

ENERGETICS OF CIRCULAR MOTION

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The Summary

Kinetic energy and work are vectors. A change of energy vector direction in systems without transition of kinetic energy to potential one and inversely, needs the application of work. The conservation of a stable amount of a body's energy during its motion on a closed and even circular trajectory may be achieved in systems, in which every turn of the kinetic energy vector is achieved by means of the transition of at least a part of this energy to a potential and later on again to a kinetic one but of the opposite direction. The keeping stable of a body's energy amount during its motion in a free space on a circular trajectory, needs a stable and regular application to the body of a work directed to the center of the trajectory. The full amount of work applied to a body moving on a circular trajectory with a constant amount kinetic energy E , makes $W = 2\pi E$ for one turn. The work for electron rotation kinetic energy conservation is accomplished in atoms and molecules by ether, by means of applying to the electron of Coulomb force. The work for astronomic bodies' rotation kinetic energy conservation is accomplished by ether, by means of applying to them gravitational forces.

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The aim of this study is to analyze energetic aspects of the orbital motion of electrons in atoms and molecules, as well as astronomic bodies, particularly the solar system planets and their satellites. In spite of the motion of such objects occurs on impurely circular trajectories the study's philosophy would not suffer if to accept them to be purely so.

Circular motion is accelerated even if the angular rate of rotation is constant, because the object's velocity vector is constantly changing direction. Such change in direction of velocity involves acceleration of the moving object by a centripetal force, which pulls the moving object towards the center of the circular orbit. Without this acceleration, the object would move in a straight line, according to Newton's laws of motion http://en.wikipedia.org/wiki/Circular_motion.

On the other hand, according to modern scientific views "work can be zero even when there is a force. The centripetal force in a uniform circular motion, for example, does zero work since the kinetic energy of the moving object doesn't change. This is because the force is always perpendicular to the motion of the object; only the component of a force parallel to the velocity vector of an object can do work on that object. Likewise when a book sits on a table the table does not work on the book despite exerting a force equivalent to mg upwards, because no energy is transferred into or out of the book" [http://en.wikipedia.org/wiki/Work_\(physics\)](http://en.wikipedia.org/wiki/Work_(physics)).

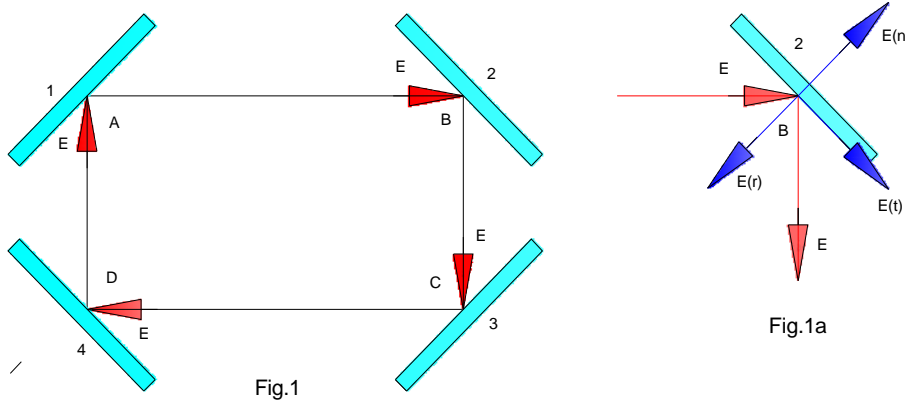
In my opinion the conviction that the centripetal force in a uniform circular motion makes zero work is erroneous, which I will try to prove founding on the following examples.

Example 1

An absolutely elastic little ball is dropped over an absolutely elastic floor. The ball falls to the floor from a height h , and in the moment of their encounter the ball's kinetic energy becomes equal to the work made on it by the force of gravity $E = mgh$. While encountering, the ball and floor undergo local elastic deformations on the expense of the total ball's kinetic energy. While rebounding the said deformations make a work the amount of E , provoking the ball to jump back with the same amount of energy E that it had before its encounter with the floor and that it completely loses at the height h . At the height h the ball starts falling again and if its motion does not undergo any resistance it would jump without interruption conserving its energy that twice a cycle would transfer from potential to kinetic and inversely.

