The Uncertainty Principle

Near the end of the Nineteenth Century physicists believed that they were getting close to sorting out the rules of reality once and for all. Please forgive them – this mistake has been made a few times over the years. At the time some scientists were trying to get an accurate measure of the influence of the "ether" on the speed of light. A couple of chaps at a university in Ohio performed what is now called the "Michelson-Morley Experiment". The details can be found online but basically the experiment failed to find a difference. This result was a clanger that completely destroyed the theories so far in use – which admittedly had worked quite well.

So in 1905 Albert Einstein said suppose we just accept that the speed of light is constant in a vacuum. What does this mean? This led him to the Special Theory of Relativity. This is the point at which most people will glaze over because some of the concepts of relativity are a bit hard to understand.

In 1927 Werner Heisenberg used the principles of Relativity to publish a "concrete" fact: it is impossible to simultaneously determine both the position of an object and the momentum of an object accurately. i.e. the more you know about an object's position the less you know about its momentum and vice versa. At reasonably large object sizes the degree of uncertainty is so small that we cannot really detect it – which is why no-one noticed for a long time. However when the object sizes get down to sub-atomic sizes then it *really does matter*. This new field of science became known as Quantum Physics. For us the most important feature of Quantum Physics is the use of Probability Functions to describe the position or state of particles. E.g. electrons no longer have fixed positions around a nucleus – they have spaces called "orbitals" where there is a certain *probability* that you can find the electron.

So currently we have three different models of physics in use: the Newtonian model (where things make sense to us and which describes most objects at most speeds); the Relativistic model (which describes really fast objects); and the Quantum model (which describes really small objects). Oh yes – when you deal with really small objects that go really fast you have to use both the Relativity and Quantum models.

Why does this matter? Well it means that we cannot expect the world around us to be deterministic. In our every day experience today probably will unfold much the same as yesterday unless you are travelling too close to the speed of light but it is still not guaranteed. The reality we take for granted is built not on a solid rock but on a web of probability.

When life gets difficult people tend to cling to certainty but the "certainty" to which we cling is (at the bottom level) as solid as smoke. Instead we should not just cope with but relish the gray areas. Religion has gray areas. Psychology has gray areas. Science has gray areas. This could become quite repetitive but I think you get the pattern. Having uncertainty does not mean something is "Wrong". Far from it. In fact it really means that it is more likely to be "Right".

Sean Bennett

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