# Almost a Flying Saucer

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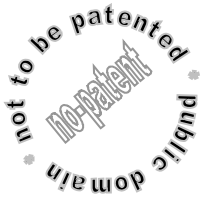


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**ABSTRACT**

One of the most fascinating subjects on our way to the understanding of the laws of the Universe is the almost delirious search for the ability to levitate (ourselves and objects), which in modern times also became associated with some *anti-gravity* purported effects, fantastic space ships, as well as with what is commonly known as *flying saucers*. A significant number of proposals for achieving such abilities claimed as *anti-gravity* are focused on the *gyroscopic effect* observed when a fly wheel is suddenly forced to move out of its initial plane of rotation [1]. The law of Physics for the conservation of angular momentum results here in the appearance of what some explain as 'apparent' forces, which give the observer the illusion that it is close to achieving the goal of building an *anti-gravity* device. This article deals with some of the thoughts usually behind such claims, proposals and experiments, and has the intention of contributing to a better understanding of the mechanical effects involved in these gyroscope based devices.

## 1. Introduction

A simple search on the Internet will result in thousands of documents found about *anti-gravity*. Among articles of opinion, purported discoveries, claims of new devices and even the promotion of personalities (as well as conspiracy theories, some probably true, some not), there is however something we consider an extraordinary symptom: finally the possibility of researching, discussing, producing experiments and publication of ideas is spreading globally, and being made available to people in general. Even if not all those people are able to manipulate the mathematics of the phenomena, at least some of them do and many of them reveal very interesting levels of intuition and imagination. It is, in our opinion, the beginning of the liberation of the creative mind from the old *schools of thought*, since, at a certain level, those schools frequently act more as an obstruction to new ideas than to bring them to light. There is, however, in this apparently chaotic system named the Internet, a large amount of information which is fake, exaggerated, incorrect, or simply deliberately wrong or destructive, therefore not deserving credibility. In a certain sense that is also understandable, since even in schools and research institutions it is sometimes difficult not to question credibility, mainly when it comes to a subject where logic is still surrounded by the cloud of fantasy and imagination. It is not surprising, therefore, that some sort of hallucination will emerge and even affect people in such a space when touching on such matters. Adding to this a certain love affair with illusionism frequently found in certain minds, we may definitely state that hallucination is going global in the Internet. And the subject of *anti-gravity* is of the most preferred ones, due, of course, to the fact it is on the edge of current knowledge; it is associated with the fascinating stories of flying saucers of the 60s; it deals with the unknown, etc. Although we are also human, we will try to be as wise as possible in commenting about this matter in the next sections. This article is as an introductory text about the idea

of building an *anti-gravity* craft.

## 2. What is *anti-gravity*?

In effect no one knows what *gravity* is, so, anyone who will talk about *anti-gravity* can only be talking in an abstract sense. What certain people already know and understand is the *effect of gravity*: a strange *acceleration* which is produced in objects at a distance and resembles an attraction field coming from who knows where. That is, we are currently able to measure gravity, but we don't yet know where it is coming from, its origins. Contrary to what happens with the electromagnetic field, which we already know is a result from the movement of charged particles, both *gravity* and *magnetism* are still a mystery for the physicists.

The term *anti-gravity* is also frequently used in an abusive way, since certain people mention it even when other type of phenomena are used to suspend objects above the ground, like jet propulsion, fluid lift effects (*Coandă effect*, etc.), repulsion of magnets, electronic repulsion effects, and so on... So, before knowing what *anti-gravity* is it is important to recognise what *anti-gravity* definitely is not.

