Dark Matter May Not Be (Completely) Dark After All, Says Vanderbilt Researcher

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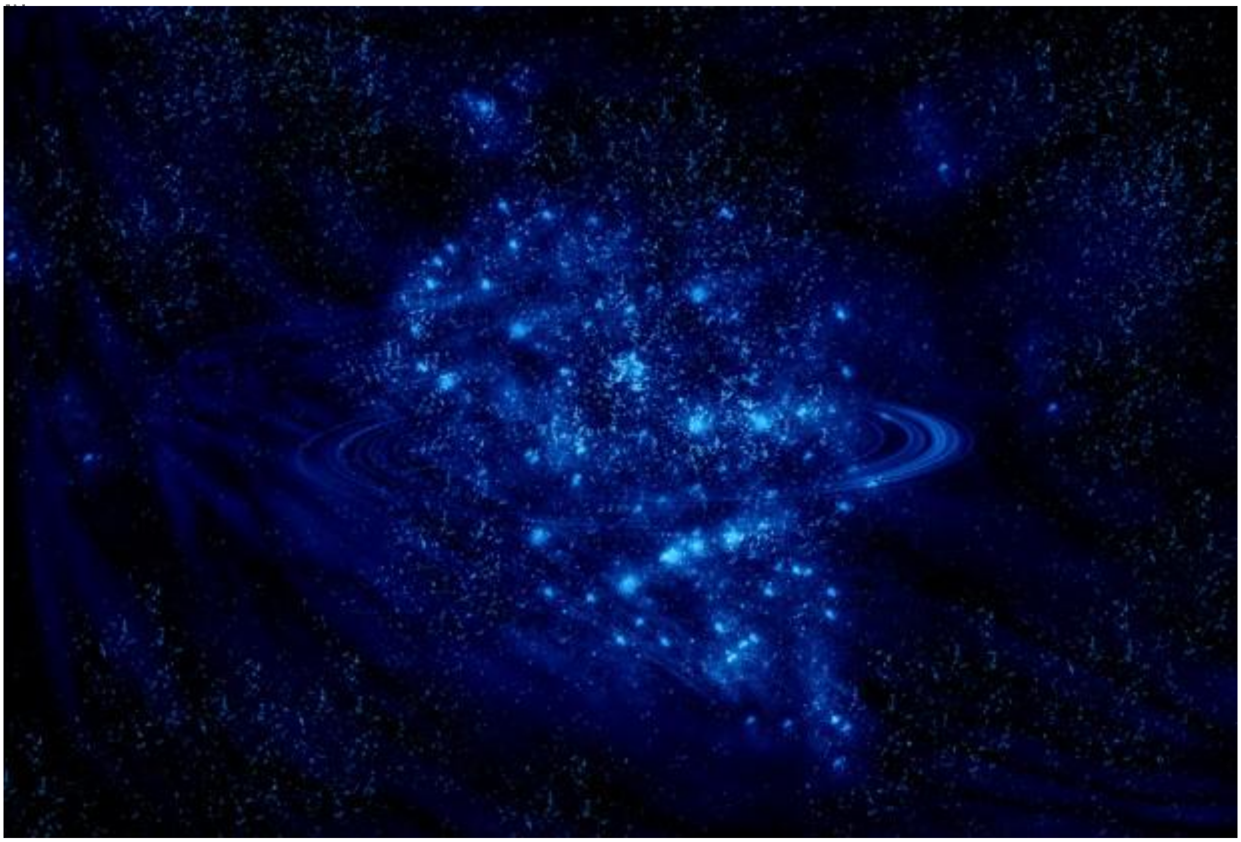

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John P. Millis, PhD for redOrbit.com – Your Universe Online

For more than 80 years physicists and astronomers have been searching for an elusive form of matter that appears to be responsible for most of the mass in the Universe. While the presence of this dark matter can be measured by the gravitational influence of the particles, directly "seeing" the mass has proven troublesome.

The working theory for decades has been that the candidate particle should be electrically neutral, possessing no electric or magnetic field of its own. Consequently, dark matter would not be expected to interact with light and other electromagnetic fields, which is why we do not detect light scattering after it comes in contact with the matter – the usual way we study things in the Universe.

Many, if not most, models of dark matter predict that the particles would be a special variety predicted by Ettore Majorana that are self-annihilating. Such dark matter particles would convert their mass into radiation when they collide with other dark matter particles. Recent results from the Fermi Space Telescope and the Alpha Magnetic Spectrometer (AMS) detector on board the International Space Station have provided hints that this may, in fact, be happening.

Now, new research is building upon the notion that dark matter may be Majorana particles, and suggests that perhaps dark matter can interact electromagnetically after all – meaning that dark matter may not be 'dark' after all.

The candidate particle, suggested by Professor Robert Scherrer and post-doctoral fellow Chiu Man Ho at Vanderbilt University, would still be electrically neutral but would possess a rare type of electromagnetic magnetic field known as an anapole. This special type of field is characterized by rings of current around the particle that create a donut shaped magnetic field contained near the particle boundary. This differs from classical electromagnetic dipole fields which spread out from the particle.

According to Scherer, “Most models for dark matter assume that it interacts through exotic forces that we do not encounter in everyday life. Anapole dark matter makes use of ordinary electromagnetism that you learned about in school – the same force that makes magnets stick to your refrigerator or makes a balloon rubbed on your hair stick to the ceiling.”

If this theory is correct, then dark matter particles would in fact be able to interact electromagnetically with other matter. Which begs the question, why have we not “seen” such interacts yet?

The reason is that the strength of anapole magnetic fields derives its strength from the speed of the particle’s motion. Anapole fields around stationary particles interact very weakly, if at all, but can interact quite strongly as their speed increases. Observations of dark matter halos suggest that the particles are very slow moving, and clump together, so we would not expect to see strong electromagnetic signals.

Yet this new model provides hope. As Scherrer explains, “the model makes very specific predictions about the rate at which it should show up in the vast dark matter detectors that are buried underground all over the world. These predictions show that soon the existence of anapole dark matter should either be discovered or ruled out by these experiments.”

Source: John P. Millis, PhD for redOrbit.com – Your Universe Online

http://www.redorbit.com/news/space/1112870568/dark-matter-not-actually-dark-061113/