Radio astronomy began with the discovery of cosmic radio signals by Karl Jansky in the early 1930’s, and has greatly changed our view of the Universe. It was early realized that groups of radio telescopes could be used to reveal finer detail in radio images of astronomical objects. Very Long Baseline Interferometry can obtain resolutions 50–100 times better than the Hubble Space Telescope achieves. Today, radio astronomy is undergoing a technological revolution, with data sent from telescopes to processing centres along optical fibres at enormous rates of up to 30 Gbit/sec. Current development efforts are pushing toward the Square Kilometre Array – an international radio telescope with unprecedented high sensitivity planned to be finished in 2025.

Denise Gabuzda is a Senior Lecturer in the Department of Physics, UCC. Before coming to UCC, she carried out astrophysics research at universities and institutes in California, Canada, Russia, Japan and the Netherlands. Her research focuses on the origin and physical nature of “jets” of radio-emitting material that are ejected from the centres of active galaxies, and she is especially interested in finding new and creative ways to link observation and theory.

Future energy infrastructure must accommodate not only large centralized power and energy sources, but also input from the growing array of distributed resources. Such widespread resources will include renewable energy from wind, ocean, solar and biomass and the use of bulk and small scale energy storage. The transition from a simple centralized energy system to a complex multi-source system will require a host of new and improved functions. This lecture will describe the new architecture and identify changes required for optimized operation of future energy systems.

Eamonn McKeogh is a Senior Lecturer, Department of Civil & Environmental Engineering, UCC. His research is focused on the control and prediction of sustainable energy from sources such as wind and solar energy, and biomass. He recently investigated the use of pe-clusters for long cycle wind energy forecasting and storage scheduling. Dr. McKeogh is currently involved in the development of a National Energy Competence Centre. His current research project is Assessment of the European Terrestrial Carbon Balance, EU 6th Framework programme.

In the recent International Partnership for Change Conference in Cork, November 2008, on global warming the topic of sea level changes linked to that of regional climate variability attracted most attention. The impacts of future rises in sea level under global warming may have profound effects in the 21st century on about 50% of the world’s population. The lecture will explore this and other questions about the impacts of global warming.

Robert Devoy is a Professor in Physical Geography at UCC and a lead author of the International Panel on Climate Change’s (IPCC) Nobel Prize (2007) winning Fourth Assessment Report. He has an international reputation in the field of coastal science, physical geography and palaeoenvironmental research. Recently his work has focused on the repercussions of climate change upon coastal processes and sea-level rise in particular. Work on tsunamis in New Zealand is another topic of current research. He was the founder and Director until 2002 of the Coastal and Marine Resources Centre (CMRC), UCC.

The right to life is not absolute – Irish law permits taking life if that is necessary/ inevitable in order to avert a threat to the lives of others. Embryonic stem cell research raises the question of whether it should be legitimate to destroy life that is non-threatening which might produce significant benefit to others. This proposition, if accepted, would undermine the principle that an individual should always be regarded as an end in herself and never as a means to an end. Accordingly, the only way in which embryonic stem cell research may be reconciled with a refusal to treat the individual as a means to an end is if it can be shown that the moral status of the embryo is qualitatively different to that of life at later stages of development. In this lecture, the various arguments advanced in support of such differentiation are examined and found wanting.

Gerry Whyte is an Associate Professor in Trinity Law School and a Fellow of Trinity College. The author and co-author of books on public interest law, constitutional law and trade union law, he is a former member of the Commission on Assisted Human Reproduction and the author of the minority report on the status of the embryo.

In genetically susceptible individuals, ingestion of gluten and related proteins triggers an immune-mediated enteropathy known as coeliac disease. One in 100 people worldwide suffer from coeliac disease. Coeliac disease is more common in Ireland than elsewhere, affecting up to 1 in 20 people. Currently, the only treatment is lifelong avoidance of gluten ingestion. Therefore, coeliac sufferers have to follow a strict diet and avoid products which contain wheat, rye or barley (some authors also include oats). Avoidance of these cereals leads to recovery from the disease. This presentation will give an overview of coeliac disease, recent advances in the area of gluten free foods and beverages.

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Even though Quantum Mechanics is one of the most complete and successful theories ever developed in physics, it is also the least understood. Many of the effects it predicts are counterintuitive to everyday life experiences. Over the last 100 years this has lead to intensive discussions about fundamental questions such as what reality and locality really are. Recent progress in the area of quantum information has shone new light on these questions and I will give an insight into some of the most puzzling paradoxes and the current explanations.

Thomas Busch is a Science Foundation Ireland Principal Investigator in the Physics Department in UCC. A native of Germany, he obtained his PhD from the University of Innsbruck in the area of quantum statistics in 2000. His current research deal with designing computational devices using the laws of quantum mechanics to achieve superior computing powers.

The reaction of atmospheric nitrogen with hydrogen to form ammonia is one of the most important industrial chemical reactions as ammonia is used in the synthesis of a great many chemicals but most importantly explosives and fertilizers. The development of nitrogen fixation has played a very significant role in recent political history and ammonia fertilizers have become a vital component of food production. The higher yields obtained with fertilizer use has allowed the world population to grow. This lecture will explore these issues and address the question of population growth sustainability given that gas and petroleum are the basic feedstock for ammonia production.

Michael A. Morris is professor of inorganic chemistry at UCC where his research centres on the development of nanoscale materials. Of particular interest is the growing role of nanoscience in ICT hardware and Prof. Morris is a principal investigator at the Tyndall National Institute and director of the nanoelectronics research at the Centre for Research in Adaptive Nanastructure and Nanodevices in Trinity College Dublin. Prof. Morris worked in industry for several years in areas including the development of catalysts for ammonia synthesis.