Since the gravity effect is a *vectorial* quantity, an acceleration, it seem to us reasonable to expect an anti-gravity device to be based on some kind of vectorial principle or phenomenon, and not on a simple transfer of power (energy) which in effect represents a *scalar* quantity. This means that we are at least convinced that anti-gravity may only be achieved by creating a *vectorial* field that can be made opposite to the field of gravity, therefore it must come from some *vectorial* principle. Could magnetism, for example, play an effective role on creating such effect? The discussion could be extended, but it is not the subject of this article. What is important here is to recognise that since long ago people were curiously looking at the *gyroscopic effect* as an excellent candidate for letting us achieve anti-gravity, a *deus-ex-machina* concept which frequently we suspect mankind is not yet prepared for. Even so, the bet seems to follow a good path: the *gyroscopic effect* is a *vectorial* effect and not a *scalar* one. It is not derived from the *principle of conservation of energy*, but from another extremely important principle of Physics: the *principle of conservation of angular momentum*. This is very interesting because *high momenta* are associated with the rotation of *high masses*, what seems a little compliment to the notion "*the heavier the lighter*", as we imagine it to be true in a real *anti-gravity* phenomenon. We hope such a discussion will be addressed in future articles; at this point, however, we will focus the attention on what is commonly called the *gyroscopic effect*.

## 3. The *gyroscopic effect*

This is the effect responsible for maintaining the equilibrium of the toy called *top*, or *spinning top,* while it spins. It is, therefore, an effect produced by rotation, which tends to react against the expectable effect of the gravity in order to maintain the system rotating in its initial axis of rotation. It could also be imagined as a sort of syndrome: *I am rotating around this axis, please do not disturb because I will react if you do*. In true, the effect is not even dependent on gravity, it is simply against change, a pure conservation of momentum, but the *top* spinning under gravity is an excellent example to explain and understand it.

The *conservation of angular momentum*, which in truth is a particular case of the more general *principle of conservation of momentum*, may be stated as follows: *a system will react in a way that it will conserve its angular momentum*. From this, we may already expect that a *reaction* will occur if we try to *force* the system into a different situation of *angular momentum*. Let us now inspect the *spinning top* represented in the next figure and try to understand why it does not fall while rotating:

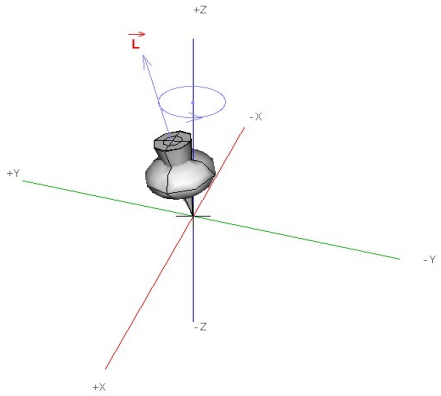


**Fig. 1** Spinning top basic movements: *spin* and *precession*.

The top spins around its axis of symmetry, and

this instantaneously creates an *angular momentum* denoted by the vector $\boldsymbol{L}$ on figure 1. $\boldsymbol{L} = I\,\boldsymbol{\omega}$, where $I$ is the distribution of *mass* seen by the axis of rotation, and called *moment of inertia*, and $\boldsymbol{\omega}$ is the angular velocity. On this system, the forces of gravity are also applied, which tend to pull the top down into the -*Z* direction. Since the total $\boldsymbol{L}$ must be conserved, the spinning top reacts by producing a torque around its fixed point (origin of coordinates) in order to try to "elevate back" its mass. This torque then induces a movement of *precession* around the axis defined by the lines of force of the gravitational field (same as *Z* axis). This is known as the *gyroscopic effect*. The angular speed of *precession* is a measure of the intensity of the gravity. In the absence of gravity, *precession* would not exist, since it wouldn't be needed for anything. So, instead of falling, the top answers with a movement perpendicular to the direction of falling, as if trying to get away from that perturbation in order to avoid it. But, as the perturbation also persecutes it, the top repeats this behaviour, therefore resulting in drawing an orbit around the perturbation axis. The idea seems to be: "*in order to avoid being captured, I run away into an orbit around that which wants to capture me*".

But there are other interesting conclusions one can get from this example; for instance, one may notice that the "force" "generated" to conserve the angular momentum is of the same order of the force of the perturbation. So, the bigger the mass of the spinning top the bigger this "force". It is therefore amazing to realize that by simply spinning a mass of 1000 Kg, for example, one is able to generate "forces" of the order of 1000 Kgf, which react "against" gravity. In effect, this phenomenon can turn out to be something huge.

