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Dark Matter

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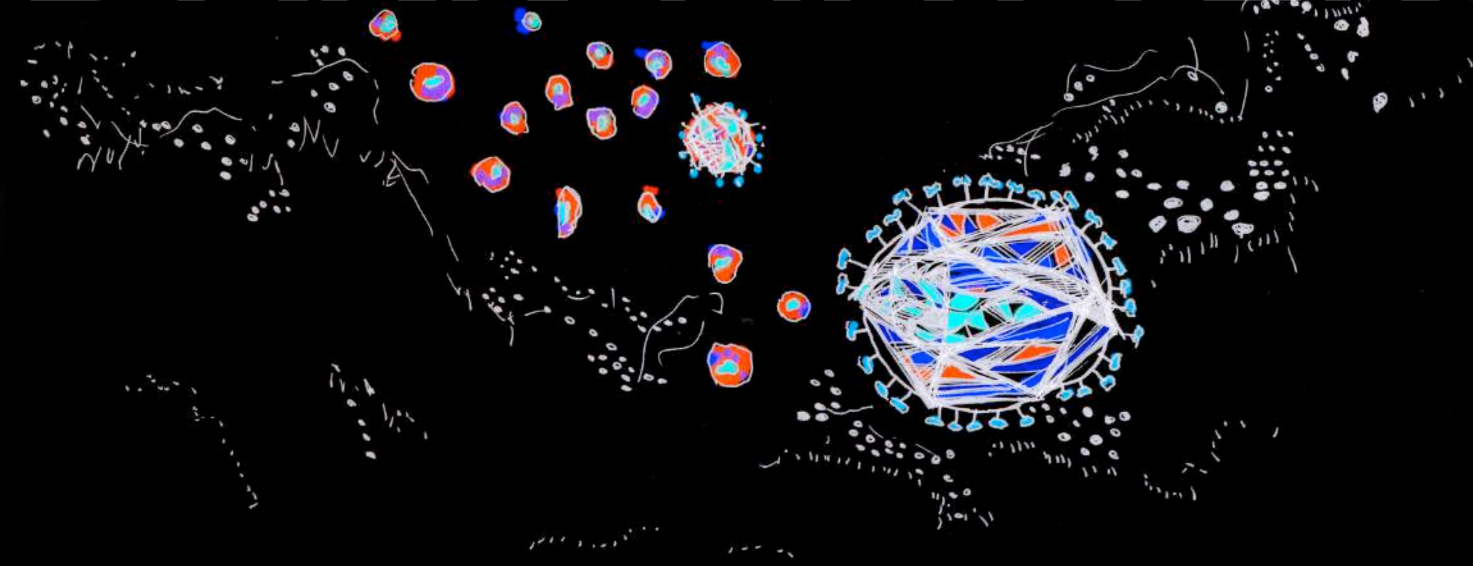

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By Rachel Budker

Cold, dark, and mysterious. Strange. Misunderstood. No, not your angsty teenage self, but Dark Matter.

You may have heard of dark matter, but what *is* it?

In the 1930s, an astronomer by the name of Zwicky first mentioned 'dark matter' while measuring the speed of galaxy clusters. He, and many after him, noticed big discrepancies between the observed speeds of galaxies within galaxy clusters and what is expected from the observed mass distribution in the cluster. Basically, the calculated mass of the galaxy cluster was not adding up. Something, something quite massive, remained unaccounted for.

Scientists noticed a similar discrepancy on a much smaller scale: within individual galaxies. Scientists can predict how quickly stars should revolve around the center of a galaxy by calculating how much gravitational pull should affect the speed at which the star travels. When scientists calculate and then measure the speeds of the objects, assuming certain masses of the objects that exert gravitational pull on them, the observed speed grossly mismatches the calculations. The difference between the calculated and observed is a huge discrepancy, not just a small anomaly — something enormous is somehow being overlooked.

Dark matter has become the most widely supported theory to explain these discrepancies. Dark matter cannot be seen, does not emit energy, and only interacts with ordinary matter through gravity and possibly the weak force; therefore, its existence may only be inferred from the gravitational pull dark matter has on observed matter, calculated by use of classical mechanics. The Hubble Space Telescope may provide the best evidence for dark matter, allowing astronomers to observe dark matter rings emanating from the collisions of galaxy clusters, indicating the gravitational role dark matter may play in holding galaxies together.

However, much remains shrouded in mystery. Dark matter does not fully account for the unknown substances of our universe. By most recent estimations, 4.9 % of the universe is observable matter such as stars, galaxies, and dust, but only 27 % is dark matter — 68% is currently believed to be 'dark energy'. Dark energy is an even more enigmatic concept than dark matter. Put most simply, dark energy helps account for the majority of the unknown makeup of our universe and helps explain the observed acceleration of the expansion of the universe. Dark energy pushes the universe apart, while dark matter holds it together.

As the dark matter theory grows in support, a greater mystery remains: what is dark matter actually made out of? Many believe that the elemental particles of dark matter have yet to be uncovered, such as the theoretical weakly interacting massive particles (WIMPs); weakly interacting subatomic particles that have already been discovered, such as neutrinos, are not massive enough to constitute dark matter. Terrestrial experiments, such as those underway in the Large Hadron Collider (LHC) in Geneva, have already begun to shed some light on the darkness, and in time will hopefully explain much more about the particles that make up our universe.

A deeper understanding of dark matter will lead to a greater understanding of our infinitely complex universe. However, it is important to note that despite its popular support, dark matter is still a theory. Other theories, such as the antigravity theory, suggest that Newtonian/Einsteinian laws of gravity are incomplete and need to be expanded or rewritten in order to explain galactic phenomena. The discrepancies observed in galactic rotation curves do not suggest an invisible, unaccounted-for mass, but a colossal gap in our understanding of classical mechanics and the laws of gravity at such large scales. Such theories are more complex, stranger, and less favored — yet still absolutely possible.

At the frontier of physics, astronomy, and cosmology, dark matter is just one example of the way scientists continually use creativity and imagination to dream up what the universe may look like, open their eyes, and see if the order of their imagination holds true against scientific data.