SHOW ME THE MATH

CONSERVATION OF ANGULAR MOMENTUM

The law of conservation of angular momentum states that as long as there is no external torque, the total angular momentum of a set of interacting objects cannot change.

Consider Earth's orbit around the Sun. A simple formula tells us Earth's angular momentum at any point in its orbit:

$$\text{Angular momentum} = m \times v \times r$$

where m is Earth's mass, v is its speed (or velocity) around the orbit, and r is the "radius" of the orbit.

Conservation of angular momentum explains why we see so many spinning disks in the universe, such as the disks of material orbiting young stars. It is easiest to illustrate this idea with an ice skater spinning in place.

Because there is so little friction on ice, the angular momentum of the ice skater remains essentially constant. When she pulls in her extended arms, she decreases her radius – which means her velocity of rotation must increase. Stars and galaxies are both born from clouds of gas that start out much larger in size. These clouds almost inevitably have some small net rotation, though it may be imperceptible. However, like the spinning skater as she pulls in her arms, they must spin faster as gravity makes them shrink in size.