To better understand why some people went on to believe they had discovered *anti-gravity* based on this effect, let us exchange the *spinning top* for a horizontal *spinning wheel* mounted onto a vertical axis, as represented in figure 2. The wheel of mass *M* spins around its symmetry axis with an angular speed $\boldsymbol{\omega}_0$, thus producing an angular momentum $\boldsymbol{L}_0$. Since the wheel is rigidly connected to the central axis (*Z*) we assume that nothing will happen, as the action of the gravity will be perfectly compensated by the reaction of the structural forces suspending the arm of the wheel. That is, in this case there will be no *precession*, since nothing is trying to change the $\boldsymbol{L}_0$ vector.

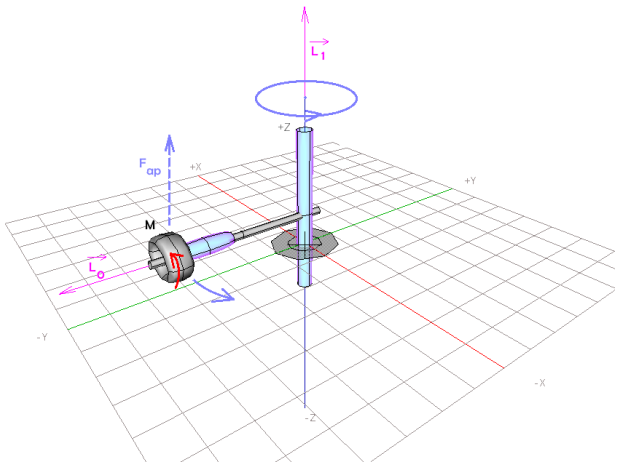


**Fig. 2** A spinning wheel's *spin* and *forced precession*.

The interesting question now is: what about if we decide to *induce* (or *force) precession* into the system? Or, in other words, what will happen if we force the system to rotate around the *Z* axis, and introduce a new angular momentum $\boldsymbol{L}_1$? Not so surprising, an *apparent force* $\boldsymbol{F}_{ap}$ trying to pull up the wheel will be generated, giving the impression of a lift. This is really a strong effect, that anyone can experiment by means of a spinning bicycle wheel, for example, arranged as suggested in the figure. This apparent force $\boldsymbol{F}_{ap}$ is even proportional to both $\boldsymbol{\omega}_0$ and $\boldsymbol{\omega}_1$; thus one could control its strength very easily. And even more: inverting the direction of the rotation around *Z*, one can invert the direction of the apparent force, purportedly making the system heavier.

If we now use several of these rotating wheels connected to the central axis, it is not so difficult to imagine a heavy spacecraft being suspended in the air by this effect, a true *anti-gravitational* effect, and to use the same effect as a method of propulsion. Some of our ancestors of the 20th century have, indeed, observed this behaviour and even followed the same direction of our thoughts. It happened principally after Word War II with the suspicion that German scientists and military forces were already in control of *anti-gravity* devices, which usually resembled a saucer. Soon this belief became popular under the term "*flying-saucer*". One can find a lot of information about this on the Internet, as we said,

but, in our opinion, it is the book "*The Truth About The Wunderwaffe*" (2003), from Igor Witkowsky[1], a well-known Polish journalist specialist in military technology, that may be considered the most detailed and recent historical work about the subject. Here, however, we are mainly interested in the physics of the phenomenon, therefore let us present our own proposal for a personal anti-gravity craft:

