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Analysis of the Orbitation and Rotation of Celestial Bodies

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Abstract

We have developed a structure of dynamic knowledge for non-inertial systems, the so-called Theory of Dynamic Interactions (TDI) as a part of non-inertial dynamic knowledge, which incorporates a causal demonstration of phenomena accelerated by rotation, which would complement Classical Mechanics. We believe that the TDI mathematical model that we propose is of great conceptual importance. In addition, we think that it is not only necessary to understand the dynamics of rotating bodies, but also to understand the dynamics of the cosmos, with bodies that orbit and with constantly recurring movements, which make possible systems that have been in dynamic equilibrium for centuries and are not in a process of unlimited expansion. We even believe that this new dynamic theory allows us a better understanding of our universe, and the matter from which it is made.

Keywords

Rotational Dynamics, Dynamic Interactions, Accelerated by Rotation, Dynamics of Rotating, Dynamics of the Cosmos, Dynamic Equilibrium, Secular Dynamic Equilibrium, Behavior of Rotating Bodies, Moments

1. Introduction

More than 40 years ago, I intuited the aporia of orbit and rotation that we can observe in the universe, proposing that every celestial body that orbits also has intrinsic rotation.

Starting from this initial intuition, we have built a structure of dynamic knowledge for non-inertial systems, which incorporates a causal demonstration of phenomena accelerated by rotation, without any known refutation or antithesis to our arguments ever since.

We have developed the so-called Theory of Dynamic Interactions (TDI) as a structure of non-inertial dynamic knowledge, which would complement Classical Mechanics.

We understand that this theory provides a clear and satisfactory explanation of the rotational phenomena of bodies with axial symmetry, which allows us to overcome a translational image of the environment. It transports us to the reality of a universe in rotation, modifying our perceptions, conceptualizations, and evaluations of our context, and how nature should be perceived and interpreted in physics.

In our opinion, the application of laws of dynamic interaction to the phenomena that occur in nature with rigid solid bodies endowed with angular momentum will facilitate the understanding of these phenomena and the inference of new systems and artifices that use these laws.

Simultaneously, it will enhance people's understanding of the physical laws of a universe that is rotating but remains in constant dynamic equilibrium and transfer these hypotheses to other areas of knowledge [1] (Section 6.11, Laws of Rotational Dynamics).

Along with the aporia of orbit and rotation, the observation of the universe generated other new doubts: its secular dynamic equilibrium did not seem to be reconciled with Newtonian physics in which forces generate constantly accelerated translational movements. The balance of the universe, and its dynamics, did not seem to be consistent with the conceptual structure of Classical Mechanics [1] (Section 0.1, Aporia).

Newton's universal law of gravitation should generate wavy orbits, depending on the positions of the other celestial bodies. For example, the Moon should have an oscillating orbit, depending on whether the Earth is in conjunction with the Sun. This circumstance was neither considered by Newton nor Einstein; they did not value the intrinsic rotation of the Earth in its orbit or that of the celestial bodies.

It was also observed that the rotation rate of galaxies was uniform and independent of their distance from the center of spin, which disagrees with the Newtonian theory and general relativity stating the rate of rotation should decrease with distance. This is how modified Newtonian dynamics (MOND) was born.

In our opinion, it is not a matter of modifying Newtonian law but of replacing it altogether with a more reliable and coherent formulation describing the true behavior of nature (considering intrinsic rotation) and the true discriminant coupling of speeds.

Any observer can notice how systems in the universe are in motion, in constant dynamic equilibrium. In the real observable universe, the general dynamic behavior of rigid bodies is characterized by their dynamic equilibrium. Through time, it is confirmed how the orbiting coexists with the intrinsic rotation.

We are convinced that it is possible to find new fields of investigation in the new rotational dynamics of non-inertial systems.

Our theory also allows us to respond to the initial aporia, establish and understand the physical and mathematical correlation between an orbit and intrinsic rotation, and the rational cause of the existence of days and nights on Earth, since in our theory, there is a clear correlation between the intrinsic rotation of the Earth and its trajectory in its orbit.

In short, we propose a rational structure for rotational mechanics, which enables us to develop a mathematical model that adequately justifies the dynamic equilibrium of the cosmos.

