Mohawk Valley Library System

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CONSERVATION OF ANGULAR MOMENTUM

To illustrate how angular momentum of a rotating body is conserved as the effective radius of its mass is changed.

MATERIALS:

a swivel stool or platform
2 hand-held weights (small dumbbells of 3-5 pound weight)
Note: Two persons are required for this experiment

WHAT TO DO:

One person sits on the stool or stands on the platform, grasps a weight in each hand and extends arms outward.
The second person spins the subject as rapidly as possible, up to the point where he/she can still stay on the support.
The subject then brings arms inward.
What happens? Try various extensions of the arms and note how rotation is affected.

WHAT IS HAPPENING?

One of Sir Isaac Newton's laws of motion says that a body in motion will continue in motion in the same direction unless acted on by an applied force. The body is said to have momentum. If we label mass as m and velocity as v, Momentum is expressed mathematically as $M = m \times v$

A special case of momentum is when the initial motion is rotation about an axis. In this case the equation becomes $M = m \times v \times r$

Where is the radius? Where the mass is located. **SO** if momentum is not changed and mass is not changed, the velocity must increase if the radius is changed.

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(continued)

In our experiment, the subject has mass which does not change radius, but the radius of the added mass held in the hands changes. Hence the rotational rate must change – it will be faster when the arms are retracted.

Of course, this motion will stop eventually because the friction in the bearings of the platform or stool soaks up the energy that the assistant put into the test at the start.

This principle is behind the very graceful motions executed by ballet dancers and figure skaters. In the case of skaters, the ice provides a bearing surface of low friction so the motion can be sustained for a longer time.

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