Deciphering the Cosmic Number: The Strange Friendship of Wolfgang Pauli and Carl Jung

by Arthur I. Miller

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The "strange friendship" between Wolfgang Pauli (1900–1958), the Nobel Prize winning physicist so influential in the "quantum revolution", and Carl Gustav Jung (1875–1961), famed founder of analytical psychology, has fascinated many people. The correspondence between them has been published [1], and there are now several books and articles dealing with their relationship [2]. The Pauli-Jung friendship is an ideal subject for Arthur I. Miller, professor emeritus at University College London, who has had a long-time interest in the border area between science and art, particularly concerning questions of creativity and imagery.

As a student at the City College of New York, Arthur I. Miller took large doses of philosophy in addition to physics. This was the start of a career that would lead him to become a well known historian of science and an acclaimed author. In 1965 he earned a Ph.D. in physics at the Massachusetts Institute of Technology and went on to research in theoretical particle physics. Reading the original German-language papers written by the giants of twentieth-century physics – scientists such as Albert Einstein, Niels Bohr, Werner Heisenberg, Erwin Schrödinger, and Wolfgang Pauli – drove him to study the role of visual thinking in highly creative research and the importance of the history of ideas. In 1991 Miller moved to England where he became Professor of History and Philosophy of Science at University College London. He is the author not only of academic works but also of several widely acclaimed books for a wider audience, including *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc* (2001), nominated for the Pulitzer Prize.

The seeds for the extraordinary relationship between the theoretical physicist Wolfgang Pauli and the psychoanalyst Carl Gustav Jung were sown in the first two decades of the twentieth century. These two decades were, both culturally and scientifically, among the richest periods of recent history. Sigmund Freud developed his ideas of the unconscious and psychoanalysis, which were now being popularized, as well as criticized, by Jung. As Miller points out, "Carl Jung was a celebrity and regarded as the chief rival of the great Sigmund Freud […] He extended the boundaries by using dream images to explore the unconscious more deeply than Freud had, probing into the archetypes built into our minds." In 1905 Albert Einstein revolutionized the world of physics with his special theory of relativity, while artists were reassembling notions of reality by delving into cubism and abstract expressionism. "Classical ways of understanding the world suddenly seemed insufficient. An intellectual tidal wave – the avant-garde – swept across Europe."

Wolfgang Pauli was born into this "ferment of ideas". At the age of 21 he burst on the physical scene with a paper on general relativity. His new mentor in Munich, Arnold Sommerfeld, and even Einstein himself were impressed. Pauli was admired as a confident theoretical physicist but also feared as a pitiless critic of every illogical or wooly idea. In 1925 he made a major advance in quantum physics by formulating the famous Pauli exclusion principle (for which he was awarded the 1945 Nobel Prize in Physics). Seven years later, working at the Swiss Federal Institute of Technology Zurich (ETH—Eidgenössische Technische Hochschule—Zürich), he suffered from depression and hypersensitivity. At his father's suggestion, the apologist of intellectual rigour sought psychiatric help on the couch of Carl Gustav Jung. As Jung put it: "When the hard-boiled rationalist […] came to consult me for the first time, he was in such a state of panic that not only he but I myself felt the wind blowing over from the lunatic asylum!" And so began a long friendship that is the subject of Arthur I. Miller's *Deciphering the Cosmic Number*.

Pauli had always nurtured an interest in the irrational as a driving force of scientific creativity. Science, as his mentor Arnold Sommerfeld pointed out, had grown out of mysticism. Inspired by his mentor's interest in the occult, he immersed himself in the work of two Renaissance thinkers, the German astronomer and mathematician Johannes Kepler (1571–1630) and the English nobleman Robert Fludd (1574–1637), medico and philosopher. Kepler was inspired by the harmonious symmetry of Copernicus' heliocentric world view and the Pythagorean reverence for number. Kepler's transition "From circles to ellipses" is treated by Miller, but not emphasized as a revolutionary new ontological concept. For the philosopher of science Jürgen Mittelstraß, professor emeritus at the University of Konstanz, the transition from "perfect" circles to "imperfect" ellipses is not only a change of geometrical figures but "the momentous abandonment of mathematic-ontological distinctions" ("die folgenschwere Preisgabe mathematisch-ontologischer Unterscheidungen") [3]. Kepler sought to derive a complete description of the cosmos primarily in terms of mathematics. (One of the best fundamental analyses of the mathematically formulated world due to Galileo Galilei [and Kepler] is given by the phenomenological philosopher and mathematician Edmund Husserl [4].) Fludd, on the other hand, remained rooted in the traditions of mysticism and alchemy. He endeavored to describe the "true philosophy" by means of pictures rather than with "vulgar mathematics". In some respects comparable to *mandalas*, pictures in the alchemist tradition can be understood as universal forms that depict the whole as made up of opposing parts.

