Two Full and Good Lives

In August 1927 while enjoying his customary summer holiday with his mother in the Alps, Hans Bethe sent a postcard to Rudolf Peierls, a fellow student at Arnold Sommerfeld's institute[1] of theoretical physics in Munich.[2] Little did the two students know that their meeting in Munich in 1927 would be the beginning of a deep friendship and a productive work relationship; little, also, did they know that when Hans Bethe, shortly before his friend's death in 1995 would reminisce about their lives[3] as those of two of the giants of 20th century physics he would look back on more than 68 years of uninterrupted contact most clearly visible in the hundreds of pages of letters exchanged between the two.

Bethe and Peierls were born within a year of each other in 1906 and 1907 respectively. They came from similar social backgrounds. Hans Bethe's mother was Jewish, the daughter of a professor of medicine; she converted to Christianity even before meeting Hans's father Albrecht, a successful physiologist, who himself was a Protestant. Religion did not play an important role in the Bethe household; culture and learning, on the other hand, did.[4] Peierls was born into an assimilated Jewish family. His parents had converted to Christianity in 1912, but religion — Jewish or Christian — played little role in the Peierls household, either. Peierls' mother died, when Rudolf was fourteen years old, and his father soon remarried. His second wife was Aryan, and the Peierls's

[1] Arnold Sommerfeld (1868–1951), received his Ph.D. from Königsberg in 1891. After positions at Göttingen, Clausthal-Zellerfeld and Aachen, he became Professor of Physics and Director of the Theoretical Physics Institute at the University of Munich in 1906 where he stayed until his retirement (and the completion of the appointment of his successor) in 1939.

[2] Letter [1].

[3] Letter [214].

[4] See e.g. letters [6–7].

moved as easily in Jewish as in non-Jewish circles. And again, in these environments, religion was of little consequence; in contrast to culture and learning which were highly valued.

When Bethe and Peierls came to Munich to join Arnold Sommerfeld's Mecca of theoretical physics in 1927, they had both studied at their 'home universities' for some time: Bethe, who arrived in Munich just ahead of Peierls, had spent about two years at Frankfurt University; Peierls, a year younger and seemingly much junior to Bethe at the time, had just completed a year's study at Berlin. The correspondence between Bethe and Peierls, much of which has survived and is kept in the large collections of their respective private papers passed on to the libraries of Cornell University (Bethe) and Oxford University (Peierls) is an invaluable source. The letters shed light on the lives and the work of the two scientists, whose achievements span from significant scientific discoveries to enthusiastic and committed university teaching, from the development of the Atom Bomb to the fight against the nuclear arms race, from the establishment of institutes of theoretical physics in their adopted home countries, the US and the UK, to the development of well-functioning scientific exchange networks which linked physics institutes in Britain and the US during early post-war decades. The letters enlighten us about the lives and the plight of young Jewish scientists who were forced to leave their native countries as a result of National Socialist racial policies; they demonstrate the strength of scientific collaboration during one of the most exciting periods of scientific discovery, the years of the development of quantum mechanics; and they illustrate how these early bonds between members of an exceptional generation of theoretical physicists survived the war-years and paved the way for further scientific progress in the second half of the twentieth century.

This collection presents the vast majority of letters exchanged between Hans Bethe and Rudolf Peierls. They are arranged chronologically in four chapters, which represent four phases in their academic development and their working and personal relationship. Chapter 1 contains letters written between 1927 and 1933. During this period, both young men completed their doctorates, Bethe in 1928 under Arnold Sommerfeld's supervision and Peierls in 1928 under one of Sommerfeld's

star students, Werner Heisenberg[5] in Leipzig. Both then engaged in research and teaching at various European centres of theoretical physics. Hans Bethe went to Frankfurt (1928–29), Stuttgart (1929) and Munich (1929–1930), from where he visited Cambridge (1930–31) and Rome (1931) on a Rockefeller Fellowship, before taking on a position as acting professor in Tübingen (1932). In April 1933, with the enactment of the racial laws in Germany which prohibited Jews from holding government positions, Bethe lost his job, and although Arnold Sommerfeld provided him with a fellowship in Munich for the summer of 1933, Bethe gladly accepted an invitation from William Lawrence Bragg to come to Manchester for a year.