Example 2

An absolutely elastic ball, the same as in the Example 1 is moving on a close rectangular rout ABCD (see fig.1) between four absolutely elastic walls 1, 2, 3, 4, making angles 45° to the respective segments of the route.



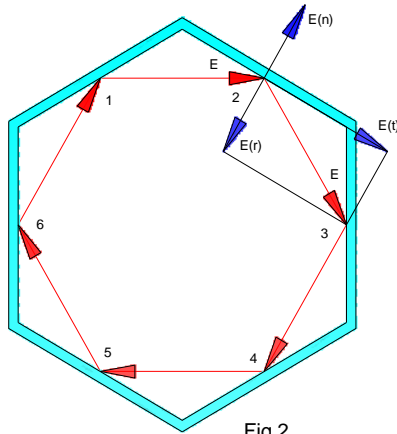
If the motion of the ball (is not represented on the drawing) does not encounter any external resistance, it in the same way as in the Example 1 would move on its route uninterruptedly with the same kinetic energy E ; and this may be understood from the fig.1a if to preliminarily realize that the kinetic energy as well as work are vectors.

As it is represented on the fig.1a, the ball with a kinetic energy E directed to the point B there strikes the wall 2, and its component directed normally to the wall's surface $E_n = E \sin 45^\circ$ while provoking its elastic deformation transfers in this way to the wall's potential energy $E_p = E_n = E \sin 45^\circ$. The potential energy of the wall transfers to the ball in the form of a reactive kinetic energy $E_r = -E_n$, which while summing up to the tangential component $E_t = E \cos 45^\circ$, forms a new vector of kinetic energy E , directed to the point C that is under angle 90° to its precedent direction.

While encountering the wall 3 and further on the walls 4 and 1, the ball conserving its energy value will each time change the direction of its motion as well as the direction of its kinetic energy. Each elastic encounter with one of the walls will initiate extinction of the normal component E_n and acquiring a reactive kinetic energy $E_r = -E_n$.

Example 3

The same ball as in the recent examples is moving on a route in form of a rectilinear hexagon 123456 (see fig.2) placed inside a hexagonal barrier made of absolutely elastic walls 1, 2, 3, 4, 5, and 6, everyone of which making an angle 30° to the respective ball's motion direction.



In the same way as in the precedent example the ball (not represented on the drawing) having encountered the wall 2 in the point 2 gives to the wall 2 the normal component of its kinetic energy $E_n = E \sin 30^\circ$ that returns to it in form of reactive energy $E_r = -E_n$. The late summing up to the tangential component $E_t = E \cos 30^\circ$, forms a new vector of the kinetic energy E , directed to the point 3 that is under angle 60° to its precedent direction.

While both the ball and wall of the barrier are absolutely elastic, then under zero external resistance the ball would be able to make its route uninterruptedly, and its kinetic energy value would remain stable.

Example 4

The same ball (fig.3) is moving tangentially to the internal surface of an absolutely elastic annular barrier. Obviously that under zero external resistance the ball is doomed to an eternal rotation inside the barrier.

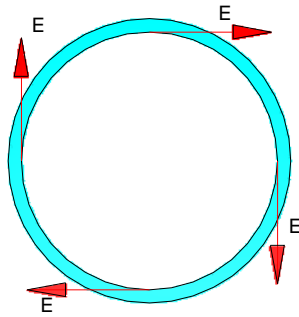


Fig.3

One can use the above examined Example 4 as an analog to a quite different problem, namely to a circular rotation of a solid body, e.g. a flywheel rim. If to single out from the rim a fragment of the mass m , then the kinetic energy of the fragment in a point of its circular trajectory will equal $E = \frac{mv^2}{2}$, where v represents the peripheral velocity of the fragment in this point. Similarly to the precedent examples one can examine this energy as composed from its centripetal component that transfers to a potential energy of the rim material elasticity and a tangential component, which summarizing with the material elasticity energy forms a deflected vector of the fragment's kinetic energy of the same value as before the deflection.

