Victor F. Weisskopf

Vienna, Austria, 19 Sept. 1908 - Newton, 21 Apr. 2002

Title Professor of Physics, Massachusetts Institute of Technology, Cambridge, MA, USA

Field Physics

Nomination 2 Dec. 1975

Most important awards, prizes and academies

Max Planck Medal (1956); Ordre pour le Mérite, Germany (1978); Smolakowski Medal, Poland (1979); National Medal of Science, U.S.A. (1980); Wolf Prize, Israel (1982); Ehrenzeichen für Kunst und Wissenschaft, Austria (1982); Giancarlo Wick Medal (1994); Grosses Goldenes Ehrenzeichen, Austria (2000). Academies: National USA, American USA, Austrian, Bavarian, Danish, French, Soviet, Spanish.

Summary of scientific research

Quantum electro-dynamics: Theory of natural line width; self-energy of electrons; calculation of lambshift; theory of charged scalar mesons.

Nuclear Physics: theory of nuclear reactions; compound nucleus; 'crystal cell' model of the