

Physicists and engineers search for new dimension

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The universe as we currently know it is made up of three dimensions of space and one of time, but researchers in the Department of Physics and the Department of Electrical and Computer Engineering at Virginia Tech are exploring the possibility of an extra dimension.

Sound like an episode from the “Twilight Zone?” Almost, but not quite; according to John Simonetti, associate professor of physics in the College of Science and Michael Kavic, graduate student and one of the investigators on the project.

“The idea we’re exploring is that the universe has an imperceptibly small dimension (about one billionth of a nanometer) in addition to the four that we know currently,” Kavic said. “This extra dimension would be curled up, in a state similar to that of the entire universe at the time of the Big Bang.”

The group is looking for small primordial black holes that, when they explode, may produce a radio pulse that could be detected here on Earth. These black holes are called primordial because they were created a fraction of a second after the beginning of the universe.

Black holes are expected to evaporate over time, losing mass and therefore shrinking. A black hole larger than the extra dimension would wrap around it like a thick rubber band wrapped around a hose. As a black hole shrinks down to the size of the extra dimension, it would be stretched so thin it would snap, causing an explosion.

The explosion could produce a radio pulse. Under a National Science Foundation grant, the Virginia Tech group is preparing to set up an Eight-meter-wavelength Transient Array radio telescope in Montgomery County to search the sky for these radio pulses from explosions up to 300 light years away. They have a similar telescope in southwestern North Carolina that has been looking for events for several months.

“We have a number of things in mind that have been predicted to produce radio pulses, which have not been seen,” Simonetti said. “One of them is a primordial black hole explosion.”

“Basically we’re looking for any exotic, high-energy explosion that would produce radio waves,” Simonetti said. He said the establishment of the second radio telescope would help the two telescopes validate one another.

“If a pulse is detected in both instruments at about the same time, that’s a good indication we’re talking about something real as opposed to a pulse from manmade interference,” Simonetti said.

Why search for extra dimensions" One reason has to do with string theory, an area of physics that postulates that the fundamental building blocks of the universe are small strings of matter that oscillate much like a guitar string, producing various harmonics.

“String theory requires extra dimensions to be a consistent theory,” Kavic said. “String theory suggests a minimum of 10 dimensions, but we’re only considering models with one extra dimension.”

Some theorists believe the Large Hadron Collider, a giant particle accelerator being constructed near Geneva, Switzerland, might be able to detect an extra dimension. The Virginia Tech group hopes to detect them via radio astronomy, a much less elaborate and costly endeavor.

The Virginia Tech research team plans to run the search for at least five years. Others involved in the project include physics graduate student Sean Cutchin; College of Engineering professors Steven Ellingson and Cameron Patterson; and graduate students Brian Martin, Kshitija Deshpande, and Mahmud Harun.

“If we had evidence there is an extra dimension, it would really revolutionize how we think about space and time,” Kavic said. “This would be a very exciting discovery.”

For more information about the project, view the project online at www.ece.vt.edu/swe/eta/ .

Source: Virginia Tech

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