Rudolf Peierls followed in some of his friend's footsteps. After completion of his doctorate in 1929, he initially became Wolfgang Pauli's[6] assistant in Zurich. Like Bethe, he travelled to Rome (1932) and Cambridge (1932–33) on a Rockefeller Fellowship. He chose not to return from England to a position in Hamburg which had been offered to him for 1933, as the political situation in Germany had become so precarious for Jews that staying abroad was considerably safer an option despite the uncertainty of job prospects. During the academic year 1933/34 both Bethe and Peierls held temporary positions in Manchester. Rudolf Peierls, in 1931, had married the Russian physicist Eugenia Kannegiser, whom he had met at a conference in Odessa the previous summer, and Bethe gladly accepted the couple's invitation to share a house with them during their Manchester year. This explains the gap in their correspondence, similar to the gap which would occur in the mid 1940s, when both were engaged in war work, most notably at Los Alamos.

[5]Werner Heisenberg (1901–1976), studied at Göttingen and Munich where he obtained his Ph.D. in 1923. After research at Göttingen and Copenhagen he became Professor of Theoretical Physics at Leipzig in 1927. In 1941 he became Director of the Max Planck Institute of Physics in Berlin. After the war he held positions at Göttingen and Munich.

[6]Wolfgang Pauli (1900–1958), received his doctorate from Munich in 1921. After research at Göttingen and Copenhagen, he taught at Hamburg for five years. In 1928 he accepted is professorship at the ETH Zurich. Having spent the war years in the United States, Pauli returned to Zurich in 1946 where he remained for the rest of his career.

Chapter 2 covers the years 1935 to 1940. After the completion of his year at Manchester, Bethe initially accepted a fellowship at Bristol to work with Nevill Mott, before taking up an assistant professorship at Cornell in February 1935 — the place where he would remain, except for shorter intervals, for the remainder of his long and illustrious career. Peierls, in the spring of 1935 moved back to Cambridge where he was offered a position at the Mond Laboratory. This laboratory for magnetism and low temperature physics had been built for Peter Kapitza, who in 1934 during one of his home visits to Russia was detained and prevented from returning to the UK. The money earmarked for Kapitza's unclaimed salary was then used to fund two additional fellowships, one of which was taken up by Peierls. After two stimulating years in Cambridge, Peierls secured his first permanent position, a professorship in Mathematical Physics at Birmingham University, the place he would stay at, except for short intervals, for over quarter of a century. The Bethe-Peierls correspondence of the second half of the 1930s is the most intense part of their exchange. Spurred by the highly productive year they had spent together in Manchester, Bethe and Peierls communicated about ongoing research, but also increasingly also about the difficult political situation in Europe and the prospects of other refugee scientists who were still looking for employment in the UK and the US. But the letters also contain more personal and family concerns. By 1935, the two friends had moved from the more formal 'Sie' to the informal 'Du' in their addressing each other, and the year spent together in Manchester had, without doubt, intensified their friendship. Peierls by then had two children, Gaby born in August 1933 and Ronnie in 1935. And Hans, in 1938, had married Rose Bethe, the daughter of his former Stuttgart mentor, Paul Ewald.[7] The depth of their friendship is best demonstrated by the offer of Rose and Hans Bethe, after the outbreak of the war in Europe and with the danger of a German

[7]Paul Peter Ewald (1888–1985), studied physics, chemistry and mathematics at Cambridge, Göttingen and Munich where he obtained his doctorate in 1912. After positions at Göttingen, Copenhagen and Munich, he took of a professorship at Stuttgart. In 1937 he emigrated, intially to Cambridge and later to Belfast. In 949 he became Professor of Physics at the Polytechnic Institute of Brooklyn.

invasion of England looming, to put up Gaby and Ronnie in their home in Ithaca.[8]

The third chapter contains letters written in the first two post-war decades between 1946 and 1963, the period when both physicists were at their most effective in building world-class institutes of theoretical physics in their respective adopted homes: Hans Bethe at Cornell and Rudolf Peierls at Birmingham. The correspondence illustrates the return to peacetime research, the endeavours to build on pre-war and wartime scientific achievements, the spirit of international collaboration cultivated among many of the scientists of the Manhattan project (if not by the political leadership), the disappointment at the ongoing east-west divide which made the revival of contacts with Soviet colleagues all but impossible, and the activities of both men in the area of arms control, nuclear disarmament and the initiatives for world peace such as in the Pugwash Movement.

