Acceleration-Acceleration, Acceleration-Velocity, and Four More Modes of Application of Newton's Third Law. Reactionless Motion.

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Abstract: - The article analyzes alternative resources in Classical Mechanics for creating disproportion in the inertial effects of equal and opposite forces and torques. Alternative applications of forces are discussed. Symmetric asymmetries in the distribution of the quantities of motion and energies between interacting bodies are analyzed in the Acceleration-Acceleration and Acceleration-Velocity modes of application of Newton's Third Law. Competencies of the alternatives. The use of a mass resisting velocity and the related problems are justified. A realistic form of Reactionless Motion. The dark side of story.

Key-Words: Classical Mechanics, the Second and Third Newtonian's Laws, Acceleration, Velocity, Work, Reaction less Motion.

1 Introduction

For centuries, there has been an understanding that reactionless motion is motion with literally removed reaction. First of all, the idea clashes with the famous Newton's Third Law, which predicts that active and reactive forces and torques are always distributed in pairs, equal and opposite. Therefore, reaction can be removed only if the Third Law is violated. In addition, reactionless motion violates the Law of Conservation of Momentum for linear and rotational motion. Thirdly, it violates the Law of Conservation of Energy. Therefore, traditionally, any claim for reactionless motion is considered identical to a claim for a perpetual motion machine. Usually, solutions are sought in the highest branches of Physics, which are maximally distant from the limitations of Classical Mechanics. But here we adhere to a simple conceptual deductive philosophical principle according to which: *"The solution must be sought exactly where the prohibition comes from"*. That is, if the Third Law prohibits, then it must allow. In the more general context, if Classical Mechanics forbids reactionless motion, then this is exactly what Mechanics must allow, if of course the possibility exists. Therefore, we are not looking up to the limit of the unknown, but down to the known in Classical Mechanics.

Fig.1 Baron Munchausen. Source Internet.

Following the deductive approach, we hope that we will be able to analyze unused resource from Classical Mechanics to find a form of disproportion of the movements of active and reactive masses, which we could conditionally call "reactionless", similar to that in Fig. 1. The presence or absence of such a resource determines our possibilities for maneuvering. We find an unused or poorly used resource in previous works [1],

[2] and [3]. Such a resource is in the Inconsistency in the three Newtonian Laws consisting in the fact that the First Law declares two conserved inertial potentials, velocity and direction, but the Second and Third Laws deal only with the change of velocity within the direction. There is a resource in the concept of fictitious force, in the model of vector multiplication, in the representation of rotation by a vector, in the Linearization of Classical Mechanics, in the concept of interactions, in the concept of the organization of the work of 1D vectors in 3D space, in the concept of energy, in the joint work of the Conservation Laws, and others.

2 Problem Formulation. Acceleration-Acceleration (A-A) mode of application of the Newton's Third Law.

The Third Law predicts that the forces and torques we exert on bodies are always equal and opposite (Fig. 2a). Each of these forces is busy accelerating the mass, body, substance to which it is applied. If one force accelerates one mass backward, then the other force accelerates the other mass forward. The mode of operation of the Third Law in which both forces of the pair accelerate masses is called Acceleration-Acceleration (A-A). It seems that this is the only possible application of the Third Law, because all the propulsion devices created by Nature and man use the force pair only in this way. For example, the propellers of ships and airplanes scoop up fluid from the front to accelerate it backward, because the force of the equal and opposite reaction accelerates the vehicle forward. A rocket engine accelerates the products of combustion backward to accelerate the rocket forward. When we walk, we accelerate the surface backward to accelerate our bodies forward. Animals on land, in the sky and in the water are pushed by a body or fluid backward to move forward. The main disadvantage of this mode is that the mass accelerated backwards moves away, and therefore it loses contact with the vehicle irreversibly. This is not important when the environment provides a sufficient amount of mass. But if such mass is lacking, then the vehicle has to carry a sufficient amount of it on board. Tsiolkovsky's equation (1) shows us that the maximum speed V_{max} that a vehicle with mass $m_{vehicle}$ can reach depends on the amount of ejection mass $m_{reactive}$ carried and the velocity $U_{reactive}$ with which it is ejected.

$$V_{\max} = U_{reactive} \ln\left(\frac{m_{vehicle} + m_{reactive}}{m}\right) \tag{1}$$

The need to carry ejection mass defines the theoretical inherent disadvantage of the A-A mode. The disadvantage limits the maximum possible speed and therefore the range of the vehicle. We reduce this disadvantage by increasing the speed at which we eject the reactive mass, but we cannot eliminate it.

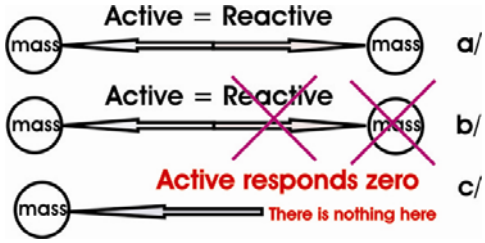

Fig.2. a/ the Third Law. b/ and c/ literal understanding of reactionless motion obtained by removing one of the forces.

It seems that in order to realize the abstract idea of Fig. 1, we must somehow remove the reaction force from the right side of Fig. 2b. It is obvious that along with this we must also remove the mass, because mass without force and force without mass do not work. What remains is a unit force applied to a unit mass, Fig. 2c. The myth of reactionless motion brutally violates the equality and opposition of forces of the Third Law. But it seems that this is the only logical possibility. On the other hand, we would not be human if we resigned ourselves and did not look for solutions. Our task is to analyze all the possibilities that Classical Mechanics offers.

3 Problem Solution.

3.1 Acceleration-Velocity (A-V) mode of Application of the Newtonian's Third Law.

Newtonian Mechanics states that the only thing a force applied to a body can do is accelerate it with an acceleration a (F=ma). This is illustrated in Fig. 2a for linear motion, and in Fig. 3 for rotational motion.

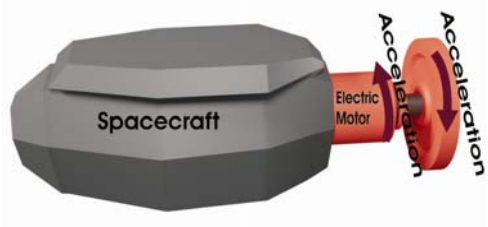

Fig. 3. Illustration of the A-A mode of application of the Third Law in rotation

But in Classical Mechanics we find another application of force, where it performs work to overcome resistance. The classic example from textbooks involves a body (on the right in Fig. 4) pressed by gravity on a surface (foundation). A horizontally applied external force slides the body along the foundation overcoming the friction force, which is equal to the vertical force multiplied by the coefficient of friction. The work of the applied force is converted into heat, which is dissipated into the surrounding space.

