Our natural world – or why physics is so interesting

Some of our SciBar participants prepared this glossary, independently of Professor Forshaw. Your feedback on the level of information and usefulness of the SciBar glossaries is most welcome.

Classical physics Non-quantum physics – a system where general principles of physics developed before the rise of relativity and quantum mechanics are valid. Practically, this means at the scale of larger than atoms and molecules.

Large Hadron Collider (LHC) A particle accelerator at CERN, used to accelerate a beam of charged particles (such as protons) to near the speed of light, in order to collide them at very high energies. The hope is that this will release exotic particles that are not normally observed.

Photon A tiny packet of light energy, or of other radiation (such as infrared, ultraviolet, radio, X-rays).

Photon energy The energy of all radiation is quantised so that it can only have certain allowed values.

Quantum (pl. quanta) From the Latin meaning “how much”. Quantum physics deal with matter and energy that can only come in certain amounts.

Quantum effects Quantum theory allows predictions about the natural world that are often counter-intuitive compared to classical physics. For example, it is possible for the same particle to be in two states – doing two contradictory things simultaneously. The effects originate at the atomic and subatomic scale, so for large objects like people, the effects are unnoticeable.

Quantum mechanics The branch of modern physics that accurately describes the dual particle-like and wave-like behaviour of matter and energy in the microscopic world of atoms and subatomic particles. Many inventions such as semiconductors and lasers are made possible by quantum mechanics.

Relativity In Einstein’s theory of special relativity, time runs slow for fast-movers (and from the point of view of a beam of light, no time passes at all). For speeds approaching the speed of light, relativity also gives length contraction.

Subatomic particle Particles smaller than atoms, including protons, neutrons, electrons and quarks.

Uncertainty principle In quantum mechanics it is impossible to know both a particle's exact position and its motion. This is far different from classical physics, where it is possible to know an object's position and speed exactly.

Wave function The probability of finding a “particle” or system of particles at a certain time and position. If the probability is “smeared” (spread through all of space), the position of the particle is completely uncertain.

Wave-particle duality Current physics holds that both light and matter have a dual nature, which can be wave-like or particle-like depending on the experiment we use to detect it. The smaller an object, the more wave-like it becomes.

Useful weblinks:

One hundred years of quantum physics: http://www.4physics.com/phy_demo/QM_Article/article.html

Article published in Science magazine in 2000. An accessible, non-mathematical summary of quantum ideas and their importance.

Next SciBar: Monday October 17: Dinosaurs by Dr Phil Manning. Time: 6.30pm as usual.