We affirm that the mathematical model that we propose is of great conceptual importance. Furthermore, we think it is necessary to not only understand the dynamics of rotating bodies but also of the cosmos (with bodies that rotate and orbit, and have constantly recurring movements), which makes it possible for systems that have been in dynamic equilibrium for centuries and are not in an unlimited expansion process to exist [1] (Section 5.0.0, New Concept).

For all the above reasons, we have defined this concept as follows: Dynamic equilibrium: State reached by bodies endowed with angular momentum, when they are subjected to a constant external and non-coaxial torque, generating a recurring movement. If the initial axis of rotation coincides with an axis of symmetry of the body, the first external torque may be instantaneous, and not necessarily constant, maintaining rotation around this principal axis of inertia indefinitely due to rotational inertia [1] (Section 5.0.0, New Concept).

Second, the non-coaxial pair generates orbital motion with a constant translational speed that is precisely the same as that previously provided by the body. In this way, the dynamic equilibrium of the observed universe can be rationally justified.

In our opinion, the interaction generated by successive non-coaxial pairs allows for a dynamic equilibrium of the bodies, which is in an apparent contradiction with the classical laws of mechanics, at least, as they have been formulated up to now. In addition, we can propose that, in certain cases, the following dynamic hypotheses may occur:

The action of two successive couples (not coincident) on a solid displacement of the axis of the body in the second couple direction and is perpendicular to its force F instead of the direction of the force F.

The constant action of the second pair produces a constant precession speed, instead of constant acceleration, as it would happen in a body without dynamic interactions [1] (Section 0.1, Aporia).

Additionally, in bodies endowed with rotation, it should be considered that the inertial dynamic interactions and the resulting behavior are not equivalent to those endowed exclusively with linear momentum.

Finally, it should be added that the dynamic interaction is a sufficient cause for the dynamic equilibrium of a body in orbit, endowed with its rotation, without, in our opinion, the central force being a requirement for this recurring movement [2].

We are convinced that it is possible to find new research fields in a new rotational dynamic of non-inertial systems. We observe how the systems in the universe are in motion, but simultaneously in constant dynamic equilibrium. In the real universe, the general dynamic behavior of rigid bodies is characterized by such dynamic equilibrium.

Over time, the orbit coexists with intrinsic rotation. In the physical-mathematical model of the universe, determined according to the TDI, a couple of forces, with a zero resultant, will generate, as long as the couple acts, a movement in constant orbit, in a closed trajectory [1].

$$\vec{v} = \vec{\vec{\Psi}}\vec{V}_0 = \begin{pmatrix} \cos M't/I\omega & -\sin M't/I\omega & 0 \\ \sin M't/I\omega & \cos M't/I\omega & 0 \\ 0 & 0 & 1 \end{pmatrix}\vec{V}_0$$

where:

M' = Second torque applied;

T = Time;

I = Moment of inertia;

ω = Initial angular velocity;

Equation of motion (Equation (1)).

The difference between these reasonings is substantial, and the interpretation through the TDI is consistent with observational evidence.

2. Equations of Motion in Rotational Dynamics

This hypothesis, the equation of movement will be determined by the translational speed of the body's center of mass, which has not changed in magnitude; therefore, it will be equal to the initial translational speed of the body subjected to spatial rotation (Equation (1)).

The coupling without discrimination proposed in our hypotheses must be identified as a spatial rotation of the translational velocity vector [1], resulting in the equation of motion 1.

As can be seen, the TDI proposes a specific physical-mathematical model for the movement of bodies that rotate on an axis and simultaneously move in space. The importance of this mathematical model is evident, in which the protagonists are not only the forces but also pairs of forces that, as long as they remain constant, will generate orbital and constantly recurring movements, generating a system that is in dynamic equilibrium, and not in unlimited expansion [2].

3. Comments

We have also confirmed that the accepted Newton-Euler equations determine an erroneous trajectory [3], which does not coincide with the one we could observe in nature (**Figure 1**). Thus, we deduced a formulation for bodies with intrinsic translational and rotational motions when they are subjected to new non-coaxial couples with that rotation (Equation (1)).

At the beginning of our project, we concluded that there could be a nomological, physical-mathematical correlation between the simultaneous rotation and the orbital movements that we observe in celestial bodies.

