The 1961 Rutherford Jubilee Conference: Perspectives from 2011

N P M Todd
University of Manchester, Manchester, UK
Email: neil.todd@manchester.ac.uk

Abstract. In 1961 the Rutherford Jubilee Conference was held in Manchester to celebrate Rutherford’s 1911 discovery of the atomic nucleus. In this paper I will give a brief history of the background to the 1961 meeting, summarise the media coverage of it and then take this opportunity to review the discovery from the perspective of 2011.

1. The 1911 discovery of the nucleus

It is widely accepted that the key dates marking the discovery of the atomic nucleus are March 7 1911 [1], when Rutherford’s scattering law was first publicly announced before the Manchester Literary and Philosophical Society, and May 1911 [2], when it was published in more detail in the Philosophical Magazine. However, as pointed out by Norman Feather [3], the term “nucleus” was actually first used in a published work by Rutherford a while later in the chapter on $\alpha$-particles in his book Radioactive Substances and their Radiations [4]. This was published in 1913, the forward dated October 1912. Prior to this, the preferred term was “central charge”, rather than “nucleus”. Of course, the $\alpha$-scattering experiments carried out by Geiger and Marsden, which had initiated the train of thought leading to the scattering law, were started in the spring of 1909, and subsequently published in the Proceedings of the Royal Society [5], received May 19th, 1909. So there was a period of some 18 months between initial experiment and final formulation of the theory, and a further period of about 18 months before the word “nucleus” first appeared in print. (The conceptual discovery though almost certainly occurred in the Winter of 1910 at his Manchester home, see section 4 below.)
2. Manchester's nuclear renaissance and the 1961 Jubilee

After 1919 with Rutherford’s departure to the Cavendish there was a hiatus in research in radioactivity/nuclear physics at Manchester until the arrival in 1955 of Sam Devons, one of the last of Rutherford’s students at the Cavendish. The same year J M Nuttall, the last of the Rutherford era staff, retired. William Kay, Rutherford’s Laboratory Steward, had retired in 1945, but still occasionally came into the Department, during which time he was interviewed by Devons [6].

[Figure 2. (left) William Kay in the late 50s. (right) Sam Devons with his 6 MeV Van de Graff accelerator]

As the Jubilee approached in the late 1950s Manchester's physics community felt that it was important to commemorate Rutherford's scientific discoveries at Manchester and the Rutherford Jubilee International Conference was planned to be held here in Manchester on 4th to 8th 1961 to mark the fiftieth anniversary of the Rutherford scattering law [7]. With Devons’ departure in 1960 the chairing of the Jubilee Organizing Committee was taken on by Brian Flowers (other members were JB Birks, JE Bowcock, HJ Braddock, JM Clavert, LJ Goldfarb, A Herzenberg, AA Jaffe, F Mandl and JO Newton). The President of the Conference was Sir Ernest Marsden.

[Figure 3. The president, chair and invited speakers of the 1961 Jubilee.]
3. Rutherford’s ‘old boys’ and the 1961 Commemorative Session

As part of the Jubilee Conference a commemorative session was devoted to memories of “Rutherford in Manchester” at which four of Rutherford’s former students or co-workers spoke, these were Niels Bohr, Sir Ernest Marsden, Sir Charles Darwin and E N da C Andrade (see Figure 4). Versions of their speeches were published in “Rutherford in Manchester” [8], edited by JB Birks (although sadly tape recordings of the speeches appear to have been lost). The session was also attended by Sir James Chadwick, three Langworthy Professors (Flowers, Devons, Blackett), Rutherford’s grandson Peter Fowler, representatives of the Cavendish Laboratory, McGill University, the Physical Society, the Royal Society and a host of other eminent nuclear scientists including John Cockroft and Lisa Meitner. Sadly William Kay died shortly before the Conference.

![Figure 4. James Chadwick, Charles Darwin, Ernest Marsden, E da C Andrade and Niels Bohr](with permission from the Guardian).

4. Media coverage of the 1961 Jubilee

The conference and memorial session was widely covered in the media, most notably in the Manchester Guardian, the Times and the Manchester Evening News. Among the headlines were “Nuclear Discovery 50 Years Old. 400 Physicists Honour Rutherford’s Work”, “Scientists Fly to Manchester. Five-day Conference”, “Commemorating Lord Rutherford”, “Millions are Wanted for Atom Research” and “Scientists Pay Tribute”. Perhaps the most thoughtful was an article by the Science Correspondent of the Manchester Guardian John Maddox headlined “A Sunday Night that Changed Physics”. One of the main points he highlighted was the fact that the actual discovery of the nucleus, i.e. first formulation of the scattering law, took place at his Manchester home in Disbury (now on Palatine Road, Figure 7). He made his first announcement of the law at one the Sunday dinners which he regularly hosted for his students and co-workers from the Manchester Physical Laboratories.
5. Perspectives from 2011: Atoms for war or peace?
The nuclear discovery in 1911 took place during the autumn of Edwardian internationalism before the debacle of the Great War. However, already at this time implications for humanity of the enormous energy latent in the nucleus had been prophesised: for peaceful use, as in Soddy’s “The Interpretation of Radium” [9], or for non-peaceful use, as in HG Wells’ “The World set Free” [10], where the spectre of atomic war was raised for the first time.

