Historical Developments

Overview

The research being undertaken today at ISIS would not be possible without the pioneering work and discoveries of the many scientists who have gone before.

Within this section you have the opportunity to find out about the achievements of just some of the physicists and chemists who have contributed to our scientific understanding of the structure and behaviour of atoms.

Appleton

Edward Victor Appleton (1892–1965)

This British physicist was born and educated in Bradford before studying at Cambridge for his BA in Natural Science.

As a result of Appleton's work in atmospheric physics he was able to prove the existence and height of the layer in the upper atmosphere now known as the ionosphere, and discovered a further atmospheric layer which was named after him.

He was awarded the Nobel Prize for Physics in 1947 for his 'investigations of the physics of the upper atmosphere especially for the discovery of the so-called Appleton layer'

Appleton's work using radio techniques led to significant developments in radio research, round-the-world broadcasting and the development of radar.

de Broglie

Prince Louis-Victor Pierre Raymond de Broglie (1892–1987)

In 1929 French physicist de Broglie was awarded the Nobel Prize for Physics 'for his discovery of the wave nature of electrons'.

De Broglie delivered a thesis in 1924 in which he outlined his ideas concerning electron waves and proposed the particle-wave duality theory, i.e. that matter has the properties of both particles and waves.

Such ideas provided the basis for the development of the general theory now known as wave mechanics.

After being awarded the Nobel Prize De Broglie continued his work on wave mechanics, publishing works on the electron, light, spin and on applications of wave mechanics to nuclear physics.

Bragg

William Lawrence Bragg (1890–1971)

Born and educated in Australia, William Lawrence Bragg came to Britain to study and work at Cambridge University. Between 1912 and 1914 he worked with his father on the use of x-rays in the analysis of crystal structures. It was as a result of this work that he became the youngest-ever laureate at the age of just 25.

He shared the Nobel Prize for Physics in 1915 with his father William Henry Bragg, for their 'services in the analysis of crystal structure by means of x-rays'

In addition to determining the atomic arrangements of both sodium chloride and potassium chloride, he and his father also deduced the structure of diamond.

The importance of their work is reflected in the continued use of Bragg's law and the Bragg equation in the investigation of the structures of crystalline materials.

Photo of the Cavendish Laboratory in 1932, the year the Neutron was discovered

Rutherford, Chadwick, Walton, Cockcroft and JJ Thompson can all be found in the photo

Brockhouse

Bertram N. Brockhouse (1918–)

This Canadian physicist shared the Nobel Prize for Physics in 1994 with Clifford G. Shull for 'pioneering contributions to the development of neutron scattering techniques for studies of condensed matter' – specifically for his 'development of neutron spectroscopy'.

As neutrons pass through a material some are deflected by atoms and their level of energy changes. Brockhouse invented the triple-axis spectrometer to measure the energy and momentum of the neutrons after they have been scattered by the atoms of a crystal.

Chadwick

James Chadwick (1891–1974)

This British physicist, who was born and educated in Cheshire, was awarded the Nobel Prize for Physics in 1935 for 'the discovery of the neutron'.

In 1932 Chadwick discovered a new particle in the nucleus of an atom, an electrically neutral elementary particle that consequently became known as the neutron.

This was a fundamental discovery in the field of nuclear science. It provided a new tool for studying atomic disintegration, and prepared the way for the fission of uranium-235 and the development of nuclear power.

Cockcroft

John Douglas Cockcroft (1897–1967)

Cockcroft's early work involved the production of intense magnetic fields and low temperatures. This was followed by work on the acceleration of protons by high voltages and in 1932 he and Walton succeeded in splitting lithium atoms by bombarded them with accelerated protons.

They then used high-speed protons to produce artificial radioactivity, which allowed them to study a wide variety of transmutations produced by protons and deuterons.

John Cockcroft and Ernest Walton were jointly awarded the Nobel Prize for Physics in 1951 for 'their pioneer work on the transmutation of atomic nuclei '.

