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## What we know for certain about uncertainty

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**DR. ROBERT BUCKMAN**  
 SPECIAL TO THE STAR

Physics research by Jeff Lundeen and Aephraim Steinberg at the University of Toronto shows that subatomic particles continue behaving normally even when nobody's looking at them.

In other words, electrons carry on doing their electron-type jobs (such as whirling) day and night whether anybody is actually observing them or not.

I had simply assumed that the laws of physics were always and perpetually obeyed: I mean 24/7, including bank holidays and even during a recession when everything seems to be slowing down.

I figured it was business as usual on the subatomic scale and on the cosmic scale, and always felt confident, for example, that while I'm asleep, the universe will continue spinning and expanding as it does during the day. And that it will still be there when I wake up.

Apparently that assumption was somewhat blithe. There were some quite serious doubts about it (at least on the subatomic scale) and about the nature of reality. And where did all this doubt come from? Who started it?

Personally, I blame Werner Heisenberg.

Heisenberg – he of the Heisenberg Uncertainty Principle – was an utterly brilliant nuclear physicist (a friend of Einstein and Born and that gang) who said that it was never possible to determine an electron's position and its velocity at the same time. I'm still not sure why anybody would have wanted to do that in the first place, but Heisenberg's Uncertainty Principle said you couldn't do it anyway, and that was that.

Anyway, the whole business apparently gets more complex when we think of pairs of particles which can cancel each other out. I gather a lot depends on the behaviour of pairs of things, such as particles of matter paired with particles of anti-matter. Now I don't actually know what anti-matter is, but I think it's stuff you can get in a cream that will abolish cellulite.

It was always assumed (by almost everyone, not just me) that particles of matter and particles of anti-matter would perfectly cancel each other out, releasing a burst of energy.

But there was this nagging doubt that they might do something different, say, on Sundays, during the summer, or in alternate universes and places such as Idaho.

Lundeen and Steinberg did some experiments (now confirmed by Kazuhiro Yokota of Osaka University in Japan) with photons – which are the smallest particles of light – and anti-photons – of which I do not have the foggiest conception.

Perhaps anti-photons are the smallest particles of darkness, and if you put a lot of them together you get a black hole or some other matter-destroying device. For example, Bernie Madoff. Anyway, photons apparently go around in pairs due to a process called Quantum Entanglement, which I think is like a dating service for very small (and presumably lonely) particles.

It turns out the experiments in Toronto and Osaka clearly show that even when you're not looking directly at them, photons and anti-photons still stick to the proper rules and are upright, laws-of-physics-abiding citizens all the time.

So the universe does do things properly and in an orderly and trustworthy way after all.

And the cosmos is basically Canadian in its outlook and respect for the rules. What a relief!

*Dr. Robert Buckman is a medical oncologist at Princess Margaret Hospital and professor at the University of Toronto.*



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