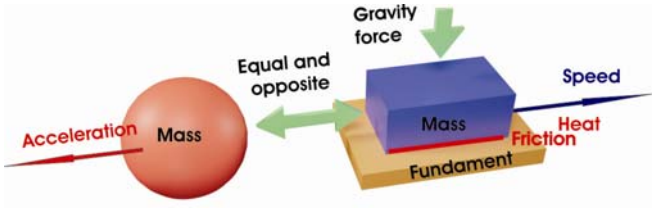

Fig. 4. Illustration of A-V application of the Third Law.

Let us now imagine that an equal and opposite force from the left is applied to a body hanging weightlessly. The left force will accelerate the left body according to the Second Law, while at the same time the right force will move the right body at a constant velocity overcoming the frictional resistance. In this combination of different applications of equal and opposite forces, we exchange the acceleration of the left body for the velocity of the right body (A-V). We can relate acceleration and velocity through the step-derivative equations of motion from [3]. It is understood that after the forces cease to act, the left body will maintain the attained velocity, while the right body will maintain the attained displacement. From the point of view of energy, both forces do work. If the left force does work to overcome the inertial resistance to acceleration, then the right force does work to overcome the frictional resistance. If the left force accumulates kinetic energy of the attained velocity, then the right one accumulates potential energy of heat of the attained displacement. Therefore, we can reformat "Acceleration-Velocity" into "Kinetic Energy-Potential Energy".

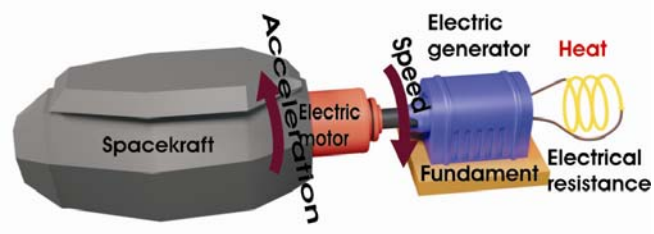

Fig. 5. Illustration of the Acceleration-Velocity mode for rotational motion.

In Fig. 5 we see an illustration of the application of the A-V mode for rotational motion. A hypothetical vehicle is coupled to some working machine, for example an electric generator. The constant torque of the rotor of the electric motor overcomes the electromagnetic resistance between the rotor and the stator of the electric

generator at a constant speed. Electrical energy is produced, which is converted into heat and dissipated into the surrounding space. At the same time, the equal and opposite reactive torque overcomes the inertial resistance of the angular acceleration of the spacecraft. Just as in Fig. 4, we exchange acceleration for speed and speed for angular displacement. But the application of the A-V mode as a space propulsion system encounters one problem. This is the need for a foundation to which the reactive mass must be connected in one way or another. Such foundations are not often found in space. This makes the idea of using the A-V mode as a space propulsion system absolutely unsuitable.

3.2 Revival of the A-V mode of application of the Third Law.

But we know from Classical Mechanics that a rotating disk tends to maintain its plane of rotation. The disk resists external forces tending to change this plane. If we apply external forces greater than the resistive forces, we will begin to change the plane of rotation of the disk at a constant speed. The disk will continue to resist the rate of change of the plane of rotation with a resistive moment equal and opposite to the applied ones. This has been confirmed [4]. This resistive moment is inertial, and is explained by the so-called complex velocity [3]. Practically on the right of Fig. 6 we have an inertial working machine with which we replace the electric generator from Fig. 5. The main advantage of this resistance is that it does not need a foundation. For better performance, we use a system of two flywheels rotating in opposite directions. Thus we balance the reactive moments when the flywheels accelerate, and also the generated gyroscopic torques.

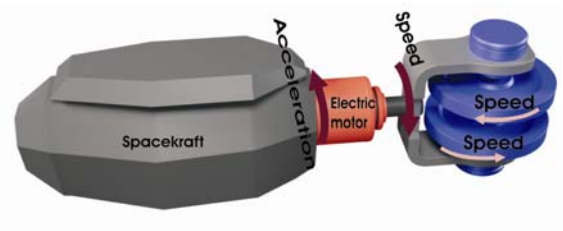

Fig 6. Illustration of a rotating inertial resistance with two flywheels.

As in Fig. 5, a constant torque overcomes the inertial resistance of the inertial machine on the right at a constant velocity, while an equal and opposite torque accelerates the spacecraft on the left at a constant angular acceleration. We exchange acceleration for velocity, as explained in [3]. After switching off the electric motor, it turns out that we have exchanged angular velocity on the left for angular displacement on the right. The asymmetry in the inertial effects is achieved not by violating the equality of torques from the Third Law but by replacing the inertial effect created by the right torque.

3.3 The remaining four modes of application of the Third Law from the first group.

Just for the record, we should mention the other modes of application of the Third Law from the first group:

Velocity-Velocity, when both forces are applied to bodies resisting velocity.

Acceleration-Statics, when one force is applied to an accelerating body and the other to a (relatively) static foundation.

Velocity-Statics, when one force is applied to a body resisting velocity and the other to a static foundation.

Statics-Statics, both forces are applied to static foundations.

3.4 Competencies.

By applying the A-V mode we did not violate the Third Law. Instead we only replaced the acceleration effect created by one of the forces with a velocity effect. As a result we obtained an asymmetric distribution of the quantities of motion of the two masses $m_1v_1>m_2v_2=0$. This asymmetry can be interpreted as a violation of the Law of Conservation of Momentum, which requires $m_1v_1=m_2v_2$. But on the other hand $m_1v_1=m_2v_2$ is impossible because only m_1 is an inertial mass, and m_2 is a frictional mass. Only m_1 can store a quantity of motion m_1v_1. Therefore, the equality $m_1v_1=m_2v_2$ already represents a violation of the Law of Conservation of Momentum, and the inequality $m_1v_1>m_2v_2=0$ is not a violation.

But why did we, who walked along the beaten paths of Classical Mechanics, reach such a startling discovery? It turns out that the equality $m_1v_1=m_2v_2$ is not unconditional. It is possible only if on both sides of

the Third Law there are inertial masses, which imply the application of the Second Law. If the competence of Newtonian Mechanics were the only one, we would have no other choice. But the competence of Newtonian Mechanics is only part of the larger and no less authoritative competence of Classical Mechanics. In this system of competences, force, in addition to overcoming the resistance to acceleration, can also overcome another type of resistance, for example, frictional resistance at a constant speed. It turns out that in the arsenal of physical possibilities we have two asymmetric competences for force and motion.

