The Rutherford Centennial Conference on Nuclear Physics

One hundred years ago in Manchester, Ernest Rutherford published a paper in *Philosophical Magazine* interpreting the results of experiments, performed by Geiger and Marsden, in terms of a dense speck of matter at the center of the atom, later to be known as the atomic nucleus. Combined with work by Moseley and Bohr, initiated at the same institution, these findings established our view of atomic structure and started the field of nuclear physics. The Rutherford Centennial Conference on Nuclear Physics was held at The University of Manchester this August to mark the anniversary by addressing the wide range of contemporary topics characterizing modern nuclear physics, including nuclear structure and astrophysics, hadron spectroscopy, fundamental interactions, and relativistic heavy-ion collisions.

The conference began by looking briefly at Rutherford and his legacy. A welcome reception was held at the Manchester Museum of Science and Industry, sponsored by Canberra Industries. This coincided with the opening of a public exhibition by Professor Mary Fowler, Rutherford’s great-granddaughter. The exhibition, sponsored by Winton Capital and open to the public until October, includes the 1911 manuscript, letters, notebooks, and equipment used by Rutherford, lent by Cambridge and Manchester Universities. Rutherford was born in New Zealand, so Derek Leask, New Zealand High Commissioner to the United Kingdom formally opened the conference, speaking about Rutherford’s early life and his importance to his nation. Rutherford was surprised to win the 1908 Nobel Prize in Chemistry, rather than Physics, and his importance to that field was also recognized by the presentation of a Landmark Plaque by the President of the Royal Society for Chemistry, David Phillips, received by Rod Coombs, Manchester University’s Deputy President. In the first talk of the conference, Jeffery Hughes spoke about the historical context of Rutherford’s work and his influence on the early development of nuclear physics by exploring the intellectual and institutional cultures of the early 20th century. John Schiffer comprehensively summarized progress made during the first century of nuclear physics, discussed the open questions in the field and reflected on our research culture and relationships with other areas. The remaining program covered modern topics, across all sub-fields of academic nuclear physics.

Several sessions addressed hadronic systems, where experiments are mapping out their internal landscape and searching for exotic hadrons. New results from electron scattering...
revealing details of the short-range NN interaction, with the surprising result of np-pair dominance, were discussed in connection to tensor forces and EMC effect. Encoding of the nucleon charge and magnetization distributions in elastic form factors was presented with a discussion of the impact on radii; other speakers generalised to 3D-parton distributions facilitated by new precision measurements. The current status of searches for glueballs and flux-tube excitations was reviewed.

Melting of Rutherford’s nucleus into a plasma of quarks and gluons during high-energy collisions is a major topical subject; the conference heard about progress made at RHIC and LHC. Talks presented jet quenching and strong elliptic flow, which have established the quark-gluon plasma and its near-perfect liquid nature. The first LHC physics run was described where the step change in energy leads to a different environment, accompanied by larger rates for hard probes. The hotter plasma has been confirmed as a very low viscosity fluid, validating some aspects of hydrodynamic models, but with surprisingly stronger radial flow. Precision measurements of jet and quarkonia suppression were also anticipated.

Attacks on the problem of using fundamental interactions between components to describe complex systems have begun to gain ground and were discussed in several contexts, including: lattice QCD descriptions of hadronic structure and nucleon forces; colour glass condensates used in the early stages of nucleus-nucleus collisions; chiral effective field theory in nuclear-lattice calculations of the Hoyle state; and experimental tests of ab-initio calculations of light nuclei using electromagnetic transitions. In fundamental interactions, developments in neutrino-oscillation experiments were presented. The potential for neutrinoless double-beta decay in addressing the absolute mass scale for neutrinos was discussed, including the potential of future projects. The importance of nuclear physics in providing tests of fundamental symmetries that can complement LHC science was also emphasized.

The sphere of studies of nuclei has progressively widened further from stability, facilitated by advances in radioactive-beam production. Several exciting results from a number of different reactions were discussed shedding light on both the reaction mechanisms and nuclear structure, particularly the use of relativistic radioactive beams yielding information on nucleon states and new collective modes. Changes in structure tracked over wide areas shed light on the forces driving structural evolution; talks highlighted the importance of the tensor interaction and three-body interactions. Nucleon clusters were examined, with reference to the Hoyle state and molecular-like phenomena. The spectroscopy of the heaviest nuclei was discussed along with the implications for super-heavy elements. Techniques to study radioactive species have become extremely sensitive, particularly with stored atoms/ions; high-precision results on ground-state properties were shown, with examples of single-atom counting for dating with long-lived cosmogenic isotopes. The influence of nuclear physics on the Universe was addressed with talks on the understanding of astrophysical processes, particularly in explosive environments, illustrating advances in both nuclear-synthetic paths and astrophysical dynamics.