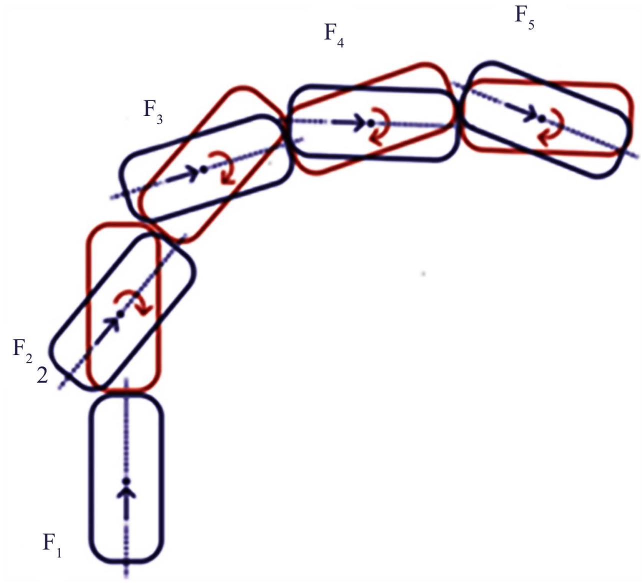

Figure 1. Trajectory of a body endowed with translation speed and intrinsic rotation about its main axis of inertia when it is subjected to a new non-coaxial moment with the intrinsic rotation [4].

In our studies, it was confirmed that we can observe how there are simultaneous movements of intrinsic rotation and orbits in nature; however, until now, there has been no physical or mathematical model that would establish a scientific correlation between both movements.

The TDI allows us to justify this constant coincidence between the orbit and intrinsic rotation, and develops a specific dynamic for rotating bodies, subjected to successive non-coaxial pairs, in which the sequence of action of the forces is decisive, and their behavior does not exactly coincide with the laws of Classical Mechanics [4].

For determining the physical-mathematical model deduced in our research search, we interpreted the concept of dynamic coupling differently, starting with new criteria concerning the combination or superposition of the movements originated by the acting forces or couples.

Our dynamic hypothesis is that the velocity field of the initial rotation remains constant, rather, the translational velocity field is coupled with the translational velocity field generated by the second, non-coaxial rotation.

In this way, the body changes trajectory, describing a new orbit, if the external action remains constant.

The theory that we propose concludes that for this case, the mobile will change its trajectory, as shown in **Figure 1**.

As shown in **Figure 1** and **Figure 2**, we can assume a body with a rectilinear trajectory, endowed with translational speed and intrinsic rotation about its main axis of inertia, which is subjected to a new non-coaxial moment with intrinsic rotation; for example, a buoyancy/weight couple, contained in the plane of the drawing, in our submarine experiment.

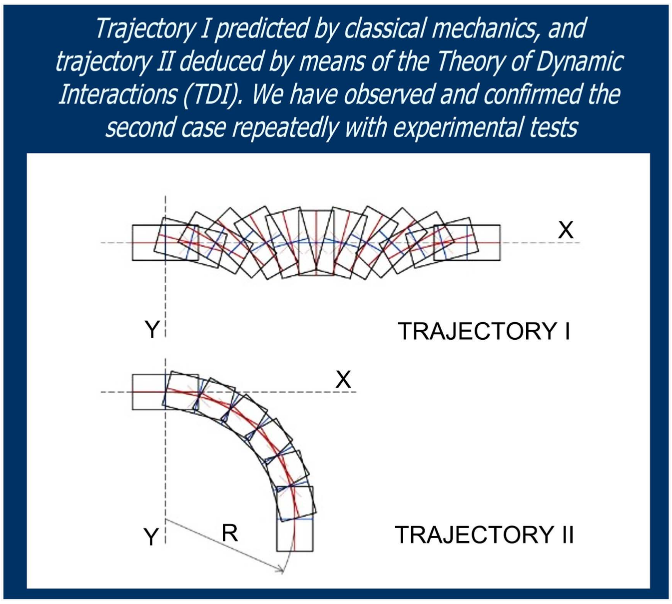

Figure 2. Comparison of trajectories.