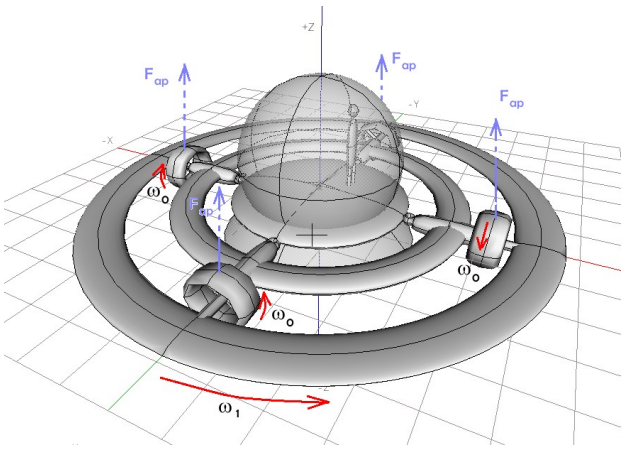


**Fig. 3** A purported anti-gravity craft with four engines driving four heavy spinning wheels, which in turn rotate around a fixed cabinet (our design).

As expected from the previous considerations, each wheel, spinning with angular speed $\boldsymbol{\omega}_0$, would be responsible for generating an apparent force $\boldsymbol{F}_{ap}$ when the circles of the machine would be made to rotate with angular speed $\boldsymbol{\omega}_1$. The overall result would be the summation of all these apparent forces, which would not only simply suspend the craft in the air but also push it up in the opposite direction of the gravity. Manoeuvreing the machine would also be an exceptional experience, since lots of possibilities could be achieved by simply changing each $\boldsymbol{\omega}_0$ and introducing variations on $\boldsymbol{\omega}_1$. The craft would be able to change direction fast, spin, quiet levitate, slowly or quickly change altitude, move horizontally or vertically, fall down like a rock, etc., as it happens in a true *flying-saucer* of our imagination.

## 4. Why don't we drive such a craft yet?

To answer this question we would like to basically suggest two main reasons: first, there was in fact a subtle but dramatic mistake in interpreting the type and direction of the *apparent forces* generated by the *gyroscope effect*. This fact invalidates the possibility of building such a craft. Second, perhaps we are not yet prepared to have such an exceptional system of transportation, since we are still too rude, insisting on developing technology based on "brute force", obviously associated with explosion, noise, chemical transformation, destructive physics; instead of on a technology of delicate interchange with the subtlety of the laws of a vectorial nature. But a third point can also be mentioned: can we really imagine regular people of today having the possibility of buying such a type of "car", something that would project actual two-dimensional human beings into the free usage of three-dimensional space? Knowing how hard it is now to receive so many messages of SPAM in our email accounts, some of them obviously futile and even insulting, please try to extrapolate it to the possibility of anyone driving a "car" above ground to wherever he or she wants, at the time he or she wants, etc. How nasty it would be to wake up relaxed in your home on the fifth floor of a building and to suddenly look out the window and see one of those abusive beings from some enterprise smiling and asking you: "*have you ever thought on creating a new Internet account with us?*". Without a real change in our way of thinking, in our mindset, anti-gravity could easily lead to an unbearable nightmare.

## 5. The true forces of the *gyroscopic effect*

It is obviously time to give an explanation about what in truth happens in the *gyroscopic effect*. We will do it now. If there is no force $\boldsymbol{F}_{ap}$ produced by the spinning wheel of figure 2, what creates such an impression? The next figure (Fig. 4) will almost by itself answer this question. The fact is, as long as we force the system to rotate around the Z axis, two forces, instead of one, appear in the spinning wheel in order to try to compensate our action: a force $\boldsymbol{F}_{int}$ in the upper part of the wheel, and a force $\boldsymbol{F}_{ext}$ in the bottom part of the wheel. These forces have opposite directions and they are always perpendicular to the *Z* axis, that is, the axis of the imposed rotation. $\boldsymbol{F}_{int}$

[1] http://en.wikipedia.org/wiki/Igor_Witkowski

tries to pull the wheel closer to the *Z* axis, while $\boldsymbol{F}_{ext}$ tries to push it away from it. Notice that these forces will be inverted if we invert the direction of the forced rotation. The demoralising truth is: they are absolutely perpendicular to the *Z* axis, therefore their component on this axis is null. This means, no component of acceleration is introduced along the field of gravity, so, no *anti-gravity* effect. We have been so near, and yet so far from reach.