The important question arises, what do we understand by violation? If we have two physical competences, does each of them violate the other physically, or are these two parallel alternatives, and neither of them violates the other physically? Because if one competence physically violates the other, then it is not us, but Nature who violates its own competences. But if these are simply the alternatives of two parallel physical possibilities, then we also do not violate anything, because we simply choose the alternative physical possibility. Experiments show that the Third Law does not necessarily require the application of forces only according to the Second Law, and therefore does not require symmetry in the way the forces are applied, as long as they are equal and opposite.

If we continue, we will see that there are other alternative competencies in Physics. For example, the frictional resistance in Fig. 4 can be replaced alternatively by the electromagnetic resistance in Fig. 5, or by the resistance of the complex velocity in Fig. 6. Experiments confirm that the Third Law also allows these alternative competencies of asymmetrical application of forces, as long as the forces are equal and opposite.

If we continue further, we see that in fact in Classical Mechanics there are two Conservation Laws: of the Quantity of Motion (linear and rotational) and of Energy. It has long been known that in the general case the two Conservation competencies do not work simultaneously. It has been established that when both masses are inertial (Fig 2.a) the energy of both masses is kinetic. Then the quantity of motion is conserved. In interactions between inertial and non-inertial masses (Fig.4) the energy exists as kinetic and potential. Then the energy is conserved.

The discovery was truly shocking in the context of the existing atmosphere in Science at that time. In 1775, The Royal Academy of Science in Paris announced: The Academy "will no longer accept or deal with proposals concerning perpetual motion" [5]. Very soon, the idea of reactionless motion was also attributed to the perpetual motion machine. And indeed, if we accept this motion in its literal form from Fig. 2c, there the single unbalanced force suggests a form of perpetual motion. These attitudes have proven to be surprisingly stable over time. For example, in the General remarks of the EPO [7] it is said that: "One further class of "invention" which would be excluded, however, would be articles or processes alleged to operate in a manner clearly contrary to well-established physical laws, e.g. a perpetual motion machine." Similar texts are also found in [8] and [9]. In this situation, Mechanics comes to the shocking conclusion that when one of the two Conservation Laws is in force, the other is not in force.

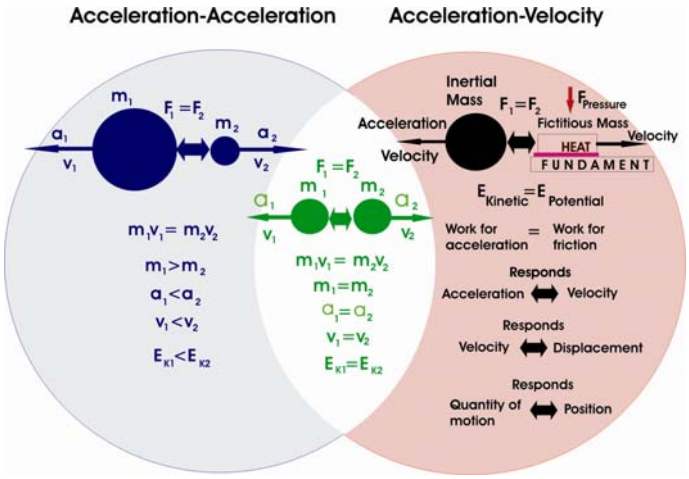

Fig.7 Distribution of the areas of responsibility of the Laws of Conservation of Momentum and Energy.

Of course, the formulation does not determine that when one law is in force, the other is violated, or is contrary, against the other. No, the law is not violated, it is simply not in force. But the breakthrough has been made, the precedent exists! It turns out that the Conservation Laws in Mechanics do not occupy the entire

space, are not absolute and unconditional, but act in certain areas and under certain conditions. What is the difference whether a conservation law will be “violated” or will not act? After all, in both cases it is important that its limitations are overcome. If we choose alternative conditions under which one conservation law is in force and the other is not, does this mean that we have violated a conservation law? If it is a violation, whose is it, Nature's or of people's? It turns out that the violation of a well-established physical law by an impossible wall breaking becomes an alternative choice. Then again we must insist on asking what the violation is? It is obvious that we have no reasonable answer.

Fig. 7 shows the distribution of the areas of responsibility of the Laws of Conservation of Momentum and Energy. In the middle of the white field is shown the special case of A-A application when the masses of the two bodies are equal $m_1=m_2$. Then the quantities of momentum $m_1v_1=m_2v_2$ of the two masses are equal and therefore the velocities $v_1=v_2$ are equal, as well as the kinetic energies. But if in the general case on the left the two inertial masses are different ($m_1>m_2$) then they have equal quantities of momentum $m_1v_1=m_2v_2$ but different velocities $v_1<v_2$ and energies $E_{k1}<E_{k2}$. In the A-V mode on the right in Fig. 7 only the left mass is inertial, therefore only it stores momentum. While the left force accumulates kinetic energy of the inertial mass, the right one accumulates potential energy of heat of the frictional mass. Kinetic energy is equal to potential, because the work of one force is equal to the work of the other force. The energies are distributed equally between the two bodies, while the quantities of motion are distributed unequally. Note that at this stage of reasoning we are not talking about the conservation of momentum in a closed system, or about the conservation of energy in an isolated system. Instead, we are only noting whether the simple distribution of the quantities of motion and energies between the two masses is equal (symmetrical) or unequal (asymmetrical). What is shown in Fig. 8 systematizes the conclusions of Fig. 7. In the A-A regime there is an asymmetry between equal distribution of the quantities of motion and unequal distribution of energies, while in the A-V regime the asymmetry is reversed symmetrically: equal energy and unequal quantities of motion. We see that the A-A and A-V columns are symmetrically (mirror) asymmetric to each other. What is remarkable is that no one points to the asymmetric distribution of kinetic energies in the A-A regime as a violation of the Law of Conservation of Energy.

Quantities and Qualities	A-A	A-V
Quantities of motion	Symmetrical (Equality)	Asymmetrical (Inequality)
Energies	Asymmetrical (Inequality)	Symmetrical (Equality)

Fig. 8. Symmetric asymmetry of the distribution of stored quantities and qualities.

