from the combustion of 7.3 M of methane:

$0,7\cdot 10^6 \text{ C} / 9,648456\cdot 10^4 \text{ C}\cdot\text{M}^{-1} = \sim 7,3 \text{ M}$  ( $\sim 116,1 \text{ g}$ ) of methane.

Thus, if the carbonic acid which is formed during the combustion of methane dissociates only into two ions:  $\text{H}_2\text{CO}_3 \Rightarrow \text{HCO}_3^- + \text{H}^+$ , for the considered equilibrium requires about 116,1 g of methane.

It is clear that the obtained result does not account for losses resulting positive charge. Here we do not take into account the further dissociation of carbonic acid [10] and the extra chemical reactions that occur in the methane flame [9]. To present our hypothesis, it is important that the methane flame contains a large number of free anions, as typical plasma [8, 9].

For further discussion of our hypotheses, we need to determine how much methane is needed for the same equilibrium of the balloon, which is influenced only by the gravity force and the Archimedes force.

For convenience, here we assumed that the balloon has a radius of  $R$  10 m and, therefore, its volume  $V$  is  $\sim 4,2\cdot 10^3 \text{ m}^3$  ( $V = 4/3\pi\cdot 10^3 \text{ m}^3 = \sim 4,2\cdot 10^3 \text{ m}^3$ ). Based on these parameters, we calculated the density of the air inside the balloon  $\rho_1$  necessary for its equilibrium in flight. First, we had defined the necessary difference between the density of the outside air  $\rho_0$  (20 °C) and the density of the air inside the balloon  $\rho_1$ :  $\rho_0 - \rho_1$ .

To this aim, we have made the equation (3):

$$\begin{aligned} M|g| &= (\rho_0 - \rho_1)V|g| \Rightarrow \\ \Rightarrow 1\cdot 10^3 \text{ kg}\cdot 9,8 \text{ m}\cdot\text{s}^{-2} &= (\rho_0 - \rho_1) \cdot 4,2\cdot 10^3 \text{ m}^3 \cdot 9,8 \text{ m}\cdot\text{s}^{-2} \\ \Rightarrow (\rho_0 - \rho_1) &= 1\cdot 10^3 \text{ kg} / 4,2\cdot 10^3 \text{ m}^3 = \sim 0,24 \text{ kg}\cdot\text{m}^{-3}, \end{aligned}$$

where:  $M$  ( $= 1\cdot 10^3 \text{ kg}$ ) – the accepted mass of hot-air balloon (without internal air);

$|g|$  ( $= 9,8 \text{ m}\cdot\text{s}^{-2}$ ) – the absolute value of the gravitational acceleration;

$V$  ( $= 4/3\pi\cdot 10^3 \text{ m}^3 = \sim 4,2\cdot 10^3 \text{ m}^3$ ) – volume envelope hot-air balloon.

Since  $\rho_0$  (20 °C,  $101,325\cdot 10^3 \text{ Pascal} = 1 \text{ atmosphere}$ ) is equal to  $\sim 1,2 \text{ kg}\cdot\text{m}^{-3}$  [7]:  $\rho_1 = \sim (1,2 - 0,24) \text{ kg}\cdot\text{m}^{-3} = \sim 0,96 \text{ kg}\cdot\text{m}^{-3}$ .

To obtain a density of air (inside the shell of balloon), its volume should be increased  $1,2/0,96 = 1,25$  times. This can be achieved by heating the air that is inside the balloon. Since the process is Isobaric ( $V/T = \text{const}$  [11]), we get (4):

$$\begin{aligned} V_1/T_1 &= V_0/T_0 \Rightarrow V_1/V_0 = T_1/T_0 = 1,25 \Rightarrow \\ \Rightarrow T_1/293,15 \text{ K} &= 1,25 \Rightarrow \end{aligned}$$

$$\Rightarrow T_1 = 1,25\cdot 293,15 \text{ K} = 366,4 \text{ K} (93,25 \text{ }^\circ\text{C}).$$

In our opinion, it is very high temperature. We doubt that

it corresponds to reality. Whatever it was, the temperature value does not prevent us to demonstrate our hypothesis.