In this case, the anisotropic velocity field, which is generated by this buoyancy/weight pair, forces the mobile to rotate on a vertical axis that is perpendicular to the acting external pair (**Figure 1**). In red is the displaced mobile (but with the previous orientation) and in blue is the new orientation of the mobile due to the dynamic coupling that occurs. The result is the coupling of both fields (translational and anisotropic) and, consequently, the change in the trajectory of the mobile, describing an orbit, if its initial speed was constant. This orbit will be closed if the external torque remains constant in time.

Figure 3 shows the prototype initially used in the experimental tests. Later other mobile prototypes were used.

We have thus expressed, in a summarized way, the dynamic theory that we have deduced [1] (Section 1.2, Introduction to Theory).

Based on the principle of conservation of momentum, we can infer that the field of inertial reactions generated in rotating space, by a new non-coaxial moment, on a moving body with a rotational movement ω and an inertial moment I on the axis of that rotation (therefore, with angular momentum), will force the moving body to acquire a precession rate Ω.

Figure 4 justifies the concept of precession.

This precession rate (Ω) can be observed simultaneously with initial ω, which remains constant inside the body. In addition, as a discriminating assumption, in the case of the translational movement of the body, we propose the dynamic hypothesis of this field coupling of translational speeds, with the anisotropic field of inertial speeds caused by the second non-coaxial moment, obtaining an orbit, which is simultaneous to the intrinsic rotation of the moving body. This new orbital movement, generated by a non-coaxial moment, is defined by the rotation of the velocity vector, keeping the latter constant in the module.

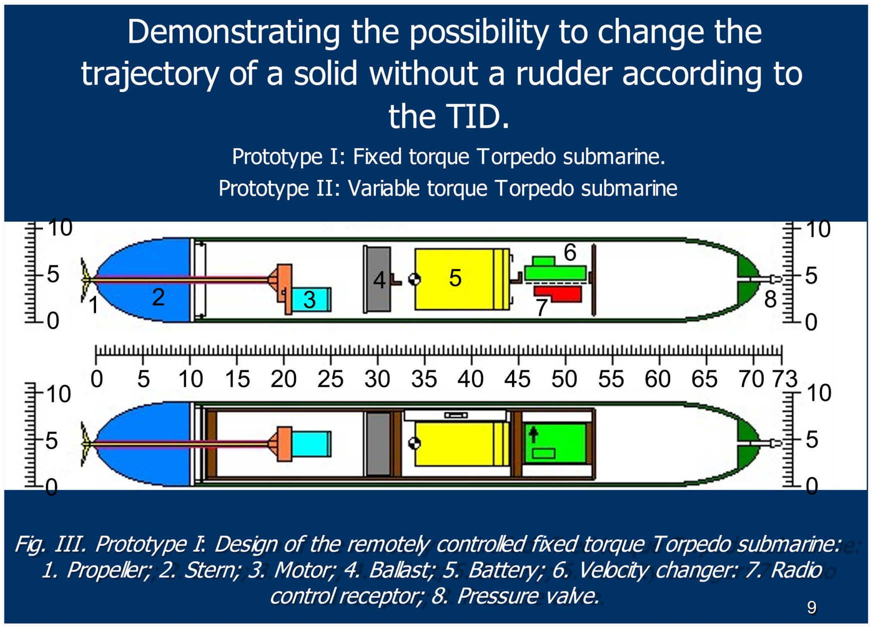

Figure 3. Experimental prototypes.

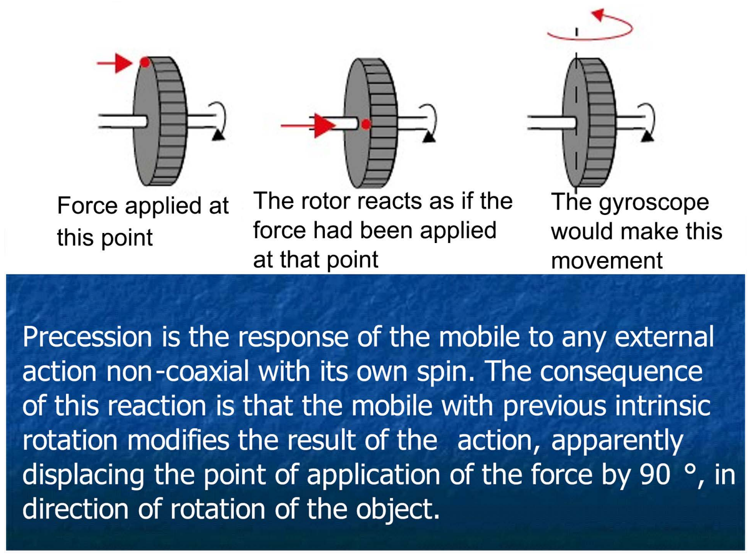

Figure 4. Justification of the precession.