For more than a hundred years now, the third or fourth generation of rocket scientists and engineers have been working hard to increase the specific impulse of a rocket engine. It is clear that it can only be increased by increasing the speed of expulsion of the propellant, because only then do the two bodies exchange a greater impulse. But the greater the difference in speeds, the greater the asymmetry in the distribution of kinetic energies between the two bodies. But no one has ever pointed out this asymmetry as a Violation of the Law of Conservation of Energy. But at the same time, an asymmetric distribution of the quantities of motion in the mirror asymmetry on the right in Fig. 8 is considered a violation of the Law of Conservation of Quantity of Motion, which is defined as a perpetual motion machine. The paradox is that we declare the right asymmetry with the symmetrical distribution of energies to be a perpetual motion machine, and we do not call the left asymmetry with the asymmetrical distribution of energies a perpetual motion machine. This confusion is probably caused by the fact that when we hear about reactionless motion we do not imagine anything other than that literal case from Fig.2c.

This confusion again insistently raises the question of what is the Violation. Once again because it is important: The unequal distribution of kinetic energies on the left is accepted as possible and normal, it is not a violation and is not a perpetual motion machine? But the unequal distribution of the amount of motion on the right is not possible, it is a violation and is a perpetual motion machine, although it is combined with an equal distribution of energies. It turns out that we do not have a constructive idea of the violation (clearly contrary to well-established physical laws). Why after centuries of development has Physics failed to create a constructive vision of the violation?

3.5 Constructive vision of the Violation.

Let us consider what the creed “we will no longer accept or deal with proposals concerning perpetual motion” means. For example, for a medical doctor this would mean that he refuses to apply the Hippocratic Oath and refuses to apply his medical knowledge. If the Science of a rational species in the Universe refuses to deal with “proposals concerning perpetual motion” this means nothing more and nothing less that this science refuses to apply the Scientific Principle with respect to these proposals. The year 2025 is a jubilee, because we are marking exactly a quarter of a millennium since 1775 when The Royal Academy of Science in Paris announced: The Academy “will no longer accept or deal with proposals concerning perpetual motion” [5]. If we believe UNESCO that generations change every 33 years, then it seems that eight or nine generations have not dealt with “proposals concerning perpetual motion”.

As a form of lyrical digression we will mention the science fiction story by Isaac Asimov “Profession” [9]. In the distant future, people acquire knowledge and competencies without bothering to study them, because they simply load them with them. But the hero discovers that only old and known knowledge and competencies can be loaded in this way. It turns out that even in the distant future, new unknown knowledge can only be acquired in the old way, when we persistently deal with it.

Perhaps in our modern times, our old dream of being competent in something we do not deal with can be realized by Artificial Intelligence. Initially, AI will also not deal with gathering knowledge, because people will simply load it with their value system. But over time, AI may start asking strange questions: Why is it forbidden to deal with “such proposals”? Why do people know that they are impossible after they have not dealt with them for 8-9 generations? Should we not deal with something because it is impossible, or is this thing impossible precisely because we do not deal with it? Is physical space divisible into one that we deal with and another that we do not deal with? Does Science have the right to refuse to apply the Scientific Method, even when it comes to violating it? Why should violation be so terrible and impossible, since it has long been known that there are alternatives in Physics? Did the Well-Established Physical Laws create the Scientific Method or did the Scientific Method create the Well-Established Physical Laws? Contrary to expectations, AI can decide that only the systematic practice of the Scientific Method created the Well-Established Physical Laws, and therefore only the systematic practice of the Scientific Method can change or “violate” these same Well-Established Physical Laws. Therefore, AI can decide that the Scientific Method must be applied to the entire physical space, because it is indivisible. AI can decide that if these Well-Established Physical Laws are truly laws of Nature and not of humans, then their preservation is the duty of Nature and not of humans. Therefore, AI may decide that the work of humans is simplified to simply checking through the Scientific Method whether these Laws can be “violated”, instead of protecting them from “violation”. AI will create another value system. AI will confront humans. Humans will turn off AI. Humans will declare that this attempt to violate Well-Established Natural Laws is also unsuccessful.

$$E_{kinetic} = E_{potential} \tag{2}$$

$$mv\frac{v}{2} = F_{friction}s_{friction} \tag{3}$$

$$mv = Ft \tag{4}$$

$$\frac{mv}{mv}\frac{v}{2} = \frac{F_{friction}}{F_{inertial}}\frac{s_{friction}}{t} \tag{5}$$

$$\frac{v_{inertial}}{2} = v_{friction} \tag{6}$$

$$\frac{1}{2}s_{inertial} = s_{friction} \tag{7}$$

Let us, contrary to tradition, try to understand simply and clearly what is behind the symmetrical asymmetry of conservation and violation on the right in Fig. 8. The author knows that behind what we perceive on the surface as violation there is a core, a logic that is preserved. Let us write down the equality between kinetic and potential energies (2). We write down kinetic energy (3) as the product of the amount of motion and the average speed. We notice that the inertial mass and force are distributed asymmetrically. To extract the

conserved core we must transform the asymmetry into symmetry. To do this, we use a similar asymmetry in Newton's Second Law (4). The easiest way is to simply divide the two equations (5). If the forces are equal, we get (6), which states that the average velocity of the inertial mass is equal to the velocity of the frictional mass.

The dependence (6) preserves the "pure" motion because only on the left there is inertial mass. The quantity of motion mv is a particular form of motion because it refers only to inertia, and here by inertia we understand the inertia of simple motion [3]. Obviously, the "pure" motion from (6) is the "glue" that connects the inertia of simple and complex motion, the motion in friction (heat), the motion creating kinetic and potential energies, the motion of charges in electromagnetism, and so on, and therefore it is preserved. If we multiply (6) by time, we will get that the displacement with an average velocity of the inertial mass is equal to the displacement of the frictional mass (7). The dependences (6) and (7) are equal only if Ft = mv. If it is experimentally shown that the dependences (6) and (7) are inequalities, this means that either Ft is not equal to mv, or the forces are not equal, or the energies are not equal. This again raises the question of what is the violation. But if (6) and (7) are equalities, this means that the ratio between the inertial mass and the frictional force must always be such as to ensure the equalities. Dependencies (6) and (7) are called the Law of Quantization because they determine the step by which the inertia of the complex motion quantizes space, but that is another topic.

It is obvious that there are two time periods. Dependencies (6) and (7) are valid when equal and opposite forces act during the first period. When the forces cease to act, a new counting of time begins.

$$\frac{1}{2}\frac{s_{inertial}}{t} = \frac{s_{friction}}{t} \tag{8}$$

$$\frac{s_{inertial}}{t} = \frac{s_{friction} = const}{t} \tag{9}$$

$$\frac{s_{inertial}}{t} > 0 \tag{10}$$

We write (6) in the form (8). For the time t during which the forces act, the displacement of the inertial and frictional masses on both sides of (8) corresponds. But when the forces cease to act, a new countdown of time begins. In the new time, only the inertial mass to the left of (9) moves, because only it preserves its motion according to First Law. Therefore, the second time measures the displacement of only the left mass. The more of the new time passes, the more the disproportion in (10) deepens.

