



Material:

Item-no.	Qty.	Description
DM350-2D	1	Rotating stool, height adjustable
DM351-1F	1	Bicycle wheel gyroscope
DM352-2A	1	Cord for spinning with handle

Purpose:

To demonstrate of the conservation of angular momentum in a closed system.

Preparation:

Place the rotating stool on a stable and even ground;
afterwards a test person takes a seat on the rotating stool.

Experiment 1:

The test person receives the resting bicycle wheel gyroscope, the position of the wheel is vertical (the axle is horizontal).

Another person sets the Bicycle wheel gyroscope in motion by hand.

What happens to the seated person?

Result:

The test person remains in the resting position.



Experiment 2:

Now the test person sets the bicycle wheel gyroscope into rotation with the axle held vertically.

Result:

The test person starts to rotate into the opposite direction since the sum of the angular momentums ($L_{\text{person}} + L_{\text{bicycle wheel gyroscope}}$) has to be zero even after setting the gyroscope into rotation.



Experiment 3:

Two students set the bicycle wheel gyroscope into rotation in the following way:

One student holds the bicycle wheel gyroscope vertically, the axis is horizontal.

The end of the cord is inserted into the dedicated groove.



The cord should be held "with a little bit tension" and winded up by turning the bicycle wheel gyroscope.



Now one student holds the bicycle wheel gyroscope firmly at the two handles while the other one pulls as fast and strong as possible on the cord so that the bicycle wheel gyroscope is rotating fast.



Another student sitting on the Rotating stool is now handed this already rotating bicycle wheel gyroscope with the axle held vertically "from the outside".

What happens to the seated person?

Result:

The test person remains in the resting position.



Experiment 4:

Again the rotating bicycle wheel gyroscope is handed over in vertical position to a test person sitting on the rotating stool. Now the test person turns the bicycle wheel gyroscope by 90° so that the axis is in horizontal position afterwards.

Result:

The test person begins to rotate in the direction of rotation of the transferring gyroscope. If the gyroscope is turned by another 90° the rotation speed of the test person is doubled.

The effect can again be explained by the preservation of the total movement size. When rotated for the first time the vertical component of the amount of rotary motion of the bicycle wheel gyroscope disappears. The vertical component of the person's angular momentum must therefore be unequal to zero. With the second rotation the angular momentum receives an opposite orientation so that the subject has to rotate at twice the speed to compensate.



Experiment 5:

The gyroscope is now rotated by 90° , its axis is now in vertical position.



Result:

The test person begins to rotate in the opposite direction of rotation of the transferring gyroscope. If the gyroscope is turned by 180° the test person rotates at the same speed but in the opposite direction of rotation.