In the following 50 years A-bombs had been invented and used against Japan in 1945. H-bombs had been developed and tested. In 1961 the Cold War was at its height. The 1961 Jubilee was held against the backdrop of the Berlin crisis (June to November 1961) which resulted in the erection of Berlin Wall. The border between East and West Germany was closed just a few weeks before the Jubilee and the Soviet Union exploded a 58 megaton device just a few weeks after [11]. The delegates and media would have been acutely aware of these issues during the conference and it was a matter of some considerable sensitivity to the organizers, as is clear from the press coverage at the time (Figure 5).

![Figure 5](image)

The early days of peaceful nuclear power were full of optimism when the first commercial station at Calder Hall opened in 1954, but the Windscale fire of 1957 and subsequent nuclear accidents, e.g. Three Mile Island 1979, Chernobyl 1986 and most recently Fukushima 2011 (Figure 6), have raised and continue to raise questions concerning the safety and economic viability of nuclear fission as a source of power. The problem of waste disposal remains to be solved. The practicality and economic viability of nuclear fusion remains to be demonstrated.
Controversies over nuclear weaponry and power aside, there can be no doubt concerning the enormous benefit to humanity from biological and medical applications of nuclear science. From the earliest days of radioactivity the medical use of radium for treatment of cancer was a primary motivation for its manufacture and the subsequent development of radiotherapy benefited from it. The use of radioactive isotope tracers has transformed biological science and imaging by means of nuclear magnetic resonance (nMRI, Figure 6) is now an absolutely essential tool in neurology and clinical neuroscience.

![Figure 6](image.png)

**Figure 6.** (left) Fukushima 2011, (right) an MRI image of the author’s brain.

An account of the importance of Rutherford’s achievements would not be complete without the centrality of the theory of radioactivity to the geological sciences being noted. Our knowledge of the age of geological strata, the earth, the solar system, etc., as well as environmental dating in general, must surely be one of the most profound ways in which his scientific discoveries have transformed our knowledge of our universe. From a fundamental perspective, however, it is clear in 2011, as it was in 1961, that following the pioneering work of Planck and Einstein, the nuclear discovery, and associated developments, e.g. the quantum atom, the concepts of atomic number and isotopes, etc., provided the very foundations of modern physical science. In the words of Niels Bohr “Indeed, the discovery of the atomic nucleus offered a decisive impetus at all stages of the ensuing development, by which it became gradually possible to achieve the incorporation of the quantum in a consistent generalization of the classical approach” [12].

6. Concluding Remarks

In looking back over the 100 years since the nuclear discovery it is hard to resist the temptation to speculate on what Rutherford himself may have thought of its consequences after his untimely death in 1937. Andrade was clear, during a discussion on the development of nuclear weapons in his presentation to the 1961 Jubilee, that in his view it was a blessing that Rutherford did not live to see the “terrors that have come from his work”. He would surely though have been delighted by the advances of nuclear medicine in the last few decades. Just a few hundred yards from the location of his Manchester home (Figure 7), where the scattering law was first conceived, is situated the Christie Hospital Nuclear Medicine Department.
Figure 7. Rutherford’s Manchester home on Palatine Road, as photographed in 2010. The scattering law was probably conceived in his study on the 1st floor. The “Sunday night that changed physics”, attended by Charles Darwin, probably took place on the ground floor.

References.
[1] Rutherford E 1911 The scattering of the $\alpha$ and $\beta$ rays and the structure of the atom. Manchester Lit. and Phil. Soc. Mem. IV 55 18-20
[2] Rutherford E 1911 The scattering of the $\alpha$ and $\beta$ rays and the structure of the atom Phil. Mag. VI. 22 669-688
[3] Feather N 1963 Rutherford at Manchester: an epoch in physics (The Collected Papers of Lord Rutherford of Nelson. Volume II) ed J Chadwick (London: George Allen and Unwin Ltd) pp 15-33
[4] Rutherford E 1913 Radioactive Substances and their Radiations (Cambridge: CUP)
[5] Geiger H and Marsden E 1909 On a diffuse reflection of the alpha particles P. Roy. Soc A 82 495-500
[6] Hughes J 2008 William Kay, Samuel Devons and memories of practice in Rutherford’s Manchester laboratory Notes Rec. R. Soc. 62 97–121
[7] Proceedings of the Rutherford Jubilee International Conference Manchester 1961 ed J B Birks (London: Heywood & Co Ltd)
[8] Birks J B 1962 Rutherford at Manchester (London: Heywood & Co Ltd)
[9] Soddy F 1909 The Interpretation of Radium (London: John Murray)
[10] Wells H G 1914 The World Set Free (London: Macmillan and Co)
[11] Arnold L 2001 Britain and the H-bomb (New York: Palgrave)
[12] Bohr N 1962 The General Significance of the Discovery of the Atomic Nucleus (Rutherford at Manchester) ed J B Birks (London: Heywood & Co Ltd)