



What is dark matter?

KS3

KS4

Ages 11-18 🕒 4 min read

When astronomers look at galaxies and measure how fast they're rotating, something strange happens. The outer edges of galaxies rotate almost as fast as the inner parts — but based on the gravity of the visible matter (stars, gas, dust), they should be rotating much more slowly. The gravity of what we can see isn't enough to explain the motion we observe.

The conclusion: there must be far more matter in and around galaxies than we can see. This invisible mass — "dark matter" — seems to make up about 27% of the universe's total energy content. All the stars, planets, gas, and dust — everything we can see — accounts for only about 5%. The rest is dark matter and dark energy.

Imagine watching a tug-of-war. From the movement of the rope, you can calculate how hard people are pulling. But when you look at the teams, the people you can see aren't pulling nearly hard enough to explain the rope's motion. Something invisible must be pulling alongside them. Dark matter is those invisible team members — we can't see them, but we can infer their presence from the effect they're having.

What might it be?

Scientists have proposed many candidates. WIMPs (Weakly Interacting Massive Particles) are theoretical particles that would interact with normal matter only through gravity and the weak nuclear force, making them essentially invisible. Axions are another candidate. Some theories suggest dark matter is made of very dense, very faint objects (called MACHOs — Massive Compact Halo Objects). None have been definitively detected. Decades of experiments designed to catch dark matter particles directly have so far come up empty.

Could our understanding of gravity be wrong?

Yes — this is a genuine alternative. Some physicists propose Modified Newtonian Dynamics (MOND) — tweaking the laws of gravity at very low accelerations to explain galactic rotation without needing dark matter. So far, modified gravity theories haven't explained *all* the evidence as well as dark matter does, but the debate is live.

The honest answer: we don't know what dark matter is, and it's one of the most significant unsolved problems in physics.