Surprisingly for a theoretical (i.e., mathematical) physicist, Pauli had sympathy for Fludd as well as Kepler. But

there was another feature of the Kepler/Fludd clash which was very important for Pauli. For Kepler the perfect number was three, but for Fludd four was "the eternal fountainhead of nature". Pauli had been torn between these two numbers in his own work. In order to derive his exclusion principle he had to allow four, rather than three quantum numbers, a break with classical physics, which Bohr admiringly described as "complete insanity". The two numbers, together with another obsessive number, the dimensionless fine structure constant with a value close to 1/137, made frequent appearances in Pauli's dreams, whose analysis by Jung would play a central role in their relationship.

One of the questions is why the prime number 137 repeatedly crops up in quantum physics, in connection with the strength of the electromagnetic force (the number emerges in a combination of the speed of light, the charge of the electron, and Planck's constant) [5]. The work on the fine structure problem was Arnold Sommerfeld's primary contribution to atomic physics. His "brainwave" was to apply Einstein's relativity theory to Bohr's atomic theory, changing the mass of the electron according to Einstein's famous equation $E = mc^2$. Miller summarizes the importance of this universal constant as follows: "A dimensionless number of such fundamental importance had never before appeared in physics. Of course dimensionless numbers had always been present in equations, but never one that was deduced from fundamental constants of nature. Scientists later realized that if the numerical value of the fine structure constant were to differ by a mere 4 percent, almost all carbon and oxygen would be destroyed in every star in the universe and life on our planet would not exist or would be dramatically different." We wouldn't exist if the fine structure constant were slightly different. This kind of question is religious or philosophical and transcends the means of physics. As pointed out by Terry Eagleton, Professor of Cultural Theory at the University of Manchester, the most fundamental question is the question (e.g., formulated by Gottfried Wilhelm Leibniz [6]): "Why is there something rather than nothing?" [7] This question can also be formulated: "Where does the cosmos come from?" Miller further states in a radio interview that in principle alien intelligent life-forms in other galaxies could likewise find the dimensionless fine structure constant (1/137) as a fundamental cosmic number [8].

In ancient Hebrew, numbers were written with letters, and each letter of the Hebrew alphabet has a number associated with it. The word "Kabbalah" in Hebrew is written with four letters – and we do not wonder at the end of the book that the four Hebrew letters add up to … 137! Thus the mystic number 137 "continues to fire the imagination of everyone from scientist and mystics to occultists and people from the far-flung edges of society" (p. 259).

Jung, too, was interested in the occult. Like Freud, he believed that dreams are the key to an individual's psyche, but in opposition to Freud he viewed them as a portal to a collective unconscious – symbolic notions, called archetypes. (The existence of the unconscious is confirmed by modern neuropsychology, but the question of archetypes as source of human thinking remains controversial.) Jung's ideas naturally led him to study the alchemists who were also "talking in symbols", and believed that ultimate wisdom – the philosopher's stone – would be achieved through a unification of opposite states. He began to incorporate alchemy into his analytical psychology. To avoid mockery, and also to build a more universal theory, he needed to give his quasi-mystical theories some kind of "scientific" footing. In 1932, an opportunity to do so was the less or more chance encounter with Pauli.

For Jung, quantum physics became important in his consideration of synchronicity, that is, meaningful coincidences as an acausal connecting principle, which he came to believe formed a link between physics and psychology [9].

More than 20 years ago, Miller came across a book Jung and Pauli had coauthored: *The Interpretation of Nature and the Psyche* [10]. Pauli re-examined the theories of Kepler (and Fludd) in the light of Jungian psychology, focusing on the role of the irrational in scientific creativity. He argued that the link between sensory experience and the rational concepts that make up a scientific theory is formed by archetypes.

Arthur I. Miller's thoroughly researched book gives an exemplary account of an excursion into the "no man's land" between physics and psychology and of fruitful interdisciplinarity in the exploration of the human mind and creativity. In the epilogue he states: "The puzzle of how we reason, how we think – of how we create knowledge from already existing knowledge and how we draw conclusions that go beyond the premises – cannot be solved by logic alone."

In an interview the author remarks, "Although the two men [Pauli and Jung] never came up with answers, the questions they raised, the level of their discussions, and their quest to fold physics and psychology together, merit further consideration. That was one of the reasons I wrote this book." [11]

It is no surprise to hear that, when Pauli was dying of pancreatic cancer at the Red Cross Hospital in Zurich in December 1958, Jung was the last person he asked to see. The number of Pauli's room was 137!

This book is also available in German and Italian Translations: München, Deutsche Verlags-Anstalt, 2011, Übers. Von Hubert Mania, CA, €22.99, 350 pp., ISBN 978-3-421-04290-3 (German edition); [Milano], Rizzoli, 2009, Trad. di Carlo Capararo, Stefano Galli, 443 PP., ISBN 978-8-817-03296-4 (Italian edition).

