A 'New Dimension' at the LHC

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(PhysOrg.com) -- Later this year, the world's largest and most powerful particle accelerator, the Large Hadron Collider near Geneva, Switzerland, will begin operating, sending beams of protons hurling around circular tracks in opposite directions at nearly light-speed and then forcing them to collide, producing a spray of energy and matter.

Scientists' hopes are high for the LHC, with many yearning that its detectors will record evidence of undiscovered theorized particles and new physics. In that respect, a group of physicists considers a new possible discovery: a new dimension. At the LHC, the proton collisions will be powerful enough to probe incredibly minute size scales, perhaps minute enough to open a tiny new dimension.

"While the LHC may uncover what appears to be an extra dimension, it could really be a hologram of some more complicated physics theory," said physicist Veronica Sanz of Boston Univeristy and York University in Ontario, Canada, to *PhysOrg.com*. Sanz is one of three physicists involved in the study.

By "hologram," Sanz and her colleagues aren't referring to a flat image that appears three dimensional. Rather, in the context of particle physics, holography imagines an extra dimension to handle the calculations of strongly interacting systems, like LHC collisions.

Added physicist Adam Martin of Yale University, "LHC could discover a new type of strong interactions wildly different from the strong nuclear force we already know from the Standard Model."

The strong nuclear force is one of the four fundamental physics forces and is what keeps atomic nuclei together, mediated by gluons. The other three forces are the electromagnetic, gravitational, and weak forces. The strong, weak, and EM forces, and the particles that experience them, are all described by a sweeping physics theory known as the Standard Model (gravity is ignored because it is so weak by comparison).

But the Standard Model isn't quite complete: One particle, the proposed "Higgs boson," has yet to be discovered. It is the missing piece of the Standard Model and perhaps the "Holy Grail" of LHC results. If found, it could tell scientists about the origins of mass itself, and why matter can be made of elementary particles that are essentially massless. The Higgs, they think, is responsible for assigning masses to those elementary particles.

But the Higgs may not exist, or may not be found. And if not, Standard Model calculations become unwieldy, as only with the Higgs do the calculations make sense. But a new physical dimension, if only an imaginary one, could make such calculations easier.

"For all we know, extra dimensions may be nature's way of computing the masses of particles," says the study's corresponding scientist, Yale University physicist Johannes Hirn.

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