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FACT SHEET – PROFESSOR BERNARD d’ESPAGNAT

August 22, 1921: Bernard d’Espagnat born to Marguerite de Ginestet, a homemaker, and Georges d’Espagnat, a post-impressionist painter, illustrator, and stage designer, in Fourmagnac, France, and grows up as an only child. Early on, his parents instill in him a love of classic literature, including evenings spent with his mother reading to him the works of Shakespeare and others.

1925 – 1939: In Paris, where his father works and his parents now spend most of their time, d’Espagnat attends primary and secondary schools, including the renowned *Lycée Condorcet*, whose alumni include Marcel Proust, Jean Cocteau, and Henri de Toulouse-Lautrec. His education largely centers on the humanities, especially Latin, Greek and general literature, which he reads voraciously. He also develops an intense interest in mathematics. He wins a Latin prize at the prestigious *Concours général des Lycées et Collèges* (open high school and college competition), and baccalaureates in philosophy and mathematics.

Despite an interest in pure philosophy, he chooses to pursue an education in science, believing that genuine advances in philosophy require an extensive knowledge and practice of current science.

1939-1942: He desires to attend the internationally acclaimed *Ecole Polytechnique*, but because of World War II, all courses to prepare for the entrance examination are transferred outside Paris. D’Espagnat settles in Toulouse to take the courses. In 1940, with France split between a non-occupied zone with Vichy as a provisional capital and an occupied zone comprising all of its northern part including Paris as well as regions along the Atlantic coast, he is forced to remain in Toulouse for one more year. By 1941, however, he is able to return to Paris, where preparation courses have reopened. He attends those of *Lycée Saint-Louis*, the Latin Quarter preparatory school once attended by Émile Zola, Yves Tanguy, and Louis Pasteur. In 1942 he passes the *Ecole Polytechnique* entrance examination.

1942 – 1945: Despite its reputation as one of the world's outstanding schools in domains such as pure mathematics and physics, the *Ecole Polytechnique* also has the status of a military school. Its students are cadets, a tradition dating from 1805 when Napoleon settled the school as a military academy. Proper military training being forbidden at that time by the German authorities, the class of 1942 was instead sent for one year to the so-called *Chantiers de la Jeunesse* (Youth Workshops), a paramilitary organization of the Vichy government. In 1943, however, with most German young men fighting in the war, Hitler required the youth in Nazi-occupied nations, including France, to go to various parts of Germany and Austria to do domestic labor. Hence, after one year spent in the *Chantiers*, d’Espagnat is forced to go to Austria to perform menial tasks. After a year and a half, he and a friend flee Vienna on foot and escape to neutral Switzerland, finally returning to France in April 1945 during the final days of the war in Europe.

Following the Allied victory in Europe, he is sent to Germany, but this time as a member of the occupation forces organized by the *Ecole Polytechnique*. Finally, in October 1945, six years after he first formed the desire to enter the school, he begins attending regular courses.

1945 – 1947: Studies at the *Ecole Polytechnique*. Encouraged by his professor of physics, Louis Leprince-Ringuet, he commits himself to a career in theoretical physics and enters the *Centre National de la Recherche Scientifique* (National Center for Scientific Research) as a researcher.

1947 – 1950: Prepares a thesis at the Institut Henri Poincaré in Paris under the supervision of Louis de Broglie, the 1929 Nobel Laureate in Physics for his discovery of the wave nature of electrons.

1950: Receives Ph.D. in Physics in the Sorbonne University in Paris (chairman, Louis de Broglie) with a thesis on “Research on the Production Theories of Mesons of High Energy.”

Marries May de Schoutheete de Tervarent in Brussels, Belgium. They have two daughters: Isabelle, born 1958 (Mme Frédéric Mersier), and Anne, born 1961 (Mme Renaud Bachy).

1951: Serves for a year as a research assistant to physicist Enrico Fermi at the University of Chicago.

1953: Prior to CERN locating its laboratories to the outskirts of Geneva, Switzerland, d’Espagnat serves for a year in the CERN theoretical research group at the Institute for Theoretical Physics in Copenhagen, Denmark, headed by physicist Niels Bohr. (CERN, the European Council for Nuclear Research [*Organisation Européenne pour la Recherche Nucléaire*], derives its name from an acronym for its original name, *Conseil Européen pour la Recherche Nucléaire*.)

1954: Appointed Physicist, then Senior Physicist at CERN in Geneva, serving until 1959. Contributes to the creation of the CERN theoretical physics group there.