The final chapter contains letters written between 1963 and 1995. During this final period, the frequency of letters was much reduced; and the nature of the exchange was much altered with personal and political rather than scientific concerns dominating the letters, especially during the 1980s and 1990s. The change in content and frequency of the correspondence was partly due to the fact that there was less official university business, especially after the retirement, in 1974, of Peierls from Oxford University, where he had spent the last eleven years of his career, and, in 1975, of Bethe from the Cornell faculty. Furthermore, when Peierls retired from Oxford, he took on a part-time position at the University of Washington, Seattle, where he spent six months in every twelve for the subsequent three years. His regular extended visits to the U.S. allowed Peierls to re-establish more regular direct contacts with his American friends and colleagues, not least with the Bethes.

The four chapters are prefaced by brief introductory remarks explaining the background to some of the developments mentioned in the correspondence. Although the collection is remarkable for both its duration and for its coverage of almost the entire period of Bethe's and

[8]In the event, the children went to Canada as part of a university evacuation scheme. See letters [59–62].

Peierls' acquaintance, important phases when the scientists were working in close proximity, are not reflected in their letters and therefore not visible in this collection. For a fuller picture of Bethe and Peierls, their friendship and working relationship, please refer to the biographical works by Lee, Brown, Bernstein and Schweber.[9]

What had begun with a light-hearted postcard in the summer of 1927 ended with a letter of reminiscences looking back on almost seven decades of friendship of collaboration which Hans Bethe sent to Rudolf Peierls whose life, as Bethe was well aware, was nearing its end in early September 1995. The spirit of their relationship was so aptly captured in Bethe's closing sentence, a sentence which, without the shadow of a doubt, Peierls would have subscribed to, had the situation been reversed: "You had a full and good life, and I thank you for letting me participate in it."

Editorial Comments

1. The letters are listed chronologically, and, unless stated otherwise, reproduced in toto.

2. The transcription is limited to the text content, not to layout or graphic details.

3. The early correspondence is in German, and letters are reproduced in the original followed by an English translation. Editorial and other notes are in English and added only to the English texts and translations.

[9]Jeremy Bernstein, *Hans Bethe, Prophet of Energy*, Basic Books, New York, 1980 (hereinafter cited as Bernstein, *Hans Bethe, Prophet of Energy*); S.S. Schweber, *In the Shadow of the Bomb. Oppenheimer, Bethe and the Moral Responsibility of the Scientist*, Princeton University Press, Princeton, 2000; G.E. Brown and Chang-Hwan Lee (eds.), *Hans Bethe and His Physics*, World Scientific, Singapore, 2006 (hereinafter cited as Brown and Lee: *Hans Bethe and His Physics*); S. Lee (ed.), *Sir Rudolf Peierls. Selected Private and Scientific Correspondence*, 2 volumes, World Scientific, Singapore, 2007 (hereinafter cited as Lee: *Selected Correspondence* and volume number).

4. Typos and misplaced letter sequences are corrected.[10]

5. The letters reproduced in this collection are held in the Bodleian Library[11] and Cornell Universitry Library.[12] Often Bethe and Peierls kept carbon copies of their typed letters, and therefore both original letter and carbon copy survive. Unless otherwise stated, the letters reproduced here are the originals. Letters from Bethe to Peierls are taken from the Peierls Papers, letters from Peierls to Bethe are taken from the Bethe Papers.

6. Handwritten additions, where included, are identified as such.

7. Editorial additions are made in square brackets.

8. Text which was deleted in the manuscript is not transcribed.

9. The reproduced material makes no distinction between single and multiple underlining.

10. Gaps arising from punching or filing are filled and only noted in square brackets, if there are doubts. Abbreviations are only completed where necessary.

11. Illegible words are noted as [??], with [?] for one word, [??] for two words and [???] for three or more words.

12. Footnotes in the text are marked with asterisk and added at the end of the letter. Editorial notes appear at the bottom of the page.

13. Repeated words at the page break are transcribed as one word.

[10]This applies in particular to correspondence in the late 1980s and 1990s. As a result of failing eyesight in later life, many of Rudolf Peierls' word-processed letters written in those years contain a large number of typographical errors which have been corrected.

[11]Sir Rudolf Peierls, Papers and Correspondence, 1898–1996; CSAS catalogue no 52/6/77 and NCUSACS supplementary catalogue 57/6/96.

[12]Division of Rare and Manuscript Collection, Collection no. 14-22-976.