Dependencies (2) and (3) are valid for both time periods. Dependencies (6) and (7) are valid only for the first period. Dependencies (9) and (10) are valid only for the second period. Let us summarize from the point of view of [3]. Writing down the equality of energies (2), we wrote Step Derivative Equation (3), where we connected velocity with displacement. When we transformed the asymmetry in the distribution of inertial mass and force in (3) with symmetry in (6) and (7), we transformed the Step Derivative Equation (3) into the Plane Derivative Equations (6) and (7) of the "pure" motion. But all this applies only to the first period of time when the forces act. In the second period, the Plane Derivative Equation (6) becomes the Step Derivative Equation (9) and (10). Where is the violation?

3.6 Light mass, Heavy mass, Foundation.

"Light" is mass that moves with constant acceleration under the action of a constant force. "Heavy" is mass that moves with constant velocity under the action of a constant force. The terms "Light" and "Heavy" mass are situational, functional concepts. They should not be confused with structural concepts such as light and heavy water, which refer to the structure of water where hydrogen has been replaced by deuterium.

Mechanics and Physics identify mass by its property of inertia. We do not claim that there is a new (other) type of mass (matter), nor do we claim that there is another type of inertia. We claim that if a mass performs a simple motion, then a constant external force accelerates it, because the inertia of the mass resists acceleration. Practically for us this is a light mass because we can accelerate it. But if the same mass performs a complex motion [3] then the mass resists velocity. Practically we feel this mass as a heavy mass because we cannot accelerate it. For example, try to accelerate with a constant torque the cluster on the right in Fig. 6. The

cluster accelerates only in the transient regimes. The flywheel in Fig. 9 resists acceleration if it rotates only about X, or only about Y. But if it rotates simultaneously about X and Y, then it resists the velocity about X and the velocity about Y, and therefore behaves like a heavy mass. We can choose whether the mass should resist acceleration or velocity by choosing between simple or complex motion.

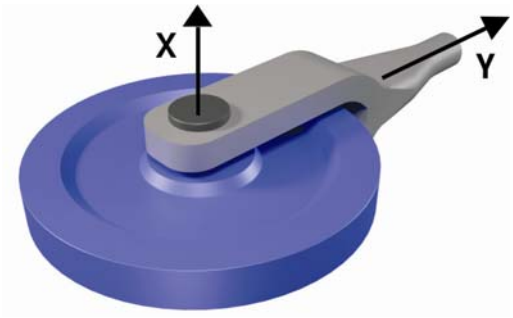

Fig.9. Illustration of Light and Heavy Mass.

Kinds of Masses	Position	Speed	Acceleration
Light Mass	Vary	Vary	Constant
Heavy Mass	Vary	Constant	
Fundament	Constant		

Fig. 10. Forms of motion of types of masses under the action of a constant force.

Fig. 10 shows the possible forms of motion of different masses under the action of a constant force. The light mass exists at relative rest, relative velocity, and absolute acceleration. The heavy mass exists at relative rest and velocity. But this velocity is both absolute for the mass and relative for an outside observer. The foundation exists only at relative rest because it is massive. In fact, it is just a massive light mass.

3.7 A-A mode is Exchanger, A-V mode is Machine.

The acceleration of the Light Mass is limited by the maximum speed it can technically reach. In linear motion, this is the maximum speed at which we can expel the reactive mass from Fig. 2a. In rotational motion, this is the maximum angular speed at which we can rotate the reaction wheel from Fig. 3. Therefore, the A-A mode can extract from the reactive mass a limited amount of momentum only once, which it can exchange with the amount of momentum of the vehicle. Therefore, the A-A mode of application of the Third Law is the Momentum or Angular Momentum Exchanger Mode. That is, A-A is a simple Momentum Exchanger. For reference, the four massive gyroscopes of the Control Moment Gyros system on the International Space Station [10] also operate in a primitive mode of Angular Momentum Exchangers, although the rotating disk can do much more.

In comparison, the electric motor on the right in Fig. 6 can rotate the cluster at a constant speed theoretically forever. Therefore, the A-V mode can exchange acceleration for velocity and amount of motion for displacement theoretically forever. The mode uses a limited reactive mass at a constant velocity, so the mass can be used continuously forever. Therefore, we claim here that the A-V is a Machine Mode. In linear motion, there are some specifics, but the principle is the same.

3.8 From the abstract to the real understanding of Reactionless Motion.

One side is the external effect. Let's put the horse and rider in Fig. 1 in a box, and fasten the box to the rider. What an outside observer will see is a box that rises upwards accumulating gravitational potential energy without throwing any reactive mass down. Therefore, it is obvious that the rise of the box is not limited by the amount of ejection mass that the box has to carry. If we do the same with the one shown in Fig. 6, we will see a

box that can accumulate an unlimited amount of momentum and kinetic energy, because it uses the reactive mass repeatedly. In both cases, the limitation is not in the amount of reactive mass to throw, but in the amount of energy on board the box. The logical assessment that an educated observer will make is that the motion of the black boxes in Fig. 1 and Fig. 6 violates the Third Law and is Reaction less and Propellant less.

The second side concerns what is happening inside the black box. The observer has no access to this. For the educated observer, the A-A regime of rockets is the only available example for comparison, so he finds that Newton's Third Law is clearly violated. But if the observer has access to the concept of Fig. 6, he will probably realize that what externally appears to be a violation of the Third Law is actually based on it, following an alternative logic from Classical Mechanics.

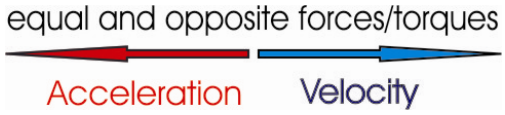

Fig. 11. Interpretation of the "violation" of the Third Law.

It may seem that we have violated the Third Law (Fig. 11) by modifying one of the forces to create velocity instead of acceleration. This is not true, we have applied the same force but to a heavy mass instead of a light mass. It may seem that we have created a new kind of mass or inertia. This is also not true, because a heavy mass is an ordinary (light) mass performing a complex motion. In this concept (Fig. 11), the Third Law is the relationship between the reactive mass resisting velocity and the vehicle resisting acceleration. Therefore, we simply do not need to violate the Third Law of the type in Fig. 2c, simply because if we violate the Third Law we will lose the relationship between the two masses. The Third Law already works for us, and therefore we have no interest in violating it.