Continuing our calculations, we calculated how much methane is needed to heat the air up to this temperature. To do this, we first used equation (5):

$$\begin{aligned} dQ &= c_p \cdot m \cdot dT \Rightarrow dQ = \\ &= \sim 1\cdot 10^3 \text{ Joule}\cdot\text{kg}^{-1}\cdot\text{K}^{-1} \cdot 5,04\cdot 10^3 \text{ kg} \cdot \sim 73,25 \text{ K} = \sim 3,7\cdot 10^8 \text{ Joule}, \end{aligned}$$

where:  $dQ$  – the heat absorbed by the air;

$c_p$  ( $\sim 1\cdot 10^3 \text{ Joule}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$ ) – the specific heat capacity of the air at atmospheric (constant) pressure and at 20 °C [7];

$m$  – the initial mass of the air inside the balloon at 293,15 K:

$$m = \rho_0 \cdot V = \sim 1,2 \text{ kg}\cdot\text{m}^{-3} \cdot \sim 4,2\cdot 10^3 \text{ m}^3 = \sim 5,04\cdot 10^3 \text{ kg};$$

$dT$  – the difference between the primary and final temperatures of the air inside the balloon:  $\sim 366,4 \text{ K} - 293,15 \text{ K} = \sim 73,25 \text{ K}$ .

It is known that during the combustion of methane released  $192 \text{ Calorie}\cdot\text{M}^{-1}$  [10] or  $192\cdot 4186,8 \text{ Joule}\cdot\text{M}^{-1} = \sim 5,03\cdot 10^7 \text{ Joule}\cdot\text{kg}^{-1}$ . In order to obtain the amount of heat  $Q = \sim 3,7\cdot 10^8 \text{ Joule}$ , needed to burn  $\sim 3,7\cdot 10^8 \text{ Joule} / 5,03\cdot 10^7 \text{ Joule}\cdot\text{kg}^{-1} = \sim 7,36 \text{ kg}$  of methane.

If we divide 7,36 kg per 116,1 g:  $7360 \text{ g} / 116,1 \text{ g} = \sim 63,4$ , we get that the described Lorentz force  $F_L$  theoretically  $\sim 63,4$  times more effective than the Archimedes force. In any case, this is true for the equilibrium that we analyze here.

The analysis of our findings, we hypothesized that the positive electrification can increase not only the lift force of balloon, and airplane. In our opinion, the positive electrification of the aircraft can occur as a result of two physical processes, at least.

First, the metal body of the aircraft can acquire a positive charge in accordance with rule Kyon: upon contact of the two phases, the phase which has high dielectric permittivity receives a positive charge [10]. Since the dielectric permittivity of air is  $\sim 1$  [7], and dielectric permittivity typical of metals accepted as  $\infty$  [7], the metal body of an airplane must acquire a positive charge. Second, the metal body of an airplane will acquire a positive charge due to thermal emission of electrons [7]. This will definitely happen, since the main body of an airplane is very hot (Figure 6) [12]. Whatever it was, but the positive electrification of an airplane may occur [13].

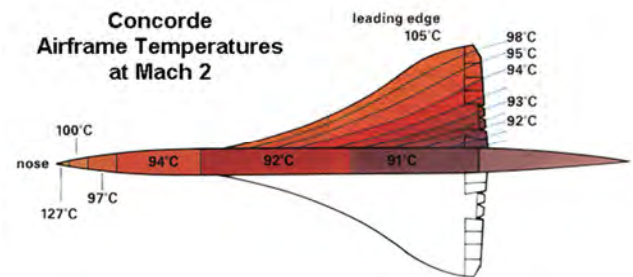


Figure 6. The heating of the body of the Concorde flying at a speed of  $\sim 2450 \text{ km per hour}$  (Mach 2) near the earth's surface (20°C, 1 atm).

Given our reasoning, perhaps not surprisingly, the principle of operation of the engine of a UFO, crashed in the

German Alps in 1939, according to Henry Stevens. “The engine of his... produced electrons and positrons. The positrons are attracted to the top of the sphere and created the levitation” [14].

### 3. Conclusion

Due to the daily rotation of the Earth the lower layers of earth's atmosphere is continuously crossed by horizontal lines of the geomagnetic field. For this reason, near the earth's surface there is an upward-directed Lorentz force. This force can increase the lifting force of flying objects, which have a positive charge.

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