Beyond the Higgs boson: Five reasons physics is still interesting

November 18 2013, by Andrew Steele

But this still exists. Credit: Hubble Heritage Team

Would physics be "far more interesting" if the Higgs boson had not been found? Stephen Hawking thinks so. He made this bold claim, possibly with his tongue slightly in his cheek, at the opening of a new exhibition at the Science Museum in London that celebrates particle physics.

With the boson in the can, the Nobel gongs handed out, and the particle collider where it was discovered offline for a two-year upgrade, why are we still doing physics? Here are five possible reasons:

1. Still in the dark

With the discovery of the Higgs, the crucial final piece of physicists' cosmic jigsaw known as the Standard Model has been put in place. However, there is plenty still to play for in particle physics. For example, we cannot explain why we are here at all. The Standard Model, for all its mathematical elegance and incredible real-life precision, predicts that the universe should just be a sea of cold, lifeless light.

When the universe began, there should have been equal quantities of matter and antimatter. Matter and antimatter aren't happy bedfellows and, on contact, tend to annihilate in a flash of light. Yet, somehow, a little bit of matter was left over, and some of it evolved into beings capable of conscious thought who are currently contemplating how their existence is even possible. What could be more interesting than a gloriously recursive existential crisis?

2. Magnets, how do they work?

The particle physicists may have nailed down the behaviour individual subatomic particles, but the collaborative shenanigans of trillions of particles together in a solid or a liquid still often elude explanation. From semiconductors to magnets, we do know how many materials work. However, there are some exotic substances that we still don't understand, such as superconductors: how can these weird materials conduct electricity with no loss of energy whatsoever? Currently, superconductors only function when kept at a couple of hundred degrees below freezing. If we could get them working at room temperature, we could ride the wave of technological revolution.

Incidentally, the Higgs mechanism (which gives rise to the eponymous boson) was first postulated by theoretical physicists investigating

superconductivity. The same mathematics describes electrons in super-cold lumps of superconducting metal, and the Higgs field which permeates the entire universe and gives all particles its mass.

3. The fastest mirror in the universe

Since physics probes the biggest, smallest, fastest, slowest, coldest and hottest things in the universe, it plays host to some jaw-dropping experiments.

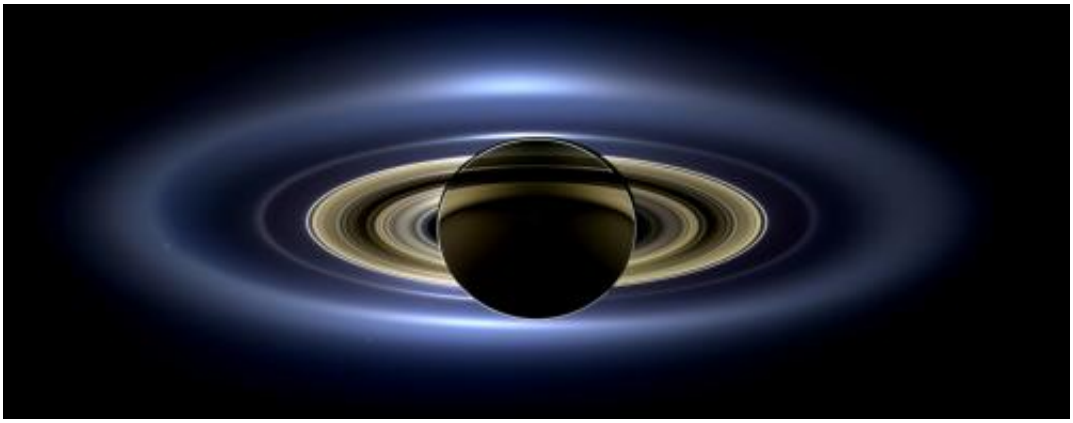
Want to detect neutrinos, the tiniest particles in existence? Deploy a 50,000-tonne tank of ultra-pure water a mile underground in a Japanese zinc mine, surround it with 10,000 ultra-sensitive detectors, and watch for almost-invisible flashes of light. Simple.

Want to double-check Einstein's theory of relativity? The man himself once devised a thought experiment where you reflect a beam of light off a mirror travelling at a significant fraction of the speed of light. It is a thought experiment no longer: physicists actually did it, bouncing light off a mirror made from electrons travelling at thousands of miles per second. (It worked, and Einstein still seems to be right.)

4. Nuclear fusion

What science other than physics could provide us with the possibility of a near-infinite source of clean energy? In nuclear fusion, the source of power which keeps the stars shining, hydrogen atoms heated to millions of degrees smash together and form helium, releasing vast quantities of delicious energy in the process. Physicists and engineers reckon that, for about the same amount of money budgeted to build Britain's new high-speed rail project HS2, we could get from today's experimental fusion reactors to industrial-scale machines delivering electricity to the grid. So,

that's almost unlimited, pollution-free energy, all for around £50 per person in the developed world. So not only is physics interesting, but it's a bargain too.



Credit: NASA/JPL-Caltech/SSI

5. Space

This image was taken by Cassini, a robotic probe orbiting Saturn. If the backlit splendour of Saturn's intricate, sparkling ring system isn't enough for you, the pale blue dot in the bottom right of the image is none other than us: planet Earth, staring back.

There is so much of our Universe left to explore, whether by spaceship or telescope, whether lakes of liquid methane on moons within our solar system, or planets orbiting distant stars in solar systems of their own.

Indeed, in Hawking's own words: "Remember to look up at the stars and not down at your feet. Try to make sense of what you see and hold on to that child-like wonder about what makes the universe exist."

Maybe he is not so cross about the yawn-inducing Higgs disappointment after all?

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