Chapter C14: Conservation of Angular Momentum

C14.3 Conservation of Angular Momentum

Interactions transfer angular momentum. Thus, in the absence of external interactions (twirls), angular momentum is conserved.

C14.4 Some worked examples

For what we'll be doing in this class, we won't need to treat $\vec{L}$ or $\vec{\omega}$ fully as vectors. It will suffice to just use plus and minus signs to indicate the direction (clockwise or counter-clockwise) of rotation.

C14.5 Application: Neutron Stars

When stars collapse, they spin faster.

Examples:

1. A thin-armed person is sitting on a stool that can rotate. Her moment of inertia is 2.5 kgm^2. She holds a 5 kg weight in each hand. Her arms are 0.8 m long. When her arms are fully extended, someone pushes her so that she's rotating at 0.25 rev/s. She pulls her arms in so that the weights are now 0.4 meters from her axis of rotation. How fast is she spinning now?

2. A 30 kg child is running at 2 m/s and jumps on a merry-go-round as show below. The merry-go-round has a radius of 1.5 m and a mass of 50 kg. How fast is the merry-go-round spinning after the child jumps on it?

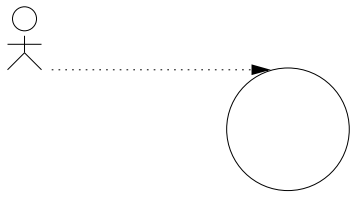

Figure 1:

Practice:

1. A 5 kg serving tray with a radius of 20 cm spins at 10 revolutions per minute. A 1 kg coffee cup is placed on the tray 10 cm from the axis of rotation. What is its angular velocity now?

2. A spherical planet is spinning in outer space. The planet suddenly collapses so that its radius is half of what it was before. What is its new angular velocity compared to its old angular velocity?

3. For each of the three figures below, a 30 kg child is running at 2 m/s and jumps on a merry-go-round as show below. The merry-go-round has a radius of 1.5 m and a mass of 50 kg. In each instance, how fast is the merry-go-round spinning after the child jumps on it?

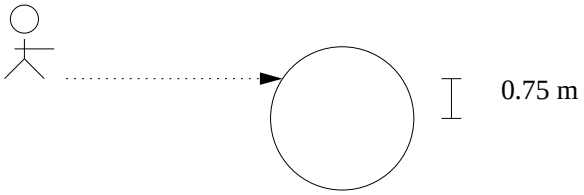

Figure 2:

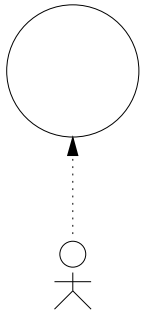

Figure 3:

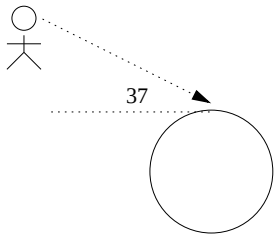

Figure 4: