Physics

visualising the invisible

Explore how physics goes beyond human perception

Physics and... the big questions

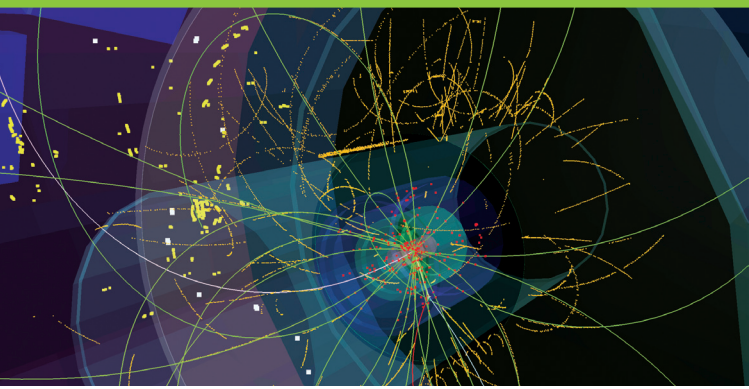

Image credit: CERN and ALICE

Cristina, a particle physicist at the University of Birmingham, studies how sub-atomic particles interact in an attempt to understand the evolution of the universe.

The set of theories known as the **Standard Model** describes the universe at the smallest scale in terms of just a few types of particles and the interactions between them. It is our current best explanation and successfully describes a wealth of experimental data, but some puzzling questions remain.

What makes things heavy? Why is gravity so feeble? What keeps galaxies spinning? Why are there no anti-worlds? Research being carried out now at the **Large Hadron Collider** (LHC) will help find the answers.

Find out more about what **Cristina Lazzeroni** does at **www.physics.org/careerprofiles.asp**

Physics and... non-destructive testing

Image credit: University of Warwick

Rachel uses **ultrasound** to ensure your safety on planes, trains and rollercoaster rides. An assistant professor at the University of Warwick, she develops new techniques for **non-destructive testing** using high-frequency sound waves.

Ultrasound can reveal hidden wear, defects and cracks inside objects and structures before the damage becomes catastrophic. And new techniques that work at high speeds have the potential to improve monitoring of the entire rail network in the UK.

The physics underlying ultrasonic measurements is now also being used to look at the fundamental properties of single crystals of new materials – paving the way for the next set of technological developments.

Find out more about what **Rachel Edwards** does at **www.physics.org/careerprofiles.asp**

Physics and... the brain

Image credit: Diamond Light Source

Mary, a PhD student at the University of Warwick, investigates changes in the iron in our brains to see if they could be an early indicator of Alzheimer's disease.

Our brains need iron, copper and zinc to work properly, but they're present in such tiny amounts that they can be very difficult to detect. Being able to study the subtle changes in the way the brain stores and uses these elements can shed light on degenerative disorders, such as Alzheimer's and Parkinson's disease.

High-intensity X-rays (from a synchrotron light source) and **Magnetic Resonance Imaging** (MRI) are at the forefront of research that promises to improve the detection and diagnosis of brain disorders in living patients.

Find out more about what **Mary Finnegan** does at **www.physics.org/careerprofiles.asp**

Physics and... the universe

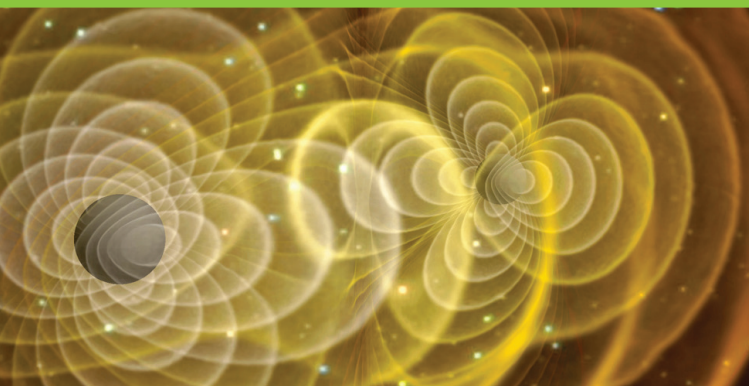

Image credit: Henze/NASA

Andreas, a physicist at the University of Birmingham, is trying to detect the tiny vibrations in space–time caused by cosmic explosions and colliding **black holes**.

We know very little about what happens near black holes or how they evolve since their gravity is strong enough to prevent anything, including light, from escaping. But very large laser antennas are now being used to detect the tell-tale signs of black holes by listening to tiny vibrations in space–time called **gravitational waves**.

Gravitational waves may also hold the key to the next big challenge facing astrophysicists – seeing what happens when black holes collide!

Find out more about what **Andreas Freise** does at **www.physics.org/careerprofiles.asp**

Further information

Brain imaging:
www.diamond.ac.uk/Home/Teachers.html

Particle physics:
www.ep.ph.bham.ac.uk/discovering-particles

Black holes:
www.gwoptics.org/bhp

Non-destructive testing:
www2.warwick.ac.uk/fac/sci/physics/research/ultra/research/rail_inspection

Your complete guide to physics on the web:
www.physics.org

Thank you to the staff and students of the universities of Birmingham and Warwick for their help at the Big Bang Fair.

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