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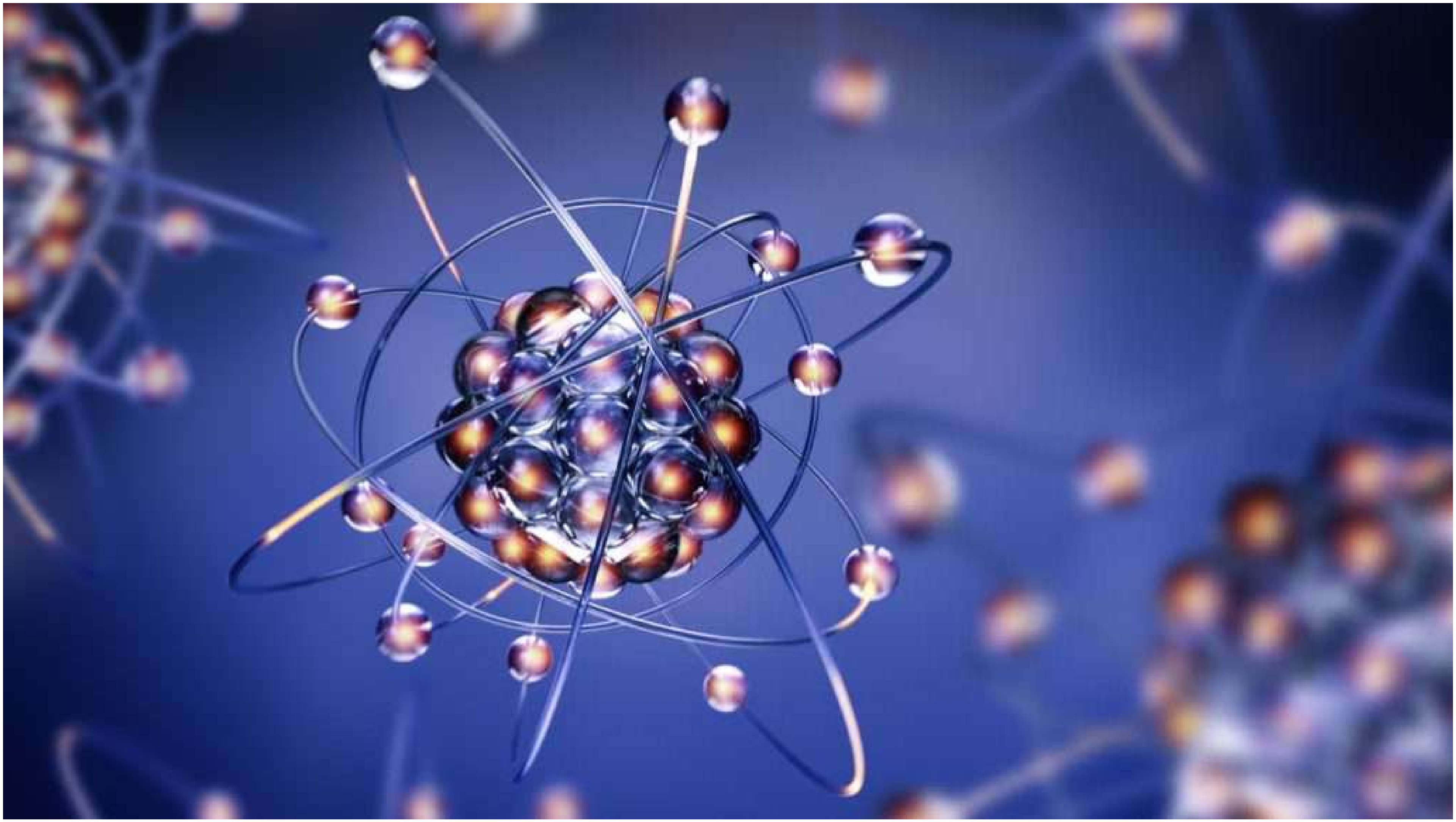
NEWS PHYSICS

Physicists may be a step closer to solving the mystery of proton size

For nearly a decade, the width of the puny subatomic particles has been disputed



Scientists disagree over the size of protons (illustrated within the nucleus of an atom). A new measurement lends additional support to claims that protons are smaller than previously thought.

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By Emily Conover

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If protons wore clothing, the label might read "XXS."

For nearly a decade, scientists have been arguing over the size of the puny subatomic particles: extra small, or extra extra small. A new measurement bolsters the case that protons are more petite than once thought, researchers report in the Sept. 6 *Science*.

Until 2010, the proton's radius was measured at about 0.88 femtometers, or millionths of a billionth of a meter. But then a new type of measurement — based on exotic atoms made with muons, the heavy cousins of electrons — clashed with that figure, registering a proton size of about 0.84 femtometers (*SN: 4/18/17*).

One way to test the proton's radius is by measuring the separation between the energy levels in which hydrogen atoms can exist — different states in which the atom's electron carries a certain amount of energy. That energy difference depends on the size of the proton.

By measuring the separation between two such energy levels, physicist Eric Hessels of York University in Toronto and colleagues have pegged the radius at about 0.83 femtometers, in good agreement with the 2010 value.

The result adds to a small heap of recent studies that have claimed a slightly slimmer proton physique, including a 2017 measurement, made by considering a different set of energy levels in hydrogen atoms (*SN: 10/5/17*), and an estimate reported in October 2018, based on scattering electrons off of protons (*SN: 11/2/18*). However, a study published in May 2018 went against the slim-proton trend, falling in line with the original, larger value of the radius.

The inability to settle on a size is impeding researchers' ability to test essential tenets of physics, like quantum electrodynamics, the theory that describes interactions of electrically charged particles. But resolving the debate is likely to be no small feat.

CITATIONS

N. Bezginov et al. A measurement of the atomic hydrogen Lamb shift and the proton charge radius. *Science*. Vol. 365, September 6, 2019, p. 1007. doi: 10.1126/science.aau780