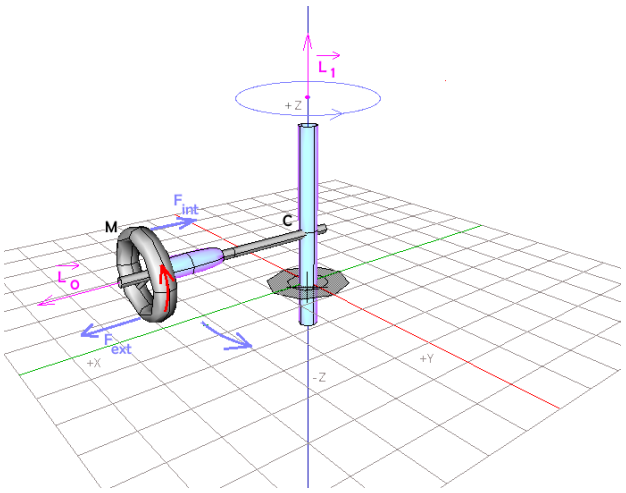


**Fig. 4** The true effect happening in a gyroscope device.

This phenomenon turns out to be due to a torque, not to a single force. Thus, the reaction to our action will be a *rotation*, not an *elevation*. To satisfy the *principle of conservation of angular momentum*, the wheel will try to rotate around the axis defined by our induced movement, but, since it is not allowed to do it because it is rigidly connect to its axis, such a rotation will propagate to the next point that is able to sustain a rotation, that is, the point denoted by "***C***" in figure 4. And this, of course, will give us the impression of an elevation of the wheel.

## 6. Why does it happen like this?

Till now we have talked about principles, but, what is it the real thing behind such behaviour? Are these forces coming from a vacuum? The truth is, they are simply an expression of *inertia*, that is, of the tendency of a mass to "avoid" being "disturbed" from its most relaxed path of movement: the *straight line*. So, in a certain way these forces represent a *complaint*. They are a kind of expression of "pain" exhibited by the mass, if allowed the abuse of such a comparison. Could force fields ultimately be seen as expressions contrary to joy? Could the universe, and even life as we sense it, result from this *pain* extended to the dimension of the universe?… where only *light* seems to be free... We don't know, but the fact is these forces appear because we *forced* the system to change its state. Figure 5 will help to explain it in detail.

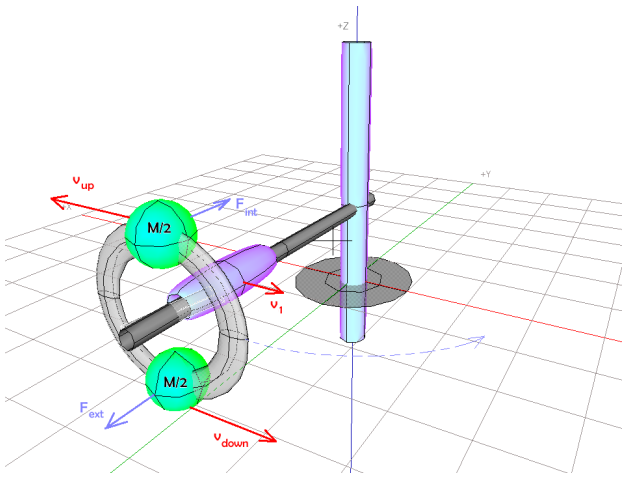


**Fig. 5** Linear velocity and torque, equivalent system.

In this figure we present an imaginary system with two spherical masses concentrated at opposite points of the wheel, and the wheel with null weight. Assuming this to be equivalent to the previous system, let us focus the attention on the linear velocities of these masses.

When no forced rotation is applied, each mass rotates with linear velocity $\boldsymbol{v}_0 = \boldsymbol{r}_0\ \boldsymbol{\omega}_0$, where $\boldsymbol{r}_0$ is the wheel radius. So, in the instant where the wheel is at the position shown in the figure, $\boldsymbol{v}_{up} = \boldsymbol{v}_{down} = \boldsymbol{v}_0$.