1959: Appointed Assistant Professor at the Faculty of Science at the University of Paris-Sorbonne and almost immediately is attached to its newly created center in Orsay, which, a few years later, was to become a full-fledged university under the name of *Université Paris-Sud* (also known as Paris-Orsay or Paris XI). In parallel with his teaching at Orsay, d’Espagnat continues working part-time at CERN in Geneva until 1970.

1965: *Conceptions de la physique contemporaine* (Conceptions of Contemporary Physics) published. This groundbreaking work offers one of the earliest analyses of the impact of quantum mechanics on standard philosophical views including realism, positivism, and idealism.

1967: Appointed Professor at the University of Paris-Orsay, with teaching responsibility mainly in quantum mechanics, and serves until his (official) retirement in 1987.

Awarded the Prix Lecomte du Noüy for his book, *Conceptions de la physique contemporaine*.

1970: Organizes and directs the 49th session of the Enrico Fermi International Summer School in Varenna, Italy, dedicated to the conceptual foundations of quantum mechanics.

1971: Appointed Director of the Laboratory of Theoretical Physics and Elementary Particles at the University of Paris-Orsay, a position he holds until his retirement.

Foundations of Quantum Mechanics, the proceedings of the Enrico Fermi summer school in 1970, published under d’Espagnat’s direction.

Conceptual Foundations of Quantum Mechanics published, with three successive editions published in 1976, 1989, and 1999. The book provides a detailed view of the conceptual foundations of quantum physics using clear mathematical arguments to describe problems with nonseparability (a newly appeared notion meaning that when two quantum systems have once interacted there is a physically definable sense in which they go on constituting but one system), hidden variable theories (which rely on possibly unknown elements to explain quantum mechanics), and several related problems. The book aims to show that while quantum mechanics is clear when used for *predicting observational results*, it raises nearly intractable conceptual problems when interpreted as *describing* atomic entities. It also puts forward the distinction between *proper* and *improper* mixtures and clarifies the quantum measurement riddle.

1975: Elected member of the International Academy of Philosophy of Science, Brussels.

1975 – current: Acts as referee for various journals including *Physical Review*, *Physical Review Letters*, *Foundations of Physics* and *Physics Letters A*, mainly on subjects having to do with interpretations of quantum mechanics.

1976: With physicist John Bell, a former associate at CERN, organizes a workshop entitled “Experimental Quantum Mechanics” in the *Ettore Majorana Centre for Scientific Culture* in Erice, Sicily. Bell’s Theorem (also referred to as Bell’s inequalities), first set forth in a 1964 paper, appears to show conclusively that realist local interpretations of quantum mechanics cannot work.

1977: Serves as Visiting Professor at the University of Texas, Austin, at the invitation of physicist John Archibald Wheeler.

1979: “The Quantum Theory and Reality” published in the November issue of *Scientific American*. The article challenges the popular doctrine of philosophical atomism, according to which the world is made up of a myriad of localized objects interacting only locally. It gives a simple proof of the fact, first established by John Bell, that philosophical atomism has experimentally testable consequences – the Bell inequalities – that are at variance with quantum mechanical predictions. At the time the article was written, despite preliminary experiments that offered strong indication otherwise, it was still possible that atomism might be right and quantum mechanics wrong. The extremely accurate experiments of physicist Alain Aspect in 1982 showed that, indeed, philosophical atomism was no longer viable.

À la recherche du réel, le regard d’un physicien, published. A best-seller in France, the book is the first to introduce Bell’s inequalities to a non-specialized educated public and explain their philosophical significance, notably that they constitute a test between quantum mechanics on the one hand and, on the other, a conception of locality that physicists such as Einstein considered self evident. Either nature – reality as it really is – fully obeys relativity requirements, in which case the inequalities would be satisfied and quantum mechanics would, for the first time in history, yield erroneous predictions, or quantum mechanics is correct and Bell’s inequalities are violated, thus

disproving realism or locality (or both). Published in English as *In Search of Reality, the Outlook of a Physicist*, in 1983.

1980: Appointed Program and Seminar Director for Philosophy of Contemporary Physics at the *Institut d'Histoire et de Philosophie des Sciences* (Institute for the History and Philosophy of Science), a dependency of the Sorbonne University, a position he holds along with his post at the University of Paris-Orsay until retirement in 1987.

1982: *Un atome de sagesse: propos d'un physicien sur le réel voilé* (An Atom of Wisdom: Writings by a Physicist on Veiled Reality) published. The book is a collection of short reflections on themes ranging from various conceptions of reality to critical analyses of thinkers' methods, hedonism, sociology, and spirituality.

