2005 EU Descartes Prize for Research Laureates

Winner

EXEL - Extending electromagnetism through novel artificial materials

Field of research *PHYSICS*

Project teams – contact persons

- Prof. Costas Soukoulis, Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), Greece
- Prof. Ekmel Ozbay, Bilkent University, Turkey
- Prof. John Brian Pendry, Imperial College of Science, Technology and Medicine, South Kensington Campus, United Kingdom
- Prof. Martin Wegener, University of Karlsruhe (TH), DFG-Centre for Functional Nanostructures (Karlsruhe-CFN), Germany
- Prof. David R. Smith, Duke University, United States

Description: The EXEL research team created and developed a novel class of artificial metamaterials, called Left-Handed Materials (LHMs) or Negative Index Materials (NIMs), which are able to overturn many familiar properties of light. Around 40 years ago, Russian scientist Victor Veselago postulated the idea of such materials, which are not actually found in nature. Thirty years later, UK theoretical physicist Sir John Pendry proposed designs for two artificial metamaterials, respectively composed of non-magnetic metallic wire arrays and split ring resonators (SRRs), which would meet the NIM criteria. EXEL project researchers were able to demonstrate the reality of these materials and their consistency with the basic laws of physics. This realisation has opened up the possibility of unprecedented applications. The team has already shown how the ability to focus radio waves could lead to smaller, better performing magnetic resonance imaging (MRI) machines. Numerous applications in the cellular communications industry are also envisioned, including antennas and waveguides that are 100 times smaller and much lighter than those of today. Even slight improvements to these types of devices can make a significant financial impact.

Winner

CECA- Climate and environmental change in the Arctic

Field of research *EARTH SCIENCES*

Project teams – contact persons

- Prof. Ola M. Johannessen, Nansen Environmental and Remote Sensing Centre NERSC, Norway
- Prof. Lennart Bengtsson, Max Planck Institute for Meteorology, Germany
- Dr. Leonid Bobylev, Nansen International Environmental and Remote Sensing Centre, Russia

Description The CECA project involved a number of multi-disciplinary research activities that have been carried out over the past decade on climate and environmental change in the Arctic. CECA has addressed environmental problems of pan-European relevance and significance. The scientific objectives of the research teams were centred upon a systematic and integrated analysis of diverse observational and model-generated data sets. Through a combination of *in situ* observation, satellite retrieval and computer modelling, the researchers were able to achieve scientific breakthroughs and innovations that advance our understanding of many aspects of the Arctic climate system and its influence on Europe. The team also investigated how increased greenhouse gases will interact and influence the natural variability of the weather system in the North Atlantic and Arctic regions. The CECA consortium has identified a number of potential human and socio-economic consequences of the undoubted shrinkage of Arctic sea-ice cover, not all of which are negative. These include reductions in solar reflections from the ice, exposure of vast areas to the cold open water of the Arctic Ocean, broad changes in the marine ecosystem and milder conditions in high latitudes.

Winner

PULSE - Pulsar Science in Europe:
The impact of European pulsar science on modern physics

Field of research *PHYSICS*

Project teams – contact persons

- Prof. Andrew Lyne, University of Manchester, Jodrell Bank Observatory (JBO), United Kingdom
- Prof. Nicolo D'amico, INAF Osservatorio Astronomico di Cagliari, Italy
- Dr. Axel Jessner, Max Planck Institut fur Radioastronomie, Germany
- Dr. Ben Stappers, ASTRON, The Netherlands
- Prof. Ioannis Seiradakis, University of Thessaloniki, Greece

Description Pulsars are rapidly rotating neutron stars resulting from the violent collapse of a massive star in a supernova explosion. Observing pulsars offers the unique opportunity to study some of the most extreme physical conditions in the universe. Monitoring apparent variations in pulse-rates makes it possible to test theories of relativity, follow their precise motion in space, explore the solid-state physics of super-dense matter and more. Since the equipment needed to study these stars can be costly to build and to run, scientists across Europe came together to found the European Pulsar Network (EPN). In collaboration with the Australian Telescope National Facility, EPN members combined instrumentation and software efforts, coordinated observing programmes, developed a common data format and set up a universal database for all observational feedback. This collaboration enabled them to locate over 850 pulsars, more than the total number found in all surveys spanning the previous 30 years. The height of the researchers' activities is undoubtedly the discovery of the first double pulsar. The existence of such a system is remarkable, since its two components needed to have survived twin supernova explosions.

Winner

ESS- European Social Survey - innovations in comparative measurement

FIELD OF RESEARCH SOCIO-ECONOMIC SCIENCES

Project teams – contact persons

- Prof. Roger Jowell, City University, Northampton Square, United Kingdom
- Prof. Peter Mohler, Zentrum fuer Umfraged, Methoden un Analysen (ZUMA), Germany
- Ms. Ineke Stoop, Sociaal en Cultureel Planbureau (SCP), The Netherlands
- Prof. Willem Saris, Universiteit van Amsterdam (UvA), The Netherlands
- Prof. Jaak Billiet, Katholieke Universiteit Leuven (KUL), Belgium
- Mr. Bjorn Henrichsen, Norwegian Social Science Data Services, Norway
- Dr. Henk Stronkhorst, European Science Foundation (ESF), France

Description.The ESS project is a major collaborative effort designed to pioneer and validate a standard of methodology for cross-national surveys. The primary objectives of ESS were to: chart and explain long-term attititudinal and behavioural changes in the social, political and moral climate within and between the European Member States; transform and spread new standards of rigour in comparative social measurement in Europe; and develop social indicators of national advancement that supplement existing indicators. With ESS, Europe has for the first time an authoritative and accurate source of data about its changing social values which, in turn, informs academic and political debate and allows the EU to measure changes in values of its citizens. Within 18 months of the public release of the first round data, nearly 6 000 registered users had begun analysing the content and producing journal articles, dissertations and books.

Winner

EURO-PID
European initiative on primary immunodeficiencies

Field of research *LIFE SCIENCES*

Project teams – contact persons

- Prof. Alain Fischer, Institut National de la Santé et de la Recherche Médicale (INSERM), France
- Prof. Jean-Laurent Casanova, University of René Descartes-INSERM Unit 550, France
- Prof. C.I. Edvard Smith, Karolinska Institutet (KI), Sweden
- Prof. Lennart Hammarström, Karolinska Institutet (KI), Sweden
- Prof. Luigi Daniele Notarangelo, Universita degli Studi di Brescia (UNIBRE), Italy
- Prof. Adrian Trasher, University College London (UCL), United Kingdom
- Dr. Anna Villa, CNR Instituto di Tecnologie Biomediche (CNR-ITB), Italy

Description The EURO-PID project focused on a group of more than 130 rare genetically determined diseases known as primary immunodeficiencies (PIDs). PIDs leave sufferers, mostly children, prone to infection, lymph cell proliferation and autoimmune disorders. A consortium of seven European research teams employed a combination of clinical immunology and basic scientific studies to understand the molecular mechanisms responsible for certain conditions. These efforts produced a wealth of information about how cells in the immune system differentiate and accomplish their specific functions as well as regulate immune responses.

During the five-year project, EURO-PID researchers described defects in 20 important defensive genes and successfully developed a promising form of gene therapy for one type of severe combined immunodeficiency (SCID). The researchers believe that the project's findings will continue to benefit patients through new diagnostic, prognostic and therapeutic tools.