Is Dark Matter a Source of High Energy Gamma Rays?

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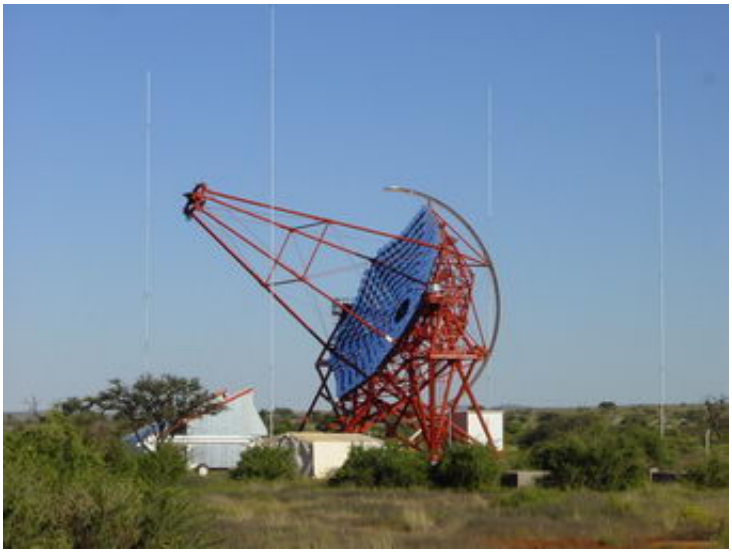

HESS telescope. Credit: HESS collaboration

"We know there is much more matter in the universe than what we see. For instance, the rotation velocity of observed spiral galaxies is much faster than the visible mass could explain," says Joachim Ripken, a researcher with the HESS Collaboration. "And we know that it is not the normal matter that we know." Ripken refers to dark matter, a type of matter that physicists know must be present in the universe, but that cannot be seen because it does not interact with light. It is matter, Ripken tells *PhysOrg.com*, that "we only know what it is not."

Ripken is part of a multi-national team known as the HESS Collaboration. HESS is named for Nobel Prize winner Victor Hess, and stands for **H**igh **E**nergy **S**tereoscopic **S**ystem. It is an array of Cherenkov telescopes located near the Gamsberg in Namibia. While the group has many observational interests, not all of them having to do with dark matter, the immediate results of an observation made regarding the Galactic Center region have just been released in a Letter published with *Physical Review Letters*. Titled, "HESS Observations of the Galactic Center Region and Their Possible Dark Matter Interpretation," the Letter reports on the interpretation of data received in 2004.

"HESS observed high energy gamma rays coming out of the Galaxy Center region," Ripken says, "and we wanted to interpret them to see if the gamma rays were produced by dark matter." Finding a dark matter source, and learning about how dark matter works, is one of the quests for scientists interested in studying particle physics. "Part of what we are doing is to see if we can actually find dark matter. And there are some candidates for dark matter that could produce high energy gamma rays."

Looking through the data and performing calculations, members of the HESS Collaboration worked to determine if the 2004 gamma ray observation could be attributed to a dark matter source. After interpreting some scenarios, including analysis of spectral shape, the source of gamma rays remains unclear. The observed gamma rays cannot be explained in such a way as to show that dark matter is their only source. However, a part of the observed emission could be dark matter, and the team calculated how large the fraction might be.

Ripken points out the following: "We are looking at finding or eliminating all possibilities for dark matter that could produce a detectable gamma ray flux. And our Galactic Center is not the only galaxy that could be investigated. One can also observe other galaxies or globular clusters." He continues: "We've investigated some possibilities

of what could be dark matter."

Even though there is no actual technical application for these observations, Ripken believes that there is the possibility for scientific advancement through the HESS Collaboration. And, even though the HESS scientists believe that most of the high energy gamma rays coming from the observed source are not resultant from dark matter, Ripken says that there is the possibility that some of the signal did originate from a dark matter source.

"The most exciting thing about this," Ripken says, "is that it could not only solve one of the fundamental problems of cosmology but also open a window into particle physics not accessible with the energy of present human-made accelerators. The probability that we really find dark matter is not that high, but the scientific breakthrough would be tremendous. So it's worth looking for in cosmic gamma rays."

By Miranda Marquit, Copyright 2006 PhysOrg.com

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