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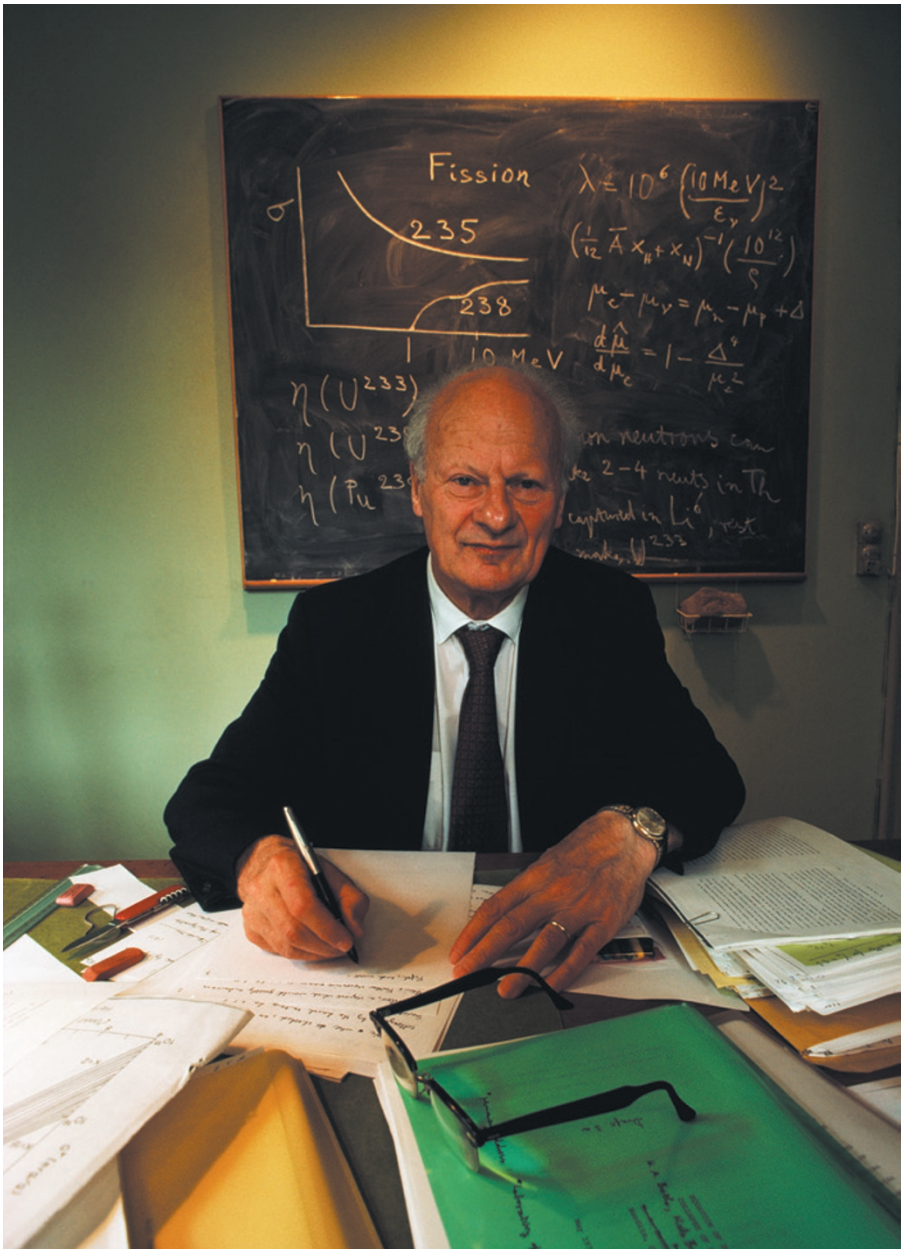


Hans Bethe, who won a Nobel prize for his work on stellar energy processes, pictured in 1979.

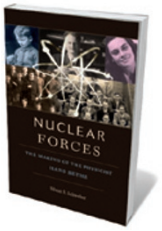
PHYSICS

A shining life

Frank Close enjoys the life of Hans Bethe, a Manhattan Project veteran who probed the hearts of stars.