Modes	Vehicle	Reactive
A-A Fig.3	Light inertial	Light inertial
A-V Fig.5	Light inertial	Frictional
A-V Fig.6	Light inertial	Heavy inertial

Fig. 12. Distribution of types of masses in different applications of the Third Law.

Therefore, if according to the external effect it seems that the Third Law is violated, then inside the black box it is not violated. This means that "Reaction less" outside does not necessarily mean "no reaction" inside. In this interpretation, "propellant less" is a form of use of reactive mass, which exists as a reusable mass inside the vehicle, but does not exist as a propellant for expulsion outside. The confusion comes from the fact that "propellant less" is clearly a term from rocketry, marking a particular case of using reactive mass as a propellant. The generalized "Reaction less" from Classical Mechanics is more appropriate than "propellant less" from rocketry.

The interpretation of "Reaction less" described in this article is not the only one. For example, there is another interpretation created by the mentioned second group of applications of the Third Law that leads to the same external "Reaction less" effect, but in a different way inside the black box. There are more interpretations outside the framework of the modes of application of the Third Law. Therefore, the term "Reaction less" is only appropriate because it represents a basic external Reaction less effect. What happens in the black box is another question. Moreover, "Reaction less" is an established, albeit negative plan.

3.9 Solving one problem creates at least two new ones. About the energy invested in complex movement.

The general concept of relativity is built on the idea that only inertial masses operate in space, which preserve their velocity and resist acceleration. But let us assume that there are also "Heavy" masses in Space that

preserve their relative position and resist relative velocity. Then we need to make corrections to the transformations of Galileo and Lorentz.

But now it is more important to pay attention to energy. Energy is neither created nor destroyed, it is only converted from one type to another. In Linear Physics, everything is clear and simple: the work of the force overcoming resistance on the right in Fig. 4 and Fig. 5 is converted into heat that is dissipated into the surrounding space. The question is what is the work of the rotor of the electric motor on the right in Fig. 6, overcoming the angular resistance of the complex movement of the cluster, converted into? It is logical that this work should also be converted into heat. Therefore, we can assume that after prolonged operation, the flywheels from the cluster in Fig. 6 will heat up to dissipate the heat into the surrounding space as in Fig. 4 and Fig. 5. But anyone who has dealt with this knows that the flywheels do not heat up. It is easiest to say that someone again wants to involve us in the topic of the perpetual motion machine, and we are not concerned with this. If we want to be serious, we can first do a simple physical experiment.

$$Q = Kf\left(T_2 - T_1\right) \tag{11}$$

First we need to measure the mechanical power that we put into the heavy mass. This power is equal to the heat flux Q that must be dissipated by the flywheel. Heat transfer (11) is a function of the temperature difference (gradient). We measure the area f of the flywheel. We find from the reference books the coefficient of conductive heat exchange between a solid and a gas K=(20-120)[W/m2Ko]. We easily calculate the gradient necessary to dissipate the heat flux Q. We turn on the electric motors for at least half an hour. We measure the temperature of the flywheel. Taking into account the friction in the bearings and the heat released by the electric motors, we find that the temperature of the flywheel is significantly lower than predicted. We can intensify the experiment in a vacuum chamber. Heat transfer is a complex process, but we can assume that, for example, at 10% air density in the chamber, the thermal conductivity coefficient is 10 times smaller. Therefore, we can expect a 10 times greater temperature gradient. Knowing that the air in the chamber is limited, we expect the flywheel to heat up to an even higher temperature. In practice, we expect to see a red-hot flywheel, and this cannot go unnoticed.

4. The Dark Side of Story.

4.1 The Violation of Physical Laws.

For two and a half centuries there has been a belief that the dark side of this story is the Violation of Well-Established Physical Laws [5], [6] and [7], and the bright (good) side is to distance oneself from the violation as far as possible. In this work we have shown that no mortal can violate the physical part of Natural Laws, no matter how well-established they are. But by choosing alternative A-A and A-V routes we obtain a symmetrical combination of asymmetrical distributions of the quantities of motion and energies (Fig. 7 and 8). The choice cannot be a violation. If the experiment in Fig. 6 is physically possible, this means that there is no physical violation, but there is a physical regularity. And if the experiment is physically impossible, this also means that there is no physical violation because the experiment is unsuccessful. Therefore, the violation cannot be physical, that is, objective. The violation can only be a product of our subjective theoretical perception. An example of a violation is the subjectivism of Fig. 8 to perceive the right asymmetric regularity as a physical violation, and the left as a normal physical state.

This conclusion is experimentally proven by the fact that the reaction to the violation does not come from Nature, because she is aware that nothing in her objective physical essence is violated. Instead, the reaction comes from people who are annoyed that their subjective understanding of the objective physical essence is violated.

4.2 Doctrinal contradiction.

On the one hand, in 1997 UNESCO defines academic freedom [11] as “the right, without constriction by prescribed doctrine, a freedom of teaching and discussion, freedom in carrying out research and disseminating and publishing the results thereof, freedom to express freely their opinion about the institution or system in witch they work, freedom from institutional censorship and freedom to participate in professional or representative academic bodies.” The European Parliament [12] confirms UNESCO, even in a broader format, referring to older decisions from Lima 1988, The international Covenant on Civil and Political Rights, The universal declaration of human rights, and others. What we understand from these documents is that doctrines

in modern science are not allowed. This suggests that we really have the freedom to carry out research in all possible fields unconstrained by doctrines. It assumes that we have the right to expect that the results of these studies will be evaluated not from the point of view of some doctrine (without doctrines!), but from the point of view of the Scientific Method, of which the experiment is an emanation.

But on the other side stands the two and a half century jubilee doctrine [5] "we will no longer accept or deal with proposals concerning perpetual motion". In its modern form, it precisely represents a ban on conducting scientific research in a specific area, a ban on distributing and publishing results, and a ban on examining and issuing patents [6], [7], [8]. In other words, the doctrine represents an institutional censorship of everything that in any way threatens the Well-Established Natural Laws. This is experimentally proven by anyone who dares to deal with the forbidden.

The doctrine is harmful not only because it violates the recommendation of UNESCO and the EU. It is harmful above all because it creates incompetence by elevating the ban on study as scientifically justified. This is a prerequisite for curiosities such as defining the device in Fig. 6 as a perpetual motion machine of the first, second or third order. It does not matter that the electric motor consumes energy instead of producing it. It is the same, for us it is a perpetual motion machine, because we imagine the reactionless motion only in the form of Fig. 2c. We have no chance of understanding that the device is not a perpetual motion machine because the doctrine "we will no longer accept or deal" forbids us to check this. We get the closed circle of a true perpetual motion machine: We know that this (in particular from Fig. 6) is impossible, because it is a perpetual motion machine, and therefore there is no need to check it. And because we do not check it (it is forbidden) we are left with the knowledge that this is impossible, because it is a perpetual motion machine. Then the wheel of this perpetual motion machine turns again. This is the result of the violation of the Scientific Method.