REFERENCES

[1] *Atom and Archetype: The Pauli/Jung Letters, 1932–1958*. C[arl] A. Meier (ed.) with the assistance of C. P. Enz and M. Fierz. Transl. from the German by David Roscoe. With an introductory essay by Beverley Zabriskie, Princeton, Princeton University Press, 2001. Originally published as *Wolfgang Pauli und C. G. Jung. Ein Briefwechsel, 1932–1958*. Hrsg. von C[arl] A. Meier. Unter Mitarbeit von C. P. Enz und M. Fierz, Berlin, Springer-Verlag, 1992.

[2] Cf. Suzanne Gieser, *The Innermost Kernel. Depth Psychology and Quantum Physics. Wolfgang Pauli's Dialogue with C. G. Jung*, Berlin, Heidelberg, Springer-Verlag, 2005; Harald Atmanspacher, Hans Primas (Eds.), *Recasting Reality. Wolfgang Pauli's*

Philosophical Ideas and Contemporary Science, Berlin, Heidelberg, Springer-Verlag, 2009; Charles P. Enz, *Of Matter and Spirit. Selected Essays*, Singapore, Hackensack, NJ, London, World Scientific Publishing, 2009, in particular essay no. 19: ''Wolfgang Pauli – C. G. Jung, a Dialogue over the Boundaries''. Further two older relevant and interesting books, not listed in Miller's bibliography: Fred Alan Wolf, *The Dreaming Universe. A Mind-Expanding Journey into the Realm Where Psyche and Physics Meet*, New York, Simon & Schuster, 1994; Arnold Mindell, *Quantum Mind. The Edge Between Physics and Psychology*, Portland, OR, Lao Tse Press, 2000.

[3] Jürgen Mittelstraß, *Die Rettung der Phänomene. Ursprung und Geschichte eines antiken Forschungsprinzip*s, Berlin, Walter de Gruyter, 1962, p. 213; cf. Alexandre Koyré, *From the Closed World to the Infinite Universe*, Baltimore, Johns Hopkins Press, 1957, pp. 1–3; Thomas de Padova, *Das Weltgeheimnis. Kepler, Galilei und die Vermessung des Himmels*, München, Zürich, Piper, 2009, pp. 276–278.

[4] Edmund Husserl, *Die Krisis der europäischen Wissenschaften und die transzendentale Phänomenologie. Eine Einleitung in die phänomenologische Philosophie*. Hrsg. von Walter Biemel (*Husserliana*, Bd. VI), 2. Aufl., [Den] Haag, Martinus Nijhoff Publishers, 1962, in particular § 9 (English translation: *The Crisis of European Sciences and Transcendental Phenomenology. An Introduction to Phenomenological Philosophy*. Transl., with an introduction, by David Carr, Evanston, Northwestern University Press, 1970); cf. Günther Neumann, ''Galilei und der Geist der Neuzeit: Husserls Rekonstruktion der Galileischen Naturwissenschaft in der *Krisis*-Schrift,'' *Phänomenologische Forschungen*, Jahrgang, 2001, pp. 259–279.

[5] For more details see Michael A. Sherbon, ''Constants of Nature from the Dynamics of Time'' (5 November 2008) (available at SSRN: http://ssrn.com/abstract=1296854 or at Philpapers: http://philpapers.org/profile/2603).

[6] ''Principes de la Nature et de la Grace, fondés en raison,'' sec. 7, Gottfried Wilhelm Leibniz, *Die philosophischen Schriften*. Hrsg. von C[arl] I[mmanuel] Gerhardt [1875–1890], Hildesheim, New York, Olms, 1978, vol. VI, p. 602.

[7] Terry Eagleton, *The Meaning of Life*, Oxford, New York, Oxford University Press, 2007, p. 2 ff.

[8] Radio interview first broadcast on 2 May 2009 – Arthur I. Miller talking to Gene Heinemeyer about *Deciphering the Cosmic Number* (available at the homepage of Arthur I. Miller: http://www.arthurimiller.com/books/deciphering-the-cosmic-number).

[9] Cf. F. David Peat, *Synchronicity: The Bridge Between Matter and Mind*, Toronto, New York, Bantam Books, 1987; Roderick Main, *Revelations of Chance: Synchronicity as Spiritual Experience*, Albany, NY, State University of New York Press, 2007.

[10] Carl G. Jung, ''Synchronicity: An acausal connecting principle'' and Wolfgang Pauli, ''The Influence of Archetypal Ideas on the Scientific Theories of Kepler''. In: *The Interpretation of Nature and the Psyche*. Transl. by Priscilla Silz, New York, Pantheon Books, 1955 (Bollingen Series LI). Originally published as *Naturerklärung und Psyche*, Zürich, Rascher, 1952.

[11] ''Why two geniuses delved into the occult,'' Interview with Amanda Gefter, *New Scientist*, 24 April 2009 (available at the homepage of Arthur I. Miller, see [8]); cf. ''Creativity and intellect: when great minds meet,'' Interview with Beatrice Bressan, *CERN Courier*, 31 March 2010 (available at the homepage of Arthur I. Miller, see [8], or at the *CERN Courier:* http://cerncourier.com/cws/article/cern/42093).

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