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The DeWitts worked together on the unresolved problem of quantum gravity for more than 50 years.

BIOGRAPHY

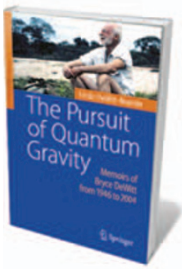
Canonical prophet

Pedro Ferreira is inspired by a treasury of recollections of physicist Bryce DeWitt by his widow Cécile.

The search for a theory of quantum gravity — the marriage of quantum mechanics and general relativity — is the ultimate frontier of physics. It remains unfinished business, and its creative ferment has attracted many vibrant people, not least Bryce DeWitt, one of the founders of the field. In *The Pursuit of Quantum Gravity*, his widow and long-time research collaborator Cécile DeWitt-Morette offers a personal view of the great man.

This is not a typical memoir, but a fascinating collage of essays, letters and commentary that is like a treasure chest: a stack of priceless, dusty heirlooms. Although the digressions into obscure aspects of quantum gravity will challenge some readers, the erratic narrative gradually builds up an impressionistic tableau of DeWitt's remarkable journey through postwar physics.

DeWitt's interest in quantum gravity began in the late 1940s when he was studying quantum field theory with Julian Schwinger at Harvard University in Cambridge, Massachusetts. Struck by gravity's "splendid isolation" in the canon of fundamental forces, DeWitt asked: "What if one simply dragged it forcibly into the mainstream of theoretical physics and quantized it?" His search for a means of doing so became his lifelong quest.



The Pursuit of Quantum Gravity: Memoirs of Bryce DeWitt from 1946 to 2004
CÉCILE DEWITT-MORETTE
Springer: 2011. 147 pp. $49.95

A trio of papers that DeWitt published in 1967 is at the heart of the field. The Trilogy, as it is known, is lucid, visionary and packed with results. The papers cover two approaches to quantum gravity. The first publication describes the 'canonical approach' that served up the Wheeler–DeWitt equation (also named after relativist John Wheeler) for the quantum evolution of the geometry of space. The second and third papers develop a 'covariant approach' to quantizing gravity, which considers the sum of all the possible configurations a system can have in space and time, and is an extension of a method that Richard Feynman applied to quantum mechanics and quantum field theory.

DeWitt, the book reveals, much preferred the covariant approach, openly ruing the day he came up with the Wheeler–DeWitt equation, which treated space and time separately rather than as a combination. His work on the covariant approach went on to play a key part in quantizing the electromagnetic, weak and strong forces during the 1960s and 1970s. The canonical approach also influenced Stephen Hawking and others in their proposal of a "wave function of the Universe".

The Trilogy was the sacred creed of quantum gravity for decades, and DeWitt was the prophet. He was a biblical character in many ways. Raised in California in a devoutly religious family (although he kept his distance from religion in later life), DeWitt had the towering, stern presence of a church elder. When he walked into a room, backs straightened. He would leave a seminar if he thought it was not worth his while. He had no time for sloppiness; things had to be done properly. Once ideas were published, they were set in stone.

DeWitt loved to travel, considering himself a "space traveller". He enlisted as a US Navy pilot in January 1944 but did not see any combat. Following his graduate studies in Harvard during the late 1940s, he hopped around the globe, working at Princeton University, at the Swiss Federal Institute of Technology in Zurich and, in what Steven Weinberg judged a "sojourn

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[that] did not make good professional sense, but … suited his roving spirit", at the Tata Institute of Fundamental Research in Mumbai, India. In 1973 he led an expedition to Mauritania to repeat Arthur Eddington's 1919 measurement of the gravitational bending of starlight around the Sun's limb during a solar eclipse. Cécile and Bryce were also known for taking long walks in the stunning landscape of the American West and in the Alps, where Cécile set up the Les Houches scientific lecture series.

DeWitt's academic career was colourful and varied. After his postdoctoral fellowships, he worked in California from 1952 to 1955 at the Lawrence Livermore Laboratory with Edward Teller on modelling nuclear artillery shells. He briefly led the Institute of Field Physics at Chapel Hill, North Carolina, a centre funded by the industrialist Agnew Bahnson, who hoped to unlock technology from basic research in gravity. In 1973 DeWitt ended up, along with Cécile, at the Center for Relativity at the University of Texas at Austin, which was at the heart of the revival of research interest in general relativity in the 1960s.