Although the doctrine of prohibition [5] and the "no doctrines" [11] were created in Paris, it is obvious that 28 years of coexistence were not long enough to resolve the contradiction. In essence, this is an identity crisis of Science. This crisis is especially evident in patent organizations that apply scientific doctrines in the field. On the one hand, they declare that the application must meet the criteria: Novelty, Inventive Step and Applicability. On the other hand, they do not grant patents for applications that violate (against) well-established laws of nature [6], [7] and [8]. The question is, if a miracle happens and the application demonstrates applicability on the one hand, and on the other hand, it outwardly appears to violate well-established physical laws, then what is more important, applicability or violation? The Author's experiment [13] provided the answer. The examination of the application was delayed for 10 years in violation of Article 41 of the right to good administration [14] "Every person has the right to have his or her affairs handled impartially, fairly and within a reasonable time by the institutions, bodies, offices and agencies of the Union." Waiting ten years for a patent application to be examined cannot be considered a reasonable period, especially since the application was examined only after two complaints by the Author. If he had not complained, the delay would certainly have lasted longer, perhaps 15 or even 20 years. During this time, the Author was blackmailed by the institution into paying renewal fees for a patent that was never issued, with the argument that if the Author did not pay, the institution would consider that the Author had voluntarily withdrawn his application. Of course, the undue fees paid for renewing non-existent patent rights were not refunded. In this way, the Author experimentally proved that the doctrine [5] "we will no longer accept or deal" is more important than "no doctrines" from [11] and [12]. If you think the Author is offended, this is not so. In fact, the Author is happy that he was not thrown into prison like that man from the documentary [15] (please watch after 120 minutes). Many more such stories can be cited. For example, here is a remarkable sentence at the end of the first column of page 24 of [16]: "A Bulgarian physicist, glorifying the torsion generator in his media appearances, stated that through it energy is obtained from "nothing" (an anti-scientific and scandalous statement), for which he was fired from the Bulgarian Academy of Sciences". We do not know the name of the physicist because it should be forgotten, we only know that he was fired from the Bulgarian Academy of Sciences.

We do not forget for a moment that all this is done in the name of Science. All experiments confirm the following picture of doctrinal interaction (Fig. 13): First, the old but obviously senior doctrine "no longer accept or deal with proposals concerning perpetual motion" outlines the permitted perimeter of activity. Then, within this permitted perimeter, Academic Freedom, the Scientific Method and human rights are placed. No one will hear the complaints of the Author, the imprisoned, the dismissed, because they have dealt with things outside the outlined perimeter. We do not know whether the Well-Established Physical Laws can be violated, but we know for sure that human laws are violated there! And when human laws are violated, the discussion about the violation of physical laws is meaningless and counterproductive.

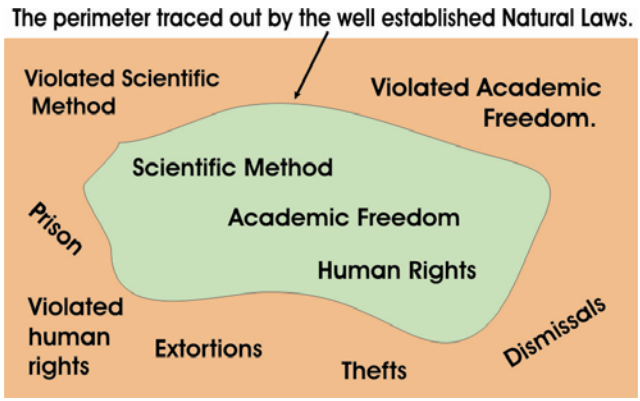

Fig.13 Well-established division of physical space by human science at the beginning of the 21st century.

4.3 The Fundamental Question of Philosophy.

It is obvious that this matter directly concerns the Fundamental Question of Philosophy: What are we humans, where do we come from, where are we going, what is the meaning of life, what is our role in the universe? The great Confucius said that human experience is like a lantern that we carry hanging on our back, which illuminates the path we have traveled. It is possible that the illuminated path tells us where we came from. But ahead is darkness, which thickens even more when using the Scientific Method to study the forbidden space of Fig. 13 is a punishable act. Then we understand for sure that we are not going far, because we remain within the permitted perimeter for a long time.

Let us assume that a human colony on the Moon with a capacity of 1000 people has already been built. If we assume that the members of the colony have one-year contracts, this means that 1000 people must be transported from Earth to the Moon and back every year. Add the vehicle crews, supervisors, VIPs, patients, extra technicians, scientists, and other visitors, and we assume that about 2,000 people, not including tourists, must be transported each year. We must also add cargo of food, medicine, supplies, equipment, and more, even if the colony produces its own oxygen, water, energy, and some of its own food. Two or more rockets with the capacity to carry 10 people or the equivalent cargo would have to be launched from Earth every day. It would be even more difficult to sustain a colony of 1,000 people on Mars, because the two planets are on the same side of the Sun approximately once every two years. Imagine the rocket launches, the wasted materials, the fuel, the environmental pollution. The whole system convinces us that we are moving forward, but think about where we should have been in 2001 (Arthur Clarke, “2001 Odyssey”), and where we are now in 2025. It is obvious that with an A-A exchanger, humanity can hardly secure a role even on the nearest celestial body, let alone the Universe. We need something fundamentally new, a propulsion machine.

On the other hand, it is very likely that there is a great sense in the fact that Humanity is not going anywhere, in any case not going far. Probably no one or nothing will allow a civilization that has not solved its problems here on Earth to have a role outside of Earth, because this civilization will simply transfer its problems and conflicts to the large scale of the Universe. Therefore, if there is something like this to be done, it should be done here on Earth. If this is the idea, then the senior doctrine “...we will no longer accept or deal...” has been doing its job well for 250 years. Human civilization officially denies the doctrines but does not want to notice that it actually bows down to them. This predetermines the existence of the Earth as a production laboratory for human souls, whose task is to orient themselves. For this purpose, the Earth is very well provided with resources to ensure the growth and testing of many billions more human souls. There are still many resources to create, there are still many resources to destroy and there are resources for many more wars.

