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News

Strongest limit set on dark matter's mass

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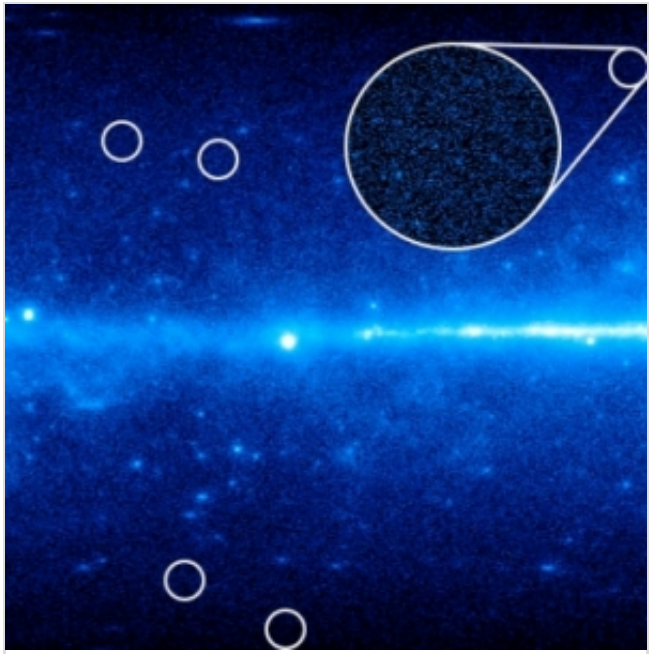
PARIS: Dark matter must have a mass greater than 40 giga-electronvolts, say scientists who claim to have set the strongest limit yet on the mass of dark matter.

A pair of physicists from Brown University in the U.S. used publicly available data from NASA's Fermi Large-Area Telescope to investigate the mysterious substance thought to make up nearly a quarter of the known universe.

Using a new statistical approach, the researchers determined that dark matter must have a mass greater than 40 giga-electron volts in dark matter collisions involving heavy quarks, which are an elementary particle and a fundamental constituent of matter. The pair constrained the mass of dark matter particles by calculating the rate at which the particles are thought to cancel each other out in seven dwarf galaxies that appear to be full of dark matter.

"What we find is if a particle's mass is less than 40 GeV, then it cannot be the dark matter particle," said co-author Savvas Koushiappas of the paper published in the current issue of *Physical Review Letters*.



Physicists have set strongest limit on the mass of dark matter yet, according to a new study. Brown physicists studied seven dwarf galaxies, some shown here circled in white. Their observations indicate these galaxies are full of dark matter because their stars' motion cannot be explained by their mass alone.

Credit: NASA/DOE/Fermi-LAT Collaboration/Koushiappas and Geringer-Sameth/Brown University

Underground detectors

Scientists believe that normal matter (which makes up all planets, stars and galaxies) accounts for only 5% of the universe. The rest is made up of dark matter (23%) and dark energy (72%). However, dark matter cannot be 'seen' and can only be inferred by the gravitational pull that it exerts on normal matter in galaxies.

There are several candidates for dark matter. These include MACHOs (massive compact halo objects) - huge gas balls made up of normal matter that emit little or no radiation and RAMBOs (robust associations of massive baryonic objects) - dark clusters of brown dwarfs. The most common suspects, however, are the hypothetical WIMPs (weakly interacting massive particles).

WIMPs are thought to be present everywhere in our galaxy and despite having a mass similar to that of an

atomic nucleus, their extremely weak interaction with normal matter enables them to travel undetected as they pass through the Earth and indeed the entire galaxy.

To spot these WIMPs directly, researchers have built detectors in underground labs where the low background noise should allow any signals to stand out. The biggest of these labs is under Gran Sasso, a mountain in central Italy, where various dark-matter experiments such as DAMA, XENON and CRESST are being performed. Such dark-matter detectors work when a WIMP collides with an atomic nucleus, which then recoils, producing a trademark scintillation, or flash.

Constraining WIMP mass

WIMPs can also be detected less directly using satellites or balloon-based instruments. Because of the effects of their own gravity, the number of WIMPs at the centres of galaxies should be very high – high enough that they begin to collide with one another.

When this happens they annihilate each other, producing large numbers of heavy quarks and leptons, and in turn generate gamma-ray photons. An excess of such photons coming from the centres of galaxies is the 'signature' of dark matter that satellites such as Fermi are searching for.

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Koushiappas and his colleague Alex Geringer-Sameth studied gamma-ray emission data collected over the last three years for seven dwarf galaxies in the Milky Way. They compared the emission from these galaxies to the emission from the area surrounding each dwarf. They analysed the gamma-ray data to estimate the number of annihilations that might be taking place. This allowed them to constrain the mass of WIMPs.

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Speed of light

My take on dark matter is, that it is a miscalculating, stemming from our presumption that the speed of light is constant.

What if the speed of light varies through time and space?

That creates some interesting theory, at least I think so.

Antimatter is the mind and consciousness of all living entities.

You are your own universe.

Reality is where the minds (antimatter) meets the physical universe.

Interested? Then read my philosophical multiverse theory.

Google crestroyer theory and find it instantly

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Submitted by Visitor on 6 December 2011 - 5:01am.