Dalton

John Dalton (1766–1844)

In 1808 this English chemist and physicist first proposed his atomic theory of matter. In this he suggested that each chemical element is composed of tiny, identical, indestructible particles called atoms, and that elements are different because they are each made of different atoms.

His theory further proposed that each atom has a characteristic mass and that atoms of elements are unchanged in chemical processes.

Democritus

Democritus (c.460 –361 BC)

Democritus was a Greek philosopher believed to have lived between c.460 and 361 BC. He believed that everything in the universe was made from microscopic and indestructible particles which he called atoms (from the Greek word for indivisible: atomon), and that differences between things are due to the shape and arrangement of their atoms.

Geiger

Johannes (Hans) Wilhelm Geiger (1882–1945)

Born and educated in Germany, on graduation Hans Geiger joined Ernest Rutherford at Manchester University where he first devised his particle counter. This invention enabled the identification of the alpha particle as the nucleus of the helium atom. It was also used to verify Rutherford's proposal that the nucleus of an atom occupies a very tiny part of the volume of the atom.

Following his return to Germany, Geiger began a collaboration with Walther Müller which led to the refinement of his original particle counter. The Geiger-Müller counter detects and measures the strength of ionising radiation, including alpha rays, beta rays and cosmic rays.

Rutherford

Ernest Rutherford (1871–1937)

Ernest Rutherford was a pioneer of modern atomic science. His main research was in the field of radioactivity, and he discovered alpha, beta and gamma rays.

Rutherford was the first to recognise the nuclear nature of the atom. In 1911, as a result of what is known as the Rutherford Scattering Experiment or the Alpha Particle Scattering Experiment, he discovered and named the nucleus.

This New Zealand-born British physicist was awarded the Nobel Prize for Chemistry in 1908 for 'his investigations into the disintegration of the elements, and the chemistry of radioactive substances'.

Shull

Clifford G. Shull (1915–2001)

This American physicist shared the Nobel Prize for Physics in 1994 with Bertram N. Brockhouse for 'pioneering contributions to the development of neutron scattering techniques for studies of condensed matter' – specifically for his 'development of the neutron diffraction technique'.

Shull's first successful experiments with neutron diffraction opened up a large field of research into how hydrogen is bound in, for example, ice, metallic hydrides and organic compounds. As the nucleus of the hydrogen atom, the proton, constitutes a very efficient neutron scattering centre, its position can be determined using neutron diffraction. This had not been possible with x-ray scattering as x-rays are scattered by the electrons in atoms and the hydrogen atom has only one electron.

Shull also found a new type of neutron diffraction where the neutrons can change direction through magnetic interactions with the atoms of a material. It is hard to imagine modern research into magnetism without this.

Thomson

Joseph John Thomson (1856–1940)

This Manchester born and educated physicist became a lifelong member of Trinity College, Cambridge after joining as a scholar in 1876. He became a lecturer in 1883 and a master in 1918.

In 1897 he achieved what has been acclaimed as the most brilliant work of his life – an original study of cathode rays culminating in the discovery of the electron.

J.J. Thomson's model of the atom and electron became known as the 'plum pudding' model. He pictured the atom as a neutral particle made of a large positive charge (the pudding) containing clumps of negative charge or electrons (the plums).

He was awarded the Nobel Prize for Physics in 1906 'in recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases'.

Walton

Ernest Walton (1903–1995)

Ernest Walton was an Irish physicist whose early research focused on hydrodynamics, followed by work on indirect methods for producing fast subatomic particles.

He then worked with John Cockcroft, using high voltages to produce fast particles. As a result of their work they were the first to 'split the atom', which they achieved by bombarding the nucleus of lithium atoms with accelerated protons.

Walton shared the 1951 Nobel Prize for Physics with John Cockcroft for 'their pioneering work on the transmutation of atomic nuclei by artificially accelerated atomic particles'.