Consequently, the dynamic effects can be associated with velocity, thus highlighting the clear mathematical correlation between rotation and translation. This mathematical correlation allows us to identify a physical relationship between the transfer of rotational kinetic energy to translational kinetic energy and vice-versa.

In these new non-inertial rotational dynamics based on the TDI, we have developed laws and corollaries that allow us an unknown number of new technological applications [4].

For all these reasons, we understood the need to reiterate the empirical verifications to confirm or rectify the results obtained from our dynamic hypotheses, and to confirm a new theory, which would resolve the phenomena of rotational dynamics.

The experimental tests carried out are easily reproducible per the scientific method. Advanced Dynamics has called three successive contests for the possible refutation or antithesis of the proposed theory without obtaining a response. The last call for a possible antithesis to our proposal ended on June 15, 2019. Presentation videos of the TDI can be found here:

http://www.youtube.com/watch?v=k177OuTj3Gg&feature=related;

https://youtu.be/keFgx5hW7ig.

The TDI justifies the behavior of rotating bodies and makes it possible to easily understand their effects, such as the interactions resulting from the spin of the top, the behavior of the radial saw or other rotating solids, such as the boomerang, the stone that is thrown spinning and bounces on water, balls with effects or the ratio of the striped soul of cannons, to provide angular momentum to the projectiles.

The main objective of our research aimed to develop a dynamic and kinematic analysis of rigid solid bodies with angular momentum (which allows us to establish the reasons for their behavior) and briefly formulate a proposal for new hypotheses in rotational dynamics.

In our experimental line and logical argumentation, we study the concept of rotation not only in Classical Mechanics but also, in the studies of Einstein and the modern theories of relativity. At the end of this analysis, we conclude that it is possible to propose new specific hypotheses for the intrinsic rotational motions of bodies. For this, we reinterpreted, at a certain moment of the logical argument, the exact dynamic justification of the spatial behavior of bodies with angular momentum.

In our opinion, there is some evidence in nature that allows us to propose hypotheses that have not been raised in Classical Mechanics. There are some clues indicating that the classical model of rotational dynamics for rigid solid bodies has not evolved, whereas the physics of the 20th century has changed substantially.

Our goal was to precisely define these new hypotheses and develop new experimental tests to corroborate them, aiming to enunciate the idealized behavioral laws, and establish a mathematical model that allows us to develop a computer-assisted simulation. Finally, based on theoretical abstractions, we understand that it is possible to conceive practical applications and develop a new specific piece of technology [5].

In our publications, we make repeated references to these possible new technological applications based on the TDI.

In addition to positive tests with moving bodies, computer simulations of our hypotheses have been carried out.

Figure 5 shows the resulting simulation, with the TDI assumptions, for the boomerang flight.

