New work gives credence to theory of universe as a hologram

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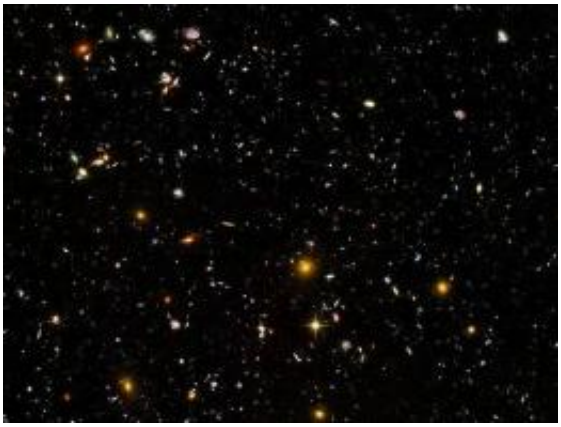

Image credit: Hubble/NASA

(Phys.org) —In publishing a story regarding work reported by Japanese physicists last month, *Nature News* has set off a bit of a tabloid firestorm by describing an obscure bit of physics theory as "the clearest evidence yet that our Universe could be just one big projection." In two papers uploaded to the preprint server arXiv, Yoshifumi Hyakutake and colleagues from Ibaraki University in Japan offer evidence that supports a theory that suggests that a universe as we conceive of it could actually be a hologram of another two-dimensional space.

The papers follow up on a theory first proposed by Juan Maldacen, who in 1997, came up with what is now known as string theory, part of which suggests certain types of universes might actually be holograms of real

two-dimensional universes, which is where, as he described it, "the real action would play out."

String theory was widely embraced by the physics community because it did what no other theory could—provide a bridge across inconsistencies that arose between quantum physics and Einstein's theory of relativity. The inconsistencies became apparent as physicists began contemplating black holes and their properties and found that the while quantum theory could explain what was observed, the theory of relativity could not. The only down side to string theory was that no one could come up with a proof of it. In this new effort, Hyakutake and his team appear to have come closer.

Hyakutake and various colleagues have been working on the problem for years, submitting papers as they go—all leading, apparently, to the two they've most recently uploaded. One of their papers describes mathematically what should happen, according to theory, in a black hole, with numbers that should describe its properties as well. The other describes what should result, theoretically speaking, if there were another, lower dimensional universe with no gravity. What's surprising, of course, is that the two match, suggesting that one could be projecting the other as a hologram.

The papers don't suggest that the universe we actually live in is a hologram, Hyakutake et al's computations describe a universe with ten dimensions in the realm of the black hole and a single dimension universe when calculating characteristics of a gravity free two-dimensional universe. The work does provide a hint however, that what can be calculated using different dimensional universes could perhaps one day be calculated for our own. That of course would imply that what we see and do here might actually be occurring elsewhere and we are merely experiencing its holographic representation.

More information: Holographic description of quantum black hole on a computer, arXiv:1311.5607 [hep-th] arxiv.org/abs/1311.5607

Quantum Near Horizon Geometry of Black 0-Brane, arXiv:1311.7526 [hep-th] arxiv.org/abs/1311.7526