"The book made me want to take up the challenge of quantum gravity, to follow the extraordinary trail to that untamed frontier of physics."

Sadly lacking from the book is a personal description of the DeWitts' epic love story. Bryce and Cécile were together for more than 50 years and had four children. According to the publication list, the couple wrote their first paper together in 1952 and their last in 2004. Yet we learn little about their joint lives. There are scraps of information: Bryce mentions that he "cast glances" at Cécile in 1949, when he met her at the Institute for Advanced Studies in Princeton. A picture of Bryce and Cécile is captioned with a quote from one of DeWitt's obituaries: "They became lifelong sparring partners." I would have liked to have known more.

Nevertheless, the book is enthralling. It made me want to take up the challenge of quantum gravity, to follow the extraordinary trail set down by Bryce and Cécile to that untamed frontier of physics. ■

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GEOGRAPHY

Islamic views of Earth

A magisterial series revolutionizes our understanding of Arabic geography, finds **Celâl Şengör**.

Geschichte des Arabischen Schrifttums, Band XIV. Anthropogeographie Teil I: Gesamt- und Ländergeographie; Stadt- und Regionalgeographie
FUAT SEZGIN
J. W. Goethe Univ.: 2010. 553 pp. €124. (In German.)

Geschichte des Arabischen Schrifttums, Band XV. Anthropogeographie Teil II: Topographie, Geographische Lexika, Kosmographie, Kosmologie, Reiseberichte
FUAT SEZGIN
J. W. Goethe Univ.: 2010. 470 pp. €117. (In German.)

Scientific geography was invented by the Greeks in the sixth century BC and reached its apogee in the mid-nineteenth century in Europe. In this five-volume work, *Geschichte des Arabischen Schrifttums* (*History of Arabic Literature*) — the last two of which were published in 2010 — science historian Fuat Sezgin shows that Muslim scholars played an integral part in developing Greek ideas about the planet, and explains how influential their work was in the West.

By reviewing and analysing a vast corpus of Arabic geographical writings from the eighth to the seventeenth centuries, Sezgin revolutionizes our view of the history of geography. The first three volumes, plus an atlas, cover the development of mathematical geography and cartography. The latter two volumes span a range of topics, from the history of general and regional geography, through topography and cosmology to the history of Arabic–Islamic travel reports. He brackets these as 'anthropogeography' to underline their relevance to human existence.

In the first three books, Sezgin establishes that Muslim scholars — starting with geographers during the reign of al-Ma'mun (786–833 AD), a caliph of Abbasid — inherited and developed the geographical and cartographical tradition of the Persian Sassanids and Greeks, from Eratosthenes to Ptolemy. The Muslims improved on Ptolemy's database of longitudes and latitudes of features such as cities, mountain ranges, rivers and continental coastlines.

They initiated geodetic work in the ninth century AD by re-measuring the length of a degree of meridian in the plains of Mosul and Damascus and at Mount Casius, or Jebel Aqra, near Hatay (ancient Antioch) in present-day Turkey, and by fixing the positions of geographical features on the basis of astronomical observations. In the eleventh century, this culminated in Turkish scholar Abu Rayhan al-Biruni's (973–1048) great work *Measurement of Distances Between Known Places on Earth*.

F. SEZGIN

A world map by ninth-century Muslim geographers.

The many maps produced as a result of these activities by Muslim scholars eventually reached Europe. Beginning with portolan maps in the fourteenth century — predecessors of accurate navigational charts showing coastlines and harbours — they influenced the European cartography of Asia, Africa and the Indian Ocean until well into the nineteenth century.

Sezgin's two most recent volumes go beyond cartography. Arabic geographical activity started before the seventh century AD, he explains. Much geographical information was included in poetry — the names of places, oases and other watering sites. So the first geographical publications in Islamic culture were penned by philologists in the second century of Islam, following the expansion of the Arabic empire under the Umayyads and then the Abbasids. The first map by a Muslim author — a remarkable map of the world in the form of a bird — was made in the seventh century by a young friend of the prophet Mohammad, 'Abdallah b.'Amr b. al-Āṣ.

The demand for broader Muslim geographies grew as European interests expanded beyond its borders from the fourteenth to the sixteenth centuries. Travellers hunted for works on

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