New approach to laws of physics based on a Law of Exceptions

Law of exceptions

To understand laws of physics we need to consider all the possible equal events that can potentially happen.

In this work we will try to show that the rule above is true and also we will show an approach based on this rule to some of aspects in physics.

Thinking about movement

We discern few types of movement

- rectilinear with a constant acceleration
- rectilinear with a varying acceleration
- movement on a curve
- circular movement

The Law of the Exceptions assumes that any movement is approached as the simplest version of the event. To understand the approach we will consider a potential path of a body in motion shown in Figure 1.

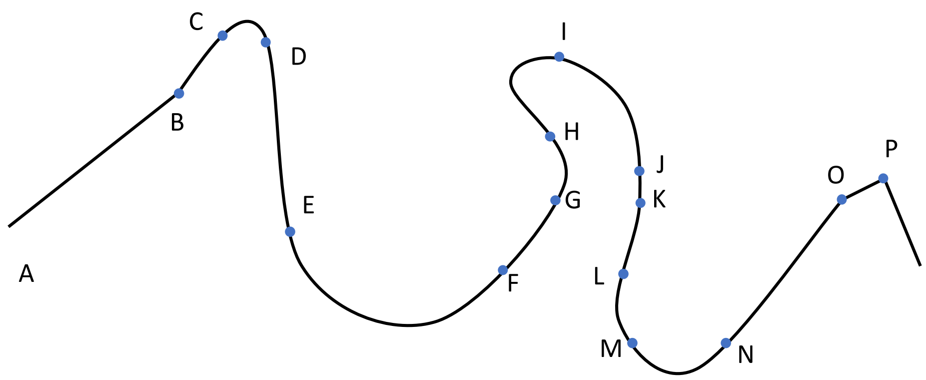


Figure 1: Path of the body in motion. Fragments of the path are denoted with letters.

The path can be divided into fragments with length l, each circular, with radii ranging from 0 to inf. This is presented in Figure 2.

We postulate that the primary type of motion is a circular motion, with which we can effectively describe all other types of motion. All the laws of dynamics can be therefore postulated based on this assumption with the circular motion being a base of the consideration.

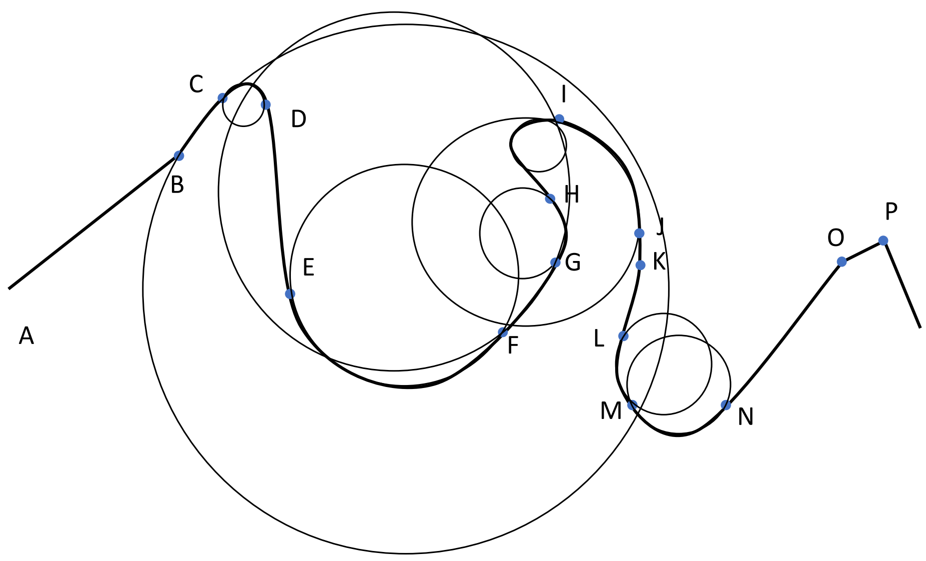
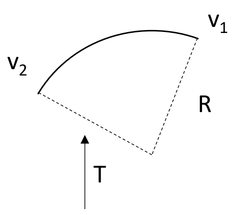


Figure 2: Path of the body in motion, divided in fragments that can be described by circles.

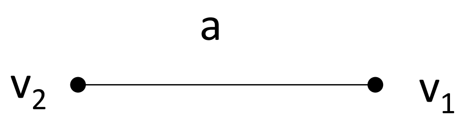
Acceleration

Acceleration 1

Let's picture a situation where a body moves with acceleration a. It changes its speed from v_1 to v_2 with a constant force F. Considering two paths shown in Figures 3b and Figure 3a for an observer looking from the point T they are equivalent. The acceleration a can therefore be thought as function of a radius R.



