Part of the 2008 Nobel Prize

13 Slovene scientists played an important role in the experimental validation of the theory that won this year's Nobel Prize in Physics.

By Matija Pavlič

When this year's winners of the Nobel Prize in Physics–Japan's Makoto Kobayashi and Toshihide Maskawa, and an American of Japanese descent Yoichiro Nambu–heard the good news, the trio was not the only one that went ballistic. A group of 13 Slovene scientists working abroad in Japan shared their sentiment, while the news quickly spread to the other side of the globe and was greeted in style at the group's home base - the Jožef Stefan Institute, Ljubljana–Slovenia's powerhouse in scientific development.

Experimental validation

Slovene physicists from the Jožef Stefan Institute and the Universities of Ljubljana, Maribor and Nova Gorica played an important part in the experimental validation of Kobayashi-Maskawa's Nobel Prize winning theory. The group of 13 scientists working under the leadership of Peter Križan PhD, a Professor of Physics at the Faculty of Mathematics and Physics, Ljubljana, joined the Belle experiment at the Japanese institute KEK some twenty years ago. It became quickly obvious that Kobayashi and Maskawa had a revolutionary theory that could result in winning a Nobel Prize if experimentally validated. After many years of hard work the Slovene group of scientists was accepted into the Belle Group in Tsukuba (which is an international group since the physics of basic particles in a vastly international field) where it conducted extremely difficult measurements registering a disintegration of particles that live only for a billionth of a second, which experimentally confirmed Kobayashi-Maskawa's theory to a large extent.

Revolutionary theory

Kobayashi and Maskawa presented their revolutionary theory in 1973 predicting that the existence of six types of basic particles called quarks was the only valid explanation for experimental evidence on symmetry violation in basic particles. At the time only three types of quarks were known, which made Kobayashi and Maskawa's assumptions rather bold; yet after a couple of decades it has now been proved that their theory was ahead of time, offering an explanation for a phenomenon that caused differences between particles and their antiparticles, which none understood at the time.

The universe is formed out of matter almost exclusively, not antimatter. The key for this supposedly lies in the small difference between the frequency of decay of particles and antiparticles. What Kobayashi and Maskawa did was to predict that this was only possible if six different types of quarks existed. Eleven years after the publication of their theory, physicists discovered heavier particles that contained the three missing quarks, but to prove a violation of symmetry between these particles and their antiparticles more time had to pass. In 2002 it finally happened–the Belle and Babar research groups conducting research in Japan and the USA discovered this violation.

Kobayashi and Maskawa share their prize with Yoichiro Nambu for his discovery of the mechanism of spontaneous broken symmetry in subatomic physics.

Slovene physics of basic particles

The researchers of the Department of Experimental Physics of Basic Particles at the Jožef Stefan Institute (conducting research of basic particles in nature and their interaction, also researching the development and the use of technologically demanding particle detectors) in collaboration with colleagues from the Universities of Ljubljana, Maribor and Nova Gorica conduct their research in three international centres: European Organisation for Nuclear Research (CERN) in Geneva, Switzerland; German research centre DESY in Hamburg and High Energy Accelerator Research Organisation (KEK) in Tsukuba, Japan.

They are also part of four international groups: ATLAS, a particle physics experiment at the Large Hadron Collider at CERN; DELPHI, a particle physics experiment at CERN studying the products of electron-positron collisions at the LEP circular accelerator; BELLE, an experiment at KEK B-factory studying the origin of CP violation and HERA-B, a fixed target experiment at the 920 GeV HERA proton beam at DESY using a variety of nuclear targets.

Slovene scientists are also part of the construction and test measurements of cosmic particles containing highest energies at the Pierre Auger Observatory in Argentina, which is an international cosmic ray observatory designed to detect ultra high energy cosmic rays, i.e. ultra-high-energy particles.

Knowing that you were part of this year's Nobel Prize in Physics certainly makes for a nice recognition of your overall work. The group of 13 Slovene scientists working at the Belle Experiment at the High Energy Accelerator Research Organisation (KEK) in Japan–where this year's Nobel Prize laureate Makoto Kobayashi is also employed–said they will now have all the more reason to continue their hard work with increased vigour and determination. ■

Professor Peter Križan, leader of the Slovene group.