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The presented Examples 1 – 4 materialize themselves only on the condition of absolute elasticity of the ball and interacting with it guard walls. It is fully understandable that on the absence of such absolute elasticity that is if the transfers of kinetic energy to potential and inversely are impossible no one of the presented Examples would occur realistic.

Under real circumstances the stable value preservation of a body's kinetic energy after its turn on an angle α may be realized only at the expense of a work, and in the case of the body's interaction with an absolutely inelastic medium this work, as it may be seen from the above represented examples has to be spent in the turning point on: 1) absorption of the normal component of the body's kinetic energy $E_n = E \sin \frac{\alpha}{2}$ and 2) application to the body in the direction opposite to one of E_n , of the same value kinetic energy $E_r = -E_n$.

Example 5

Let us imagine a body moving with a kinetic energy E on a route in form of an n -sides rectilinear polygon. Then in order to preserve its kinetic energy along all the sides of the polygon, the body on each of its turns has to get a work directed to the center of the polygon.

The turning angle being $\alpha = 180^\circ - \beta$, where β is the apex angle of the rectilinear polygon, and the angle β being $\beta = 180^\circ - \frac{360^\circ}{n}$, the work applied to the body on every turn has to make $w = 2E_n = 2E \sin \left(\frac{180^\circ}{n} \right)$, while the work necessary to preserve the body's energy during a full cycle will make

$$W = 2nE \sin \left(\frac{180^\circ}{n} \right) \tag{1}.$$

Work values calculated with the formula (1) are gathered in the Table 1, from which one may see that in order to maintain the circular motion of a body with a kinetic energy E every cycle one has to apply to the body a work of $2\pi E$.

Table 1

n	3	6	180	∞
W	$5.196E$	$6E$	$6.283E$	$2\pi E$

The circular motion of electron in atoms and molecules as well as rotation of planets and other natural and artificial satellites occurring in absolutely inelastic pseudo gaseous medium, which is ether, the circumstances of the Example 5 have to fully comply with the rotation of these bodies. Preservation of the kinetic energy of electron in atoms and molecules occurs on the expense of work of the Coulomb forces that is ones, which are applied to it by those etheric particles that are prevented by it from encountering the nuclei of respective atoms and molecules; preservation of the kinetic energy of orbiting planets and other celestial bodies occurs on the expense of gravitational forces.

The obtained result as well as the above presented commentaries are in full opposition to the entrenched views of the official science claiming that the rotation of orbital electrons in atoms and molecules as well as that of celestial bodies occurs without any expense of energy, the views originated from their incapacity to realize that the centripetal forces are not any fictitious but real forces of resistance of that universal medium, which is ether.

Conclusions:

- 1) Kinetic energy and work are vectors;
- 2) A change of energy vector direction in systems without transition of kinetic energy to potential one and inversely, needs the application of work;
- 3) The conservation of a stable amount of a body's energy during its motion on a closed and even circular trajectory may be achieved in systems, in which every turn of the kinetic energy vector is achieved by means of the transition of at least a part of this energy to a potential and later on again to a kinetic one but of the opposite direction;
- 4) The keeping stable of a body's energy amount during its motion in a free space on a circular trajectory, needs a stable and regular application to the body of a work directed to the center of the trajectory;
- 5) The full amount of work applied to a body moving on a circular trajectory with a constant amount kinetic energy E , makes $W = 2\pi E$ for one turn;
- 6) The work for electron rotation kinetic energy conservation is accomplished in atoms and molecules by ether, by means of applying to the electron of Coulomb force;
- 7) The work for astronomic bodies' rotation kinetic energy conservation is accomplished by ether, by means of applying to them gravitational forces.