(a) The side observation



(b) Rectilinear

Figure 3: A circular movement viewed by the observer from the side is equivalent to observation of the rectilinear motion.

Change in the force results in the change of the radius.

Laws

With this we can reformulate the three laws of dynamics.

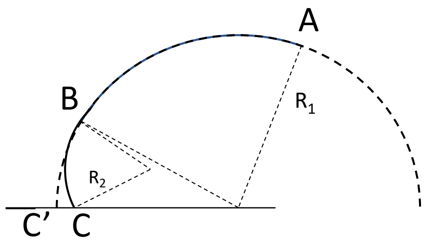


Figure 4: The change in force results in acceleration thus changing the radius of the circle

1st Law of Dynamics If no force is acting on a body or the forces that are acting on a body are in equilibrium the body moves on a circle with radius 0 or inf. (Tho understand that one has to assume that for an observer of a rectilinear motion that looks in the direction of movement the radius of the observed circle is also equal to 0).

2nd Law of Dynamics The second law states that the rate of change of momentum of a body over time is directly proportional to the force applied, and occurs in the same direction as the applied force. Considering a body with constant mass m and undergoing a circular motion with a radius R the law can be written as

$$F = m\mathbf{a}(\mathbf{R}), \tag{1}$$

where $\mathbf{a}$ is the body's acceleration.

3rd Law of Dynamics The third law states that a force F applied to a body results in a change of the circular motion. The radius of said motion can either change or remain the same, as demonstrated in cases of a collision (Figure 5a) and a bounce (Figure 5b).

Inertia

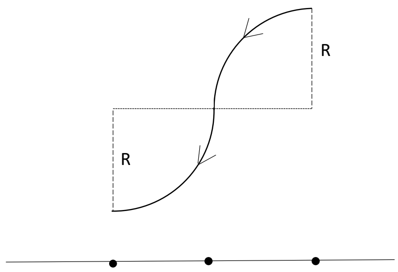
In this section we will explore connection between circular motion, centripetal force and inertia.

Centripetal force exits when there is a point about which rotation is undergoing. Not every motion on a curve generates centripetal force. We can think for example about the wind acting on a sail or a gravitational force, pictured on 6

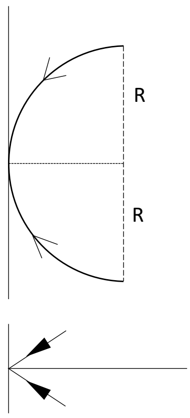
The value of the centripetal force Looking at the example shown in the Figure 7.

Knowing the kinetic energy in the point A

$$\frac{mv^2}{2}, \tag{2}$$

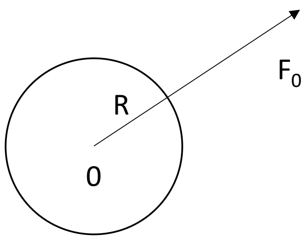


(a) Collision. The radius stays the same.

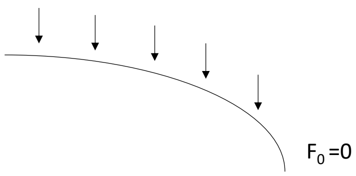


(b) A body bouncing off a wall. Radius stays the same.

Figure 5: Action of the force F



(a) The gravitational force



(b) The force of the wind on a sail

Figure 6: Examples of the movements where the centripetal force is not generated.

the work of the force F_0 on the distance R is

$$\frac{mv^2}{2} = \frac{1}{2}R\frac{mv^2}{R} \tag{3}$$

$$F_0 = \frac{mv^2}{R}. \tag{4}$$

Inertia Assuming that there is an equivalence of movement in a circle of a radius R with the change in acceleration we can declare inertia to be a composite of the centripetal force, demonstrated in Figure 8.