Hans Bethe was one of the outstanding scientists of the twentieth century, making seminal contributions to almost all areas of theoretical physics. When he died in 2005, aged 98, he was the last of the generation whose members had, in their youth, established quantum mechanics as the descriptive theory of the atomic world. He was also one of the last veterans of the Manhattan Project.

Nuclear Forces, by the distinguished physicist Silvan Schweber, tells the story of the first three decades of Bethe's life and career, up to the time of his Nobel-prizewinning work on nuclear reactions in stars. But the book offers much more besides, with a history of the development of physics — atomic, solid-state and nuclear — in the first third of the twentieth century, and of the institutions in which Bethe worked.



Nuclear Forces: The Making of the Physicist Hans Bethe
SILVAN S. SCHWEBER
Harvard University Press: 2012. 518 pp. £25.95, $35.00

Schweber's analysis of the physics is the book's great strength. Readers conversant with Schrödinger's equation will find it deeply informative. But this is not a book for the faint-hearted, and at times it is hard to determine its target readership. For example, although the concept of the electronvolt is spelled out in some detail, elsewhere we are assured, without further amplification, that "By virtue of the finite range of nuclear forces only the L = 0, s-wave phase shift contributes to the cross section".

Bethe himself sometimes disappears for pages on end as the author provides background. One section covers the history of Cornell University in Ithaca, New York, where Bethe settled. Another explores Jewish intellectualism in German science and the experience of being a Jew in Germany in the 1930s, which were the environments in which Bethe developed. These digressions enrich our understanding of who Bethe really was, and of his milieu.

The complicated role of women in Bethe's life comes through well. His letters revealed that he loved his mother dearly, but that she managed to destroy his potential nuptials with the scientist Hilde Levi. Levi worked in physicist Niels Bohr's institute in Copenhagen, and she and Bethe had planned to marry in 1934. His mother's "continual battering" wore him down and a few days before the wedding, Bethe called it off.

Bohr disapproved, and never subsequently invited Bethe to the annual conferences he hosted in Copenhagen. Schweber notes that Bethe never visited Bohr's institute after he moved to the United States in 1935, although he did go to Europe to see his parents.

Schweber's careful research offers a postscript to this tale. He showed Levi a draft of the relevant chapter, and she told him that Bethe had been prepared to go through with the wedding. It was his mother who had forced the issue by sending a telegram to Levi "stating that the engagement was being broken. Hans's letter to Hilde came thereafter." Later, Schweber reveals, Bethe's mother almost thwarted him again when he set out to marry Rose Ewald, who became his companion for more than 60 years.

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To read about physicist Edward Teller, see:
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Bethe's long friendship with the great German theoretical physicist Rudi Peierls also comes to life in *Nuclear Forces*. Between 1933 and 1934, Bethe spent a year in Manchester, UK, staying with Peierls' family. In a letter to Arnold Sommerfeld, his mentor, Bethe offers a portrait of a place and an era, remarking that his coal-dust-covered window was cleaned in the spring, after which he could see the rest of the campus "on days when there was no fog".

That year with Peierls was in Bethe's opinion the most productive of his career. He became enamoured of nuclear physics; met Patrick Blackett, an experimental physicist known for his work on cosmic rays; spent time in Bristol, UK. He then moved to Cornell for good. Had someone had the initiative, or daring, to create a position for him in Britain, the course of theoretical physics on two continents might have been very different.

Having settled in the United States, Bethe went to the Washington Conferences on Theoretical Physics every year from 1935 until 1937. He decided not to take part in 1938, because the subject was energy production in stars and "he wasn't interested in that problem". At the urging of fellow émigré Edward Teller, he finally went, and what he heard led him to discover the CNO cycle in stars, in which reactions between protons and nuclei convert carbon sequentially into nitrogen and oxygen and back to carbon, liberating energy. And he identified the dominant processes that power the Sun. At first, the editor of *Physical Review* was not enthused by the CNO article. The resultant delay in publishing proved fortunate for Bethe: it enabled him to win the New York Academy of Science's US$500 prize for an unpublished work on stellar energy. The same work was later instrumental in him winning the Nobel Prize in Physics.

"At first, the editor of* Physical Review *was not enthused."

There is no mention of the legendary story of a romantic walk under the stars, on which Bethe tried to woo Ewald by commenting that at that moment, he was probably the only person on Earth who understood why stars shine. None too impressed, she reportedly replied, "That's nice."

