EMMY NOETHER

Emmy Noether Amalie (1882 - 1935) was a German mathematician specializing in the theory of invariants and is known for her contributions of fundamental importance to the fields of theoretical physics and abstract algebra. She was considered the most important woman in the history of mathematics by David Hilbert, Albert Einstein, and other notable scientists. Nevertheless, she was denied the possibility of a worthy position in a university because she was a woman

"My methods are, in fact, methods of working and of thinking; for this, they have gone unnoticed elsewhere"

The most beautiful theorem in Mathematics

The group of "calculators" at Harvard had routine assigned tasks to The mathematician Emmy Noether revolutionized the field of abstract algebra and the theory of rings, but she also contributed to theoretical physics with the theorem she formulated in 1915 that takes her name. **Noether's Theorem** is a central result in theoretical physics and is without a doubt one of the most beautiful theorems in mathematical physics. Her theorem tells us that for any continuous **symmetry** in a system, there is an associated **conservation law**. For example, the law of **Conservation of Energy** is a mathematical consequence from the fact that the laws of physics don't change in time – they have **time translation symmetry**!

More information

Noether's Theorem in a Nutshell

Emmy Noether: Creative Mathematical Genius

Britannica: Emmy Noether

Experiment: Explore a law of conservation

Angular momentum, *L*, quantifies the rotational movement of an object. It is given by the product of an objects rotational velocity ω and its moment of inertia, *I*, which measures how much mass an object has away from its axis of rotation.

$$\boldsymbol{L} = \mathrm{I} \cdot \boldsymbol{\omega}$$

The conservation of angular momentum is a consequence of the invariance of the laws of physics under rotations – they have rotational symmetry. We propose two experiments that demonstrate the consequences of the conservation of angular momentum.

Procedure

1. You may have seen how when an ice skater is spinning and they extend their arms their rotational velocity decreases, and how when they bring their arms back close to their body, their rotational velocity increases again. By changing how far they extend their arms, they change their moment of inertia. Since angular momentum is constant, this means their rotational velocity must change as they move their arms! You can perform a similar experiment yourself – for instance, try spinning in a chair and changing where your arms are!

2. Another experiment that demonstrates the same principle can be done with a chair that can rotate and a bicycle wheel. With your feet resting on the ground, spin the bike wheel as it would spin while riding it – along a horizontal rotation axis. Then, pick up your feet and place them on the chair so that it can rotate freely, and the floor can't compensate for any changes in angular momentum. The angular momentum of the system containing you, the spinning bicycle wheel, and the chair must now be constant. Turn the wheel in one direction or the other, so that it is spinning along a vertical rotation axis and see what happens!

Explanatory video of experiment 1

Explanatory video of experiment 2

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