

What is dark matter and how does the Large Hadron Collider help us understand it?

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Imagine looking up at a starry night sky. It's a breathtaking sight, filled with twinkling points of light. But what if I told you that most of the stuff in the universe is invisible? That's right – something mysterious and unseen is pulling at the stars and galaxies, shaping the cosmos as we know it.

This invisible force is called dark matter. Scientists have been puzzled by dark matter for years, trying to figure out what it is and how it works. While we can't see dark matter, its effects are clear. Galaxies spin faster than they should, based on the visible matter we can observe. Something extra is providing the gravitational pull needed to keep them together. This something extra is believed to be dark matter (Bahcall, 2015). It's like having an invisible friend who's always there, but you can only feel their presence.

Scientists have come up with some ideas about what dark matter might be. Some think it's made up of particles that don't interact with light. Others believe it could be a whole new kind of particle we haven't discovered yet. But no one knows for sure. To solve this cosmic mystery, scientists are using incredibly powerful tools, like the Large Hadron Collider (LHC). The LHC is a giant, underground machine that smashes tiny particles together at almost the speed of light (Cooper, 2022). By studying the results of these collisions, scientists hope to find clues about dark matter. It's like trying to understand a puzzle by breaking it into smaller pieces. If we can figure out what

these pieces are made of, we might be able to put together the picture of dark matter.

Discovering dark matter would be a huge breakthrough for science. It would help us understand how the universe formed and how it works. It might even lead to new technologies and inventions. So, while dark matter remains a mystery, scientists are working hard to uncover its secrets. Maybe one day we'll look up at the night sky and understand the invisible forces that shape our universe.

Dark matter, a mysterious substance, constitutes a significant portion of the universe.

Unlike ordinary matter, which is composed of atoms, dark matter doesn't interact with light, making it incredibly difficult to detect. Its existence is inferred from its gravitational influence on visible matter (Arbey & Mahmoudi, 2021). Galaxies spin faster than they should based solely on the visible matter they contain. This discrepancy suggests the presence of an unseen mass exerting additional gravitational pull.

Scientists have proposed various theories about the nature of dark matter. One possibility is that it consists of Weakly Interacting Massive Particles (WIMPs) (Wikipedia, 2024). These hypothetical particles would interact weakly with ordinary matter, explaining their elusiveness. Another theory suggests that dark matter might be composed of axions, lightweight particles

predicted by some theories in physics. To unravel the mysteries of dark matter, scientists have constructed sophisticated experiments. These experiments often involve deep underground laboratories to shield detectors from interfering radiation. By carefully analysing data from these experiments, researchers hope to capture the rare interactions between dark matter particles and ordinary matter.

One of the most ambitious efforts to understand dark matter is the Large Hadron Collider (LHC). While primarily designed to study the Standard Model of particle physics, (Cooper, 2022) the LHC could potentially produce dark matter particles in high-energy collisions. By examining the products of these collisions, scientists hope to find evidence of particles that don't fit the known framework, potentially revealing the nature of dark matter.

Understanding dark matter is crucial for comprehending the universe's structure and evolution. It influences the formation of galaxies, galaxy clusters, and the overall distribution of matter. By unlocking the secrets of dark matter, scientists hope to gain a deeper understanding of the cosmos and our place within it. While the quest for dark matter continues, it is a testament to human curiosity and the relentless pursuit of knowledge. As technology advances and our understanding of the universe expands, we may one day unveil the true nature of this enigmatic substance.

The existence of dark matter, an invisible force shaping our cosmos, remains one of the greatest mysteries of science. While its influence is undeniable, its composition remains elusive. From the anomalous rotation of galaxies to the gravitational lensing of light, evidence for dark matter is compelling (Thabet, 2014). Yet, despite decades of research, its true nature continues to baffle scientists.

The Large Hadron Collider, a monumental feat of engineering, offers a glimmer of hope in unravelling this cosmic puzzle. By studying the fundamental particles that make up our universe, scientists hope to discover clues about dark matter's identity. While challenges persist, the pursuit of understanding dark matter is essential for comprehending the universe's origins, structure, and ultimate fate. As technology advances, we can anticipate groundbreaking discoveries that will illuminate this enigmatic component of our cosmos.

References

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