Nuclear Forces does tell a similar story, in which a woman comments on how beautifully the stars shine and her companion proudly responds, "I've known since last night why they shine". The speaker was the atomic physicist Fritz Houtermans, whose early work was part of Bethe's inspiration. Whichever version you prefer, it is a good story. ■

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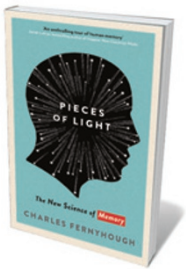
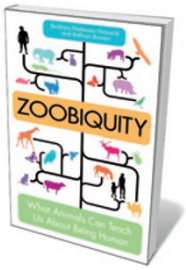
Books in brief

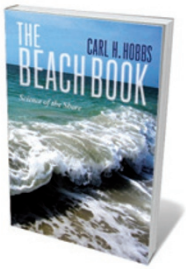


Pieces of Light: The New Science of Memory
Charles Fernyhough PROFILE BOOKS *352 pp. £14.99 (2012)*
We are our memories, says psychologist and writer Charles Fernyhough. Without them, we would be "lost to ourselves". Fernyhough deftly guides us through memory's many facets, from types (autobiographical, episodic, semantic, explicit, implicit, working) to mental mapping, trauma, sense associations such as the smell of fresh paint or a bar from Bach, and the evocative stories of his aged grandmother. Often using himself as a test case, he adds context with research and snippets from a raft of great writers. A thoughtful study of how we make sense of ourselves.

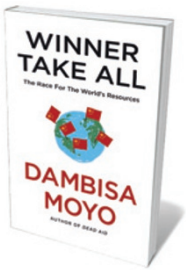
The Violinist's Thumb And Other Lost Tales of Love, War, And Genius, as Written by Our Genetic Code
Sam Kean DOUBLEDAY *416 pp. £20 (2012)*
In this successor to *The Disappearing Spoon* (Little, Brown, 2010), his bestseller on the periodic table, science writer Sam Kean explores the complexities of heredity. The broad focus on DNA allows dazzling diversions: Niccolò Paganini's eponymous thumb; the supersaturation of polar-bear livers with vitamin A; the case of Tsutomu Yamaguchi, who survived both Hiroshima and Nagasaki to live to 93; the key contributions to the field by Dominican nun and chemist Miriam Michael Stimson among others; and much more.



Zoobiquity: What Animals Can Teach Us About Health and the Science of Healing
Barbara Natterson-Horowitz and Kathryn Bowers KNOPF *320 pp. £17.23 (2012)*
Medically, how different are humans from other animals? Cardiologist Barbara Natterson-Horowitz began to probe the divide after learning that emperor tamarins can get stress-related capture myopathy — identical to the human heart condition takotsubo cardiomyopathy. With science journalist Kathryn Bowers, she covers case studies of conditions common across species, such as cancer and heart attacks, and calls for physicians and veterinarians to share data.



The Beach Book: Science of the Shore
Carl H. Hobbs COLUMBIA UNIVERSITY PRESS *192 pp. £41.50 (2012)*
With 44% of humans living 150 kilometres from a coast, according to United Nations figures, the sea's pull is undeniable. Marine scientist Carl Hobbs peels back the façade of sun and surf to explore the science of the strand. He examines in turn the shore itself, wind, waves, tides, sediments, barrier islands and tidal inlets, sand dunes and salt marshes, sea-level rise, erosion and storms. Fascinating phenomena — from surf beat, edge waves and beach cusps to the dunes known as barchans — bob through this crisply written guide to ecology and geology at the edge.



Winner Take All: The Race for the World's Resources
Dambisa Moyo ALLEN LANE *272 pp. £20 (2012)*
Economist Dambisa Moyo, whose hard-hitting *Dead Aid* (Penguin, 2010) criticized 'top-down' aid, pulls no punches in this investigation of China's global 'shopping spree' for resources. Moyo interweaves history into her analysis of the economic implications of China's ascendancy as trade partner and commodities buyer; its influence on markets and resource prices; and the social and political impacts of its investments. There may, she says, be a demographic brake on the resource rush — but commodity crises and wars cannot be ruled out.