Unfortunately, a brief summary does no justice to the detailed scientific program, to the uniformly high-quality presentations, nor to the diversity of the contributed talks and posters contributed by around 250 delegates from 36 countries. I would like to briefly mention Günther Rosner’s concluding forward look and three well-attended evening public lectures on nuclear science, and to thank the Institute of Physics Conference Office, Canberra Industries, Manchester City Council for hosting a civic reception the Ogden Trust for supporting the conference dinner and George Dracoulis for an entertaining after-dinner speech.

This is the second in a series of conferences following from the 1961 Rutherford Jubilee Conference; a number of our delegates attended both. I doubt that I will be chair in 2061, but if I am lucky enough to attend the next Rutherford conference, I expect the field will still be as vibrant and exciting, but comparing the Jubilee Proceedings to ours, I dare not predict the plenary program!

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The first International Conference on Advances in Radioactive Isotope Science (ARIS-2011) was held in Leuven, Belgium, from 29 May to 3 June 2011. It was jointly organized by the universities of Leuven (K.U. Leuven) and Brussels (ULB), chaired by Piet Van Duppen and Mark Huyse.

History of the Conference
This new series of conferences results from a merger of the “International Conference on Exotic Nuclei and Atomic Masses (ENAM)” and the “International Conference on Radioactive Nuclear Beams (RNB).”

The origin of the ENAM conferences goes back to the 1950s and 1960s when the “Atomic Mass and Fundamental Constants (AMCO)” and the “Nuclei Far From Stability (NFFS)” conferences series were held. Those were co-organized jointly in 1992 and the conferences merged in 1995 in the first ENAM conference (in Arles, France). Since then ENAM conferences took place in Bellaire, Michigan (1998), in Hameenlinna, Finland (2001), in Callaway Gardens—Pine Mountain, Georgia USA (2004) and in Ryn, Poland (2008).

The first RNB conference was organized in Berkeley, CA, USA (1989) and the series continued with events in Louvain la Neuve, Belgium (1991), East Lansing, MI, USA (1993), Ohmiya, Japan (1996), Divonne-les-Bains, France (2000), Argonne, IL, USA (2003), Cortina d’Ampezzo, Italy (2006), and Grand Rapids, MI, USA (2009).

The new “Advances in Radioactive Isotope Science (ARIS)” series of conferences aims to provide in a three-year cycle an international

Figure 1. Conference attendees.
forum to foster information exchange and collaboration among the researchers in the field of radioisotope sciences. The program of ARIS-2011 included a well-balanced amount of recent experimental and theoretical advances in radioisotope sciences, including some applications.

Participants and Program
A total of 319 participants registered for the conference, of which 95 were PhD students and 73 post-doctoral researchers! A significant amount of women attended the conference (20%) and participated as an invited or contributing speaker (20%). The participants came from 26 countries and more than 100 institutions. Japan was the best represented country with 44 participants, followed by the United States, Belgium, Germany, and France.

The international advisory committee proposed 29 invited speakers to cover highlights in the fields of nuclear structure, nuclear astrophysics, and fundamental symmetries and interactions.

More specifically, invited talks and contributions covered experimental and theoretical advances related to

- Atomic masses and fundamental constants
- Nuclear moments and radii
- Rare decay modes
- Reactions with radioactive ion beams
- Nuclei at the drip lines
- Heaviest elements and fission
- Radioactive ion beam production, experimental developments and applications

A total of 372 abstracts were submitted (+29 from invited talks). The international advisory committee was very helpful in selecting a total of 94 abstracts for oral presentation with a good balance between experimental and theoretical work. This required the organization of parallel sessions on Tuesday and Thursday afternoons. The program committee further selected 10 shot-gun presentations, to give young participants the chance to “announce” their poster in a 3-minute talk. Other eligible contributions could be presented as a poster, and a total of 163 posters was shown during a very attractive and lively poster session on Tuesday evening (the local bears probably helped to create the very informal atmosphere, allowing for lively discussions between young and well-established researchers; Figure 2).