To the contrary, when we force the system to rotate around the *Z* axis with velocity $\boldsymbol{v}_1 = \boldsymbol{r}_1\ \boldsymbol{\omega}_1$, being $\boldsymbol{r}_1$ the distance from this axis to the wheel, $\boldsymbol{v}_{up}$ and $\boldsymbol{v}_{down}$ becomes obviously different, that is:

$$\boldsymbol{v}_{up} = \boldsymbol{v}_0 - \boldsymbol{v}_1$$
$$\boldsymbol{v}_{down} = \boldsymbol{v}_0 + \boldsymbol{v}_1$$

This means that our action has broken the previous equilibrium of the system, and exchanged the previous *symmetry* for an induced *anti-symmetry*. Its reaction starts to be completely understandable now. What happens when a mass rotating with a

certain speed around an axis sees its speed increased? The answer is: that mass will feel a force pushing it away from the rotation axis in order to conserve angular momentum. And what happens when the speed of that mass decreases? It will feel a force pulling it to the rotation axis, for the same reason. In truth, what happens in our wheel is these two effects acting at the same time. The lower part is pushed away from the *Z* axis, while the upper part is pulled to the *Z* axis. The result is a torque which tries to align the angular momentum of the wheel with the external angular momentum imposed by us. And, of course, this creates an *apparent force* that levitates the wheel, but at the same time pushes down the *Z* axis.

We see that forces originate in the need to conserve momentum, and any attentive reader will for sure notice a perfect parallel between this case and what happens in magnetism, atoms, planets, etc. In a certain sense, we may even consider that we have produced *anti-gravity,* but at the same time we have produced the same "amount" of *gravity,* and the result is automatically null; also, such effects belong to the plane defined by the induced rotation, so no components can be projected onto the axis of rotation. Could it be that there is a way of breaking such an *anti-symmetry* and let the *anti-gravity* effect naturally emerge in order to be useful in practice? That seems to be the only mystery now; anyhow, we suspect the answer is yes.

## 7. Conclusions

Contrary to the illusion of the common sense which tells us the forces created by the *gyroscopic effect* could probably be used to elevate a craft against the field of gravity, we have shown that in truth this effect is due to a *pair of forces* (binary) acting at the same time in opposite directions. These forces induce a torque which in effect tries to elevate the system at its boundaries, but at the same time also tries to push it down at the centre of rotation. This can be seen as the production of *anti-gravity* at the boundaries of the rotation plane, accomplished by the production of precisely the same "amount" of *gravity* at the central point of rotation. The net result is therefore null in terms of elevation (translation), and the effect is reduced to a simple rotation. We have therefore shown that the problem to resolve in order to get *anti-gravity* by these means is to break the anti-symmetric behaviour of these two forces in a way so that they produce only *anti-gravity*. These challenge is somehow similar to transforming a pure rotation into a translation. Could it be possible to achieve this? Our optimism lets us suspect yes. But, in parallel to these thoughts other sort of thoughts arise in our mind: for example, would Einstein unveil his $E=mc^2$ if he could suspect before that two terrible bombs would soon be dropped in Hiroshima and Nagasaki? In the problematic world of nowadays, we believe many scientists pose, or at least should pose, themselves such a question.

**Author's Biography:**

J. Manuel Feliz-Teixeira graduated in Physics in the Faculty of Sciences of University of Porto, Portugal, and received an MSc in Mechanical Engineering and a PhD from the Faculty of Engineering of the same university. His work has been related to various matters, from optical communications, solar energy and seismology, to, more recently, the simulation of complex systems in management science, like warehouse, supply chain, urban traffic, metro networks, etc. His PhD thesis is on "*Flexible Supply Chain Simulation*". Lately he is also being dedicated to researching new approaches for renewable energy, as well as trying to relate *anti-gravity* phenomena and Classical Mechanics.

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