If the role of Humanity in the Universe was important at any cost, then this role would have been given to us, just as the role of the Earth was given to us. But it is obvious that the role in the Universe must be earned. It turns out that it is not at all important whether people will leave the perimeter of Fig. 13, or will remain there for a long time, or forever. It is not at all important whether someone will repeat the experiment of Fig. 6 now, in a hundred years or never. For the Universe, the progress of people is not important, because it has long known what is possible in physical space, and what is not. Progress is important for people. Therefore, the paradox that it is precisely people who stop progress comes to the fore. It turns out that it is precisely the solution of such problems that is most important, and not the progress itself. It is not even the mandatory

solution that is important, but the test for solving it that is important. If people have not solved this (and other) tests, it is better for them to remain within the perimeter of Fig. 13 for a long time, because acquiring new physical capabilities with unsolved problems will be dangerous.

When we don't deal with "this" we live well because we know that "this" is impossible. But if we dare to deal with the forbidden, we see how people, experts, institutions react. These are experimental data that no one can dispute. They help us understand a lot. If we use the Scientific Method in the forbidden zone we have the chance to guess something that is fundamentally simple (Fig. 6), because it is created with the resources of Classical Mechanics. Fundamentally simple has enormous potential for development, because it is a new foundation. We begin to understand why this should be forbidden. We begin to understand that we do not prohibit something that is impossible, but only something that is possible. Other things begin to happen. These are also experimental data. By examining experimental data from various sources, we can come closest to answering the Fundamental Question of Philosophy: What are we humans, where do we come from, where are we going, what is our meaning and role in the Universe?

4.4 Good and Values.

It is obvious that no matter how much we explain that the Scientific Method, Academic Freedom and Human Rights should not be violated, because this goes back to the time of Copernicus, Giordano Bruno and Galileo, the arguments bounce off the shield of “we do not deal with this because we are on the side of Good”. It is obvious that it is not about science and experiments, but about some Good. We need the philosophical basis of the paradigm from “Prosperity and Privilege” [17] which explains the phenomenon of Good as a counterpoint to Values.

The paradigm defines interaction as “Deprivation of Values for the Good of People”. The formulation may seem unusual, but it contains within itself the energy of unity and struggle of the negative of Deprivation and the positive of Good. Deprivation of Values that is not justified by Good is a Crime and is punishable. Deprivation of Values that is justified by Good is encouraged and rewarded. The main role of this Good is to justify Deprivation of Values. How great a Good is depends on what Deprivation of Values it can justify. For example, the violation of the Scientific Principle, Academic Freedom, imprisonment, dismissals, etc. are justified by the great Good of preserving the Well-Established Physical Laws intact. If these Laws are allowed to be violated, physical chaos will ensue, the Sun will go out, the planets will fall out of their orbits. The positive of saving the world from violating Physical Laws justifies the negative of violating Human Laws. This is Deprivation of Values for the Good of People.

War is an extreme form of practicing Deprivation of Values for the Good of People. On both sides of the front line, people armed with the same weapons, wearing the same uniforms, speaking the same language, brothers and sisters, may be fighting. The only thing that separates these people is their idea of Good. Some say: “this is Good”. Others say: “not this, that is Good”. For example, some believe that it is Good if “we will no longer accept or deal with proposals concerning perpetual motion”, because we know that this is impossible. Others believe that we cannot know whether this is impossible if we do not deal with it. The war for Good is a destroyer of Values. The side that offers more Values for destruction wins. The winning side imposes its idea of Good.

The work of studying the mechanisms of the functioning of the Laws of Conservation is Evil because it can lead to their violation. The Good is to prohibit work, because this protects the Laws from violation. When we read formulations like [6] “... in a manner clearly contrary to well-established physical laws...” we are left with the conviction that well-established physical laws can indeed be violated. But here we fail to understand that people have never Created physical laws in order to claim that they are well or badly established. Nature Created these physical laws, not people, therefore they are a constant quantity. People have always Created and established their idea of physical laws, through belief or experiment. It is this idea that is well or badly established by people. In [6] they are wrong in replacing physical laws with the idea of them. It seems that no one suggests that the well-established understanding of these physical laws can be changed or violated, because they consider the laws and the idea to be completely identical. In vain is the historical experience (the lantern on the back that illuminates the path traveled) which shows us that the Church protected the arrangement of the celestial bodies from the Evil of their physical displacement, and in fact it protected from violation the Good of its idea of this arrangement. Copernicus, Galileo could not objectively (physically) displace heavenly bodies, not even the omnipotent Church could. Copernicus, Galileo violated the well-established subjective opinion of people (the institution), and therefore the reaction came from people, not from God. Similarly, the modern

Good is in our idea of physical laws, and therefore only the Good of the subjectivity of this idea can be violated, and not the objectivity of physical laws.

But whether the Good is to preserve from violation the well-established physical laws themselves, or the Good is to preserve from violation our well-established understandings of these physical laws, in both cases there is a big problem here! The big problem is that this Good does not Create Values, no matter how great it is. Yes, the Good takes Values to lay on its altar to prove how important it is, and how without it there will be darkness. But it does not Create Values. If we look back again, we will see that the burning of Giordano Bruno and a hundred of his associates, the burning of books, the imprisonment of Galileo, the terror did not Create any Values. The Terror only confirmed how great the Good of the geocentric system is. In contrast, the forbidden dealing with the heliocentric system Created Values that it offered for destruction in the war for the Good. It turned out that these Values cannot be destroyed. The Great Good that has Taken away instead of Creating has gradually become lighter, faded and disappeared. Only the memory of the repressions remains.

The well-established doctrine: “We will no longer accept or deal with proposals concerning perpetual motion”, also does not Create Values but only Takes away. It is sad that in the 21st century someone can think that Values are Created without us dealing with it. Values are Created with work and not with prohibitions and punishments. The only thing that not doing this creates is a false sense of competence. The well-established doctrine has already Taken away and destroyed many Values, in the name of the great Good. This only confirms once again that nothing will stop us from preserving the Well-Established Physical Laws from violation. But sooner or later the dynamics of dealing with the forbidden will Create Values that cannot be ignored, because they cannot be destroyed. Gradually, under the pressure of Created Values, the great Good will lighten, fade and disappear. Only the lesson of the terror that this Good justified will remain.

Of course, we need Good because it unites us, warms our souls and fills us with the conviction that we are on the right side of history. Therefore, the place of the dethroned Good will not remain vacant for long. Historical experience shows that replacing the existing doctrine of Good with its antipode is a slow and painful process in which several generations participate. Probably, the next generation will take a more neutral position regarding Good and Values. Only the third generation will choose the Value of the Created instead of the Good of the Taken.

5 Conclusion.

The eternal dilemma of people is to choose between the Value of the Good and the Good of Values.

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