After the last session on Monday, the “2011 IBA Price for Applied Nuclear Physic and Nuclear Methods in Medicine” was handed over to Dr. Elisabetta Boaretto (Weizmann Institute, Israel) by Mr. Douglas MacGregor, representing the European Physical Society, and by Mr. Yves Jongen, chief research officer of the IBA company who sponsored the prize and also offered a wine reception after the prize announcement (Figure 3). A few weeks after the conference, all contributions (oral and poster) became available on the ARIS website, thus providing a swift dissemination of the presented results.

Sponsors
The ARIS-2011 conference was sponsored by the International Union for Pure and Applied Physics (IUPAP) through the C12 Commission for Nuclear Physics.

Other sponsors were The European Physical Journal, the Belgian scientific councils FNRS and FWO-Vlaanderen, the Belgian Nuclear Physics research center SCK-CEN, the organizing universities (K.U. Leuven and VUB) and the following companies: IBA, Amesytec, Micron Semiconductor, Pantechnik, and Scionix.

ARIS-2014 Conference
The next ARIS conference will be held in Japan in 2014. The host institute will be the RIKEN Nishina Center and the co-host institute the University of Tokyo (Center for Nuclear Study–CNS). The chair will be the director of the RIKEN Nishina Center Dr. Hideto En’yo and the co-chair will be Prof. Takaharu Otsuka.

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Figure 2. Witek Nazarwicz and Gaute Hagen, discussing during the poster session.
19th Particles and Nuclei International Conference (PANIC11)

The first Particles and Nuclei International Conference (PANIC11) in the LHC era brought 539 participants to the Massachusetts Institute of Technology (MIT) from 24–29 July 2011 (Figures 1 and 2). PANIC11 is the latest conference in a triennial series that showcases recent progress worldwide in particle and nuclear physics. PANIC11 was held in the year celebrating the 150th anniversary of the founding of MIT as well as the centennial of Rutherford’s May 1911 seminal paper, which explained the discovery of the atomic nucleus. Further, 2011 is the 65th anniversary of MIT’s Laboratory for Nuclear Science, which hosted PANIC11. With strong support by the U.S. Department of Energy, many national laboratories from around the world, industrial sponsors, and by MIT, the conference supported the extensive participation of young scientists, students, and postdocs, who were the majority of participants, making for a very lively conference. Broad international participation was enhanced by IUPAP support for scientists from developing countries.

The conference program identified 12 major scientific themes around which the program was developed:

Figure 1. Conference group photo.
• Quarks and gluons in hot and dense matter
• Quarks and gluons in hadrons
• Neutrino physics and astrophysics
• Dark matter and cosmology
• Nuclear and particle astrophysics
• Standard model physics at the TeV scale
• Tevatron and LHC physics beyond the standard model
• Heavy flavor physics within and beyond the standard model
• Tests of symmetries and conservation laws
• Kaons, hypernuclei, hadron spectroscopy, and exotics
• Applied string theory
• Accelerator physics

The program consisted of 24 plenary talks and 304 parallel session talks, as well as a poster session. In addition, there was a plenary presentation on the effects of the 11 March 2011 earthquake on nuclear and particle physics facilities in Japan. There were well-attended public lectures by Brian Cathcart on *Glimpsing the Fly in the Cathedral: Ernest Rutherford and the Atomic Nucleus* and by Jerome Friedman on *Rutherford’s Legacy in Particle Physics: Exploring the Proton*. On the day before the start of the conference, a series of nine pedagogical lectures, directed at the level of the beginning graduate student, were presented by young researchers and covered the major thrusts in subatomic physics as well as recent advances in accelerators and detectors.

Through generous support by the NSF, in an initiative to make such conferences available to a broad, world audience, video recordings of all pedagogical, plenary and public lectures are available on MIT’s Tech TV website at http://techtv.mit.edu/collections/panic11/videos. The proceedings will be published by the American Institute of Physics early in 2012.

The next conference will be hosted by the DESY Laboratory in Hamburg, Germany in 2014.

PETER FISHER AND RICHARD MILNER
PANIC11 Conference Co-Chairs

Figure 2. Photo of MIT President Susan Hockfield opening the conference on the morning of 24 July 2011.