Awarded the Prix Robert Blanché by the *Académie des Sciences Morales et Politiques* (Academy of Moral and Political Science) in Paris for *Un atome de sagesse*.

1984: Serves as Visiting Professor at the University of California, Santa Barbara.

1985: *Une incertaine réalité, le monde quantique, la connaissance et la durée* (An Uncertain Reality, the Quantum World, Knowledge and Duration) published. Here, he examines the relationship between the methodology of physicists – including their practices and criticisms – and the reality they seek to understand. Published in English as *Reality and the Physicist: Knowledge, Duration and the Quantum World*, in 1989.

1987: Named Professor Emeritus at the University of Paris-Orsay.

1989: Serves as Guest Lecturer at the *Forschungsstätte der Evangelischen Studiengemeinschaft* (FEST) (Protestant Institute for Interdisciplinary Research), Heidelberg, Germany, on the topic of "Open Realism."

1990: *Penser la science ou les enjeux du savoir* (Thinking Science or the Stakes of Knowledge) published. In it, the author expresses his views on problems and questions which science raises, for instance, what are the potential dangers of unlimited research, are paradigm changes arbitrary, is science merely a sociocultural affair, and is methodological materialism a precondition for research?

Georges d'Espagnat, a biography of his father's artistic life with two hundred reproductions of his works and texts and letters from many of his contemporaries, published.

1993: *Regards sur la matière, des quanta et des choses* (Outlook on Matter, Quanta and Things) (with E. Klein), published. An introduction to the conceptual changes brought about by contemporary physics, aimed at a general public.

1994: *Le réel voilé, analyse des concepts quantiques* published. A precise presentation of the basic principles of quantum mechanics and an analysis thereof, showing that far from restoring conventional realism, recent findings in the field speak in favor of the view that "Ultimate Reality" is *veiled*, that is, not fully describable just by means of logical and observational concepts. Published in English as *Veiled Reality, An Analysis of Present-Day Quantum Mechanical Concepts*, in 1995 and reprinted in 2003.

Serves as Guest Lecturer at the International Academy of Philosophy of Science in Nancy, France, speaking on Henri Poincaré and his idea of reality.

1995: Serves as Guest Lecturer at the *Zentrum für Interdisziplinäre Forschung* (Center for Interdisciplinary Research), Bielefeld, Germany, on veiled reality, and also Guest Lecturer at the International Academy of Philosophy of Science, Parma, Italy, on “Observation, Contextuality and Realism.”

1996: Elected Member of the *Académie des Sciences Morales et Politiques*, Philosophy section, one of five academies in the Institute of France. Membership is limited to 50 honorees, with new members admitted only upon the death of a previous member.

On the occasion of his 75th birthday, participates in a two-day symposium dedicated to him and his works at the *Institut d’Histoire et de Philosophie des Sciences* at the Sorbonne University, organized by philosopher Michel Bitbol.

1997: *Physique et réalité, un débat avec Bernard d’Espagnat* (Physics and Reality, a Debate with Bernard d’Espagnat), published. The book chronicles the proceedings of the 75th birthday symposium in 1996.

Speaks on “Problems on Objectizing” as Guest Lecturer at the Max Born Symposium, Wrocław, Poland.

2001: In honor of philosopher Jean Ladrière’s 80th birthday, presents lecture on Ladrière’s phenomenological approach, decoherence, and realism at a colloquium organized by the *Institut Supérieur de Philosophie de l’Université de Louvain* in Belgium.

2002: *Traité de physique et de philosophie* published. In it, he stresses that quantum physics totally reshaped basic concepts that were considered inviolable, such as space, time, and causality, and contends that up to now philosophers did not sufficiently take these changes into account. He describes the most recent ones in detail, compares them with the tenets of the most significant philosophical systems and concludes, again, that if there is to be an effective consideration of an ultimate reality this reality should be taken to be veiled. Published in English as *On Physics and Philosophy* in 2006.

2008: *Candide et le physicien* (Candide and the Physicist) (with Claude Saliceti) published. After reading *Traité de physique et de philosophie*, the physician and philosopher Claude Saliceti submitted 50 questions to d’Espagnat inspired by the book. Written for the layperson, it studies essential questions bearing on the concepts of time, space, objects, and objectivity using a philosophical sensitivity as a means to understanding basic notions of physics and, in the process, yields insights into the relationship between science and being.

2009: Awarded the Templeton Prize.

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