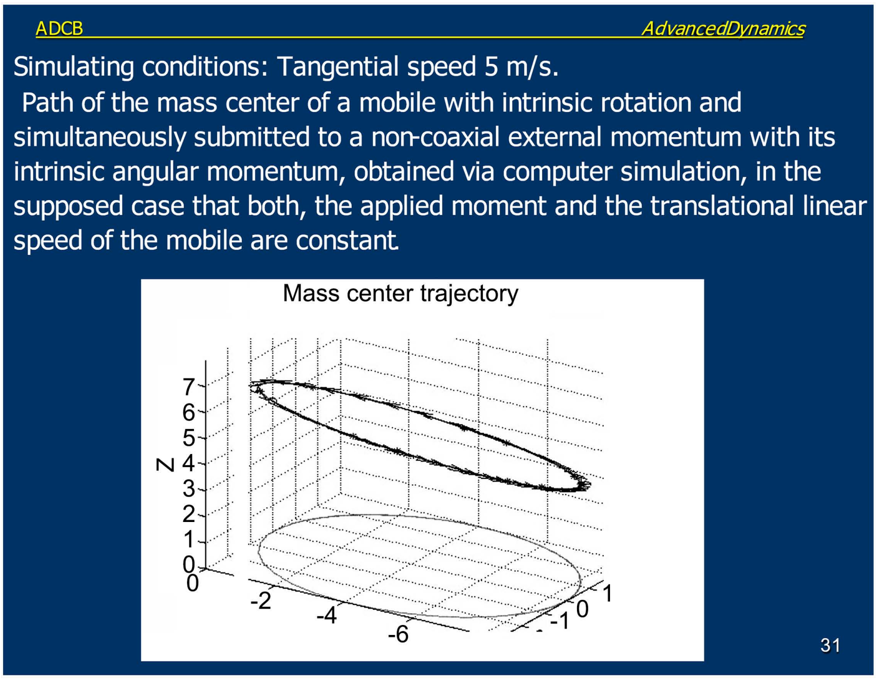

Figure 5. Description of the trajectory according to the TDI.

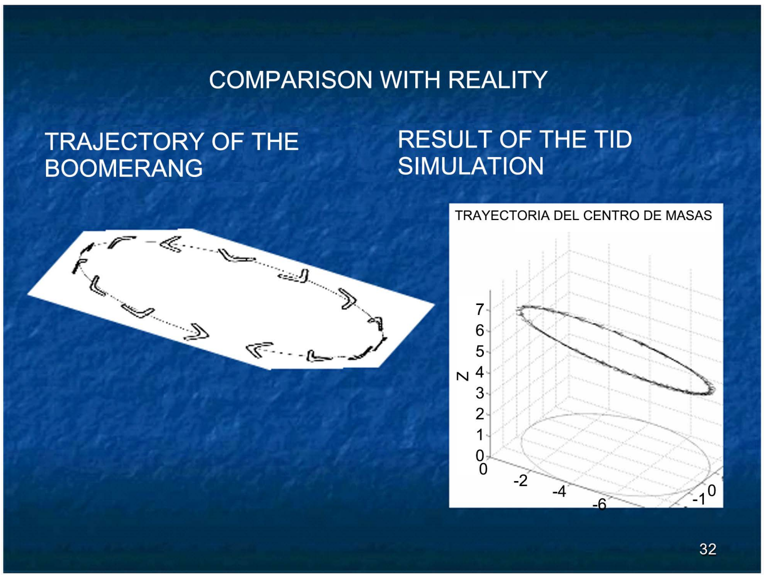

Figure 6. Comparison of trajectories.

4. Final Summary

The mechanical model established by Newton's Universal Law of Gravity must be considered an approximate model, even though it has lasted for centuries in our scientific paradigm.

TDI hypotheses, which are based on the coupling of translational speed fields at each point of the moving object, even if these fields are caused by translational movements or generated by external actions, which could create non-coaxial rotations, with a possible pre-existing intrinsic rotation.

We believe that our proposals and these results suggest new horizons for rotational dynamics and new keys to understanding the harmony of the universe. The universe is constituted not only by forces but also their movements, constantly acting on rotating rigid bodies with constant translational speed, that result in a closed orbit. Therefore, it is a system in motion, although it is also in a constant state of dynamic equilibrium.

Is this not precisely the balance of the cosmos and the behavior of celestial mechanics that we observe?

The orbital movements that we observe in celestial bodies are the result of a dynamic coupling that is not foreseen in Classical Mechanics, as expressed in the TDI, giving a secular dynamic equilibrium.

Consequently, we believe that the TID mathematical model that we propose is of great conceptual importance. Additionally, we think that it is not only necessary to understand the dynamics of rotating bodies but also of the cosmos, with bodies that orbit and have constantly recurring movements, which make it possible for systems that have been in dynamic equilibrium for centuries and are not in a process of unlimited expansion to exist. We even believe that this new dynamic theory enhances our understanding of our universe and the matter from which it is made.

More information can be obtained from the following websites:

http://advanceddynamics.net/en/;

https://dinamicafundacion.com/.

Figure 6 compares the flight path of a boomerang, with the simulation obtained on the computer, with our dynamic hypotheses.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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