Swing

As a part of the considerations we are going to think about a swing with two arms of two different lengths and two masses attached to either of the ends, a small mass m to the longer arm and a bigger mass M to the shorter arm. The swing is in equilibrium. Said swing can be described in the series of discs with the common centre, as in the Figure 9

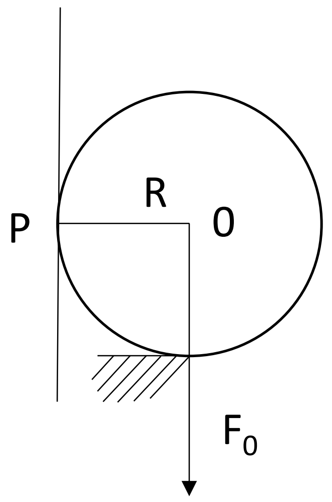


Figure 7: Example that illustrates the centripetal force

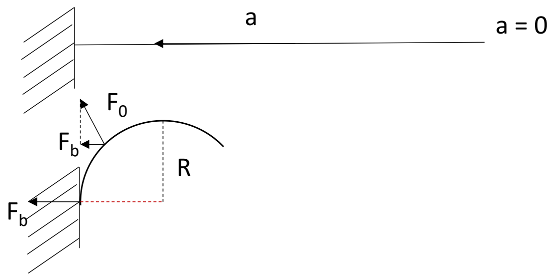


Figure 8: Force of inertia resulting from the centripetal force

To describe the the swing we first have to think about few assumptions. We are going to re-draw the swing as in the Figure 10

- When we consider the discs the mass of the smaller dark disc is the same as the bigger dqark disc.
- The density of the dark circles is equal.

From that we can write equations

$$m_1 = \rho \times V_1 = \rho L_1 \pi {r_1}^2, \tag{5}$$

and

$$m_2 = \rho \times V_2 = \rho L_2 \pi {r_2}^2 \tag{6}$$

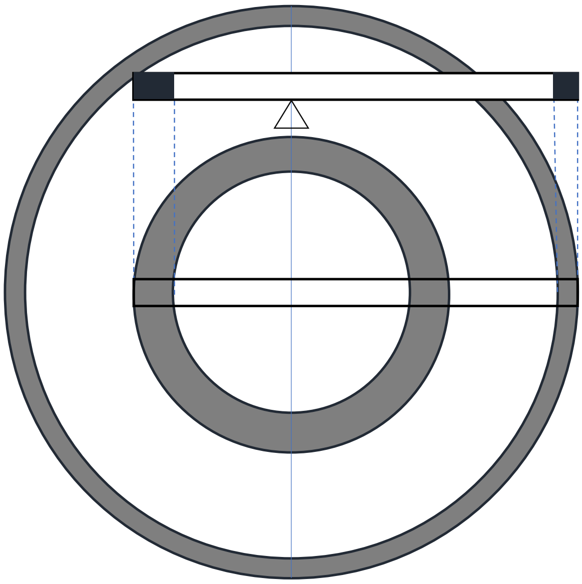


Figure 9: Swing inscribed in the series of discs that describe the event. The discs are created by taking each possible kind of the swing.

. From that

$$
{r_2}^2 = \frac{L_1}{L_2}{r_1}^2 \tag{7}
$$

. We can describe the mass M as

$$
M = \rho L \pi {r_1}^2. \tag{8}
$$

And the mass m as

$$
m = \rho L \pi \frac{L_1}{L_2}{r_1}^2. \tag{9}
$$

From that

$$
m = \frac{L_1}{L_2}M. \tag{10}
$$

Describing that with the radii of the circles

$$
\frac{m}{M} = \frac{L_1}{L_2} = \frac{s_1}{s_2} \tag{11}
$$

for the same angle. With that

$$
m \times s_2 = M \times s_1 \tag{12}
$$

which is the normal equation for the force equality of the swing.

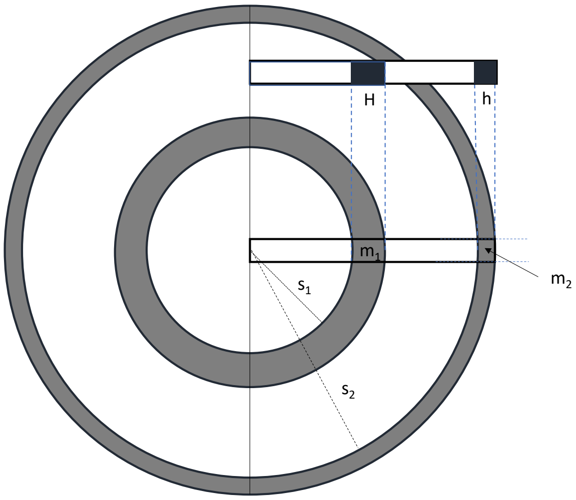
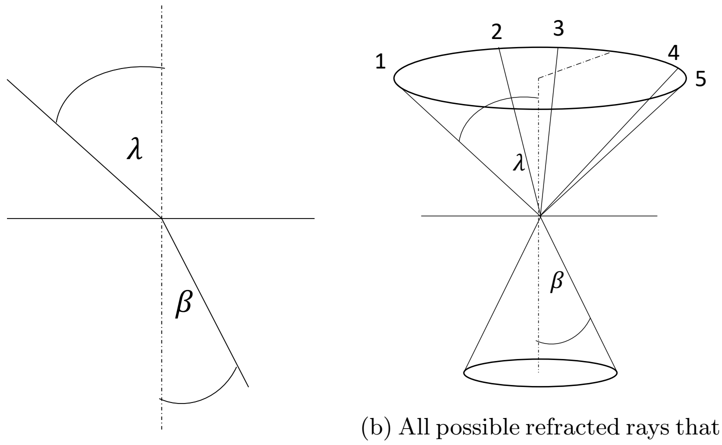


Figure 10: Swing inscribed in the series of discs that describe the event.

Optics

According to the rule of exceptions we always look at all possibilities of the event to consider a physical law. That is, in optics, instead of a single ray of light 11a we consider all possible rays that lead to the same outcome (in the example of refraction rays that refract at the same angle), like in Figure 11



(a) Single refracted ray

(b) All possible refracted rays that can refract with the same angle

Figure 11: There is a number of incoming light rays that can be refracted at the same angle as the single ray we looked at in a).

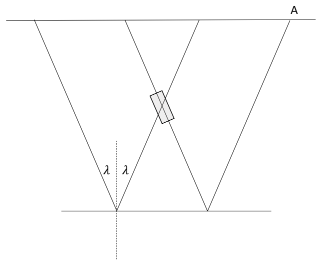
Reflection With the rule of exceptions we take into account all possibilities of the same event. If now consider a source of light that rotates with angular frequency ω around a point creating a 'clock' we can think that the angular frequency is conserved after reflection in the mirror, shown in Figure 12

Refraction Now instead of reflection let's consider a refraction. The reflecting surface is in the medium in which light has a different speed of light c_1. In the first case we will assume there is no refraction: i.e the angle at which the light travels through the medium does not change when crossing a boundary between media of two different speeds of light.

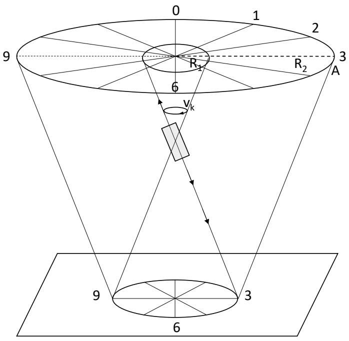
This situation cannot happen however because in the medium where the speed of light is equal to c_1 the light travels at the speed of time $t + \Delta t$. XXX

To make it possible the light has to refract as in the Figure 14.

To conserve the angular velocity with the time of the passing through the medium of Δt the light has to be refracted. We can calculate that from considering a system shown in Figure 15. If we assume that in both media the light follows the circular path with equal period T we can consider photons travelling and refracting through the medium. We can assume that the angular

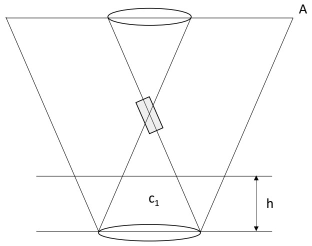


(a) Reflection in the mirror of two rays

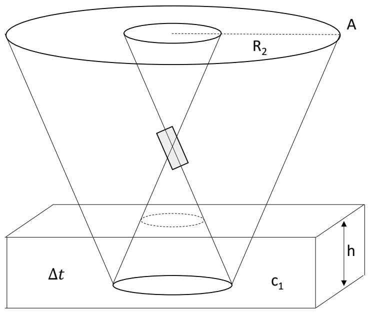


(b) Reflection in the mirror of the rotating light

Figure 12: Light rotating in a circle reflects from a mirror creating a clock, in which the angular frequency ω is conserved.



(a) Reflection in the mirror of two rays after passing through a medium with no refraction



(b) Reflection in the mirror of the rotating light after passing through a medium with no refraction

Figure 13: Light from a rotating source of light reflects from the mirror which is placed in a medium that has a different speed of light (c_1) than the medium considered previously with no refraction.

velocity is also constant.

The time the light travels on the paths s_1 in the upper medium is

$$t_1 = \frac{s_1}{c_1} \tag{13}$$

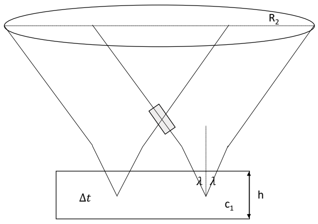
. On the path s_2 in the lower medium is

$$t_2 = \frac{s_2}{c_2} \tag{14}$$

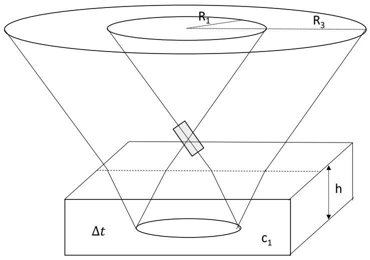
.

If we assume that we let the light travel for the same amount of time in both media

$$\frac{s_1}{c_1} = \frac{s_2}{c_2} \tag{15}$$



(a) Reflection in the mirror of two rays after passing through a medium



(b) Reflection in the mirror of the rotating light after passing through a medium.

Figure 14: Light from a rotating source of light reflects from the mirror which is placed in a medium that has a different speed of light (c_1) than the medium considered previously. Now the refraction happens and the event is possible with conserved angular velocity ω.

. Subsequently,

$$\frac{s_1}{s_2} = \frac{c_1}{c_2} \tag{16}$$

.

Looking at the angles

$$s_1 = \frac{a}{cos\alpha} \tag{17}$$

, and

$$s_2 = \frac{a}{cos\beta} \tag{18}$$

.

From that

$$\frac{s_1}{s_2} = \frac{cos\alpha}{cos\beta} \tag{19}$$

, and

$$\frac{c_1}{c_2} = \frac{cos\beta}{cos\alpha} \tag{20}$$

.

Using trigonometric identities

$$\frac{c_1}{c_2} = \frac{sin\alpha}{sin\beta} \tag{21}$$

which is equivalent to Snell's law.

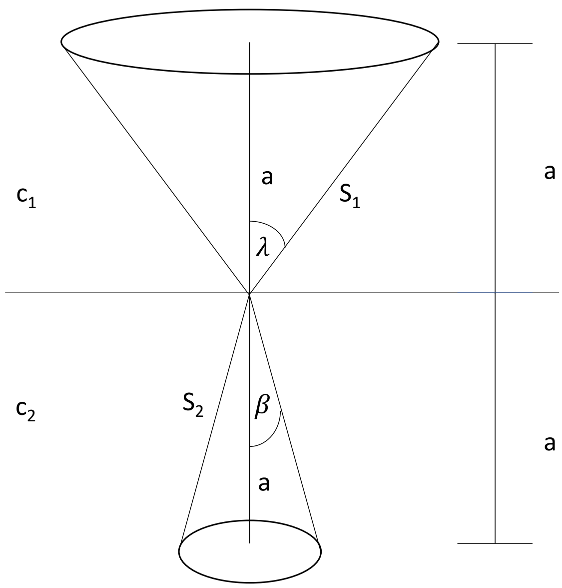
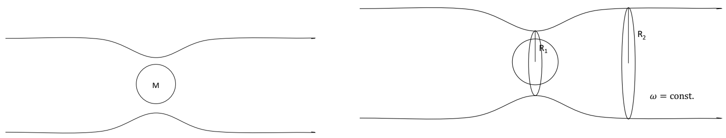


Figure 15: Derivation of Snell's law based on the Rule of Exceptions

Other considerations



(a) Mass

(b) Mass considered with the law of exceptions

Figure 16

Gravitational lensing In the case of the gravitational lensing the gravitation around a mass changes the speed of light around said mass. If we consider a circle placed in the matter around said mass that has a rotation and the rotation has a angular velocity ω, when the speed of light is slowed around the body the radius has to decrease to keep the angular velocity the same.

Form these examples we can see that to describe the causes of the refraction and reflection of light we have to assume, in keeping with the law of the exceptions, that all directions of light travel are taken into account.

Camera obscura The same consideration is taken when thinking about camera obscura. The image needs to be reversed when passing through the hole to keep the angular velocity, ω constant.

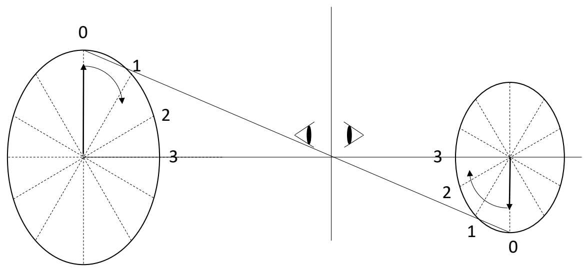


Figure 17: Camera obscura and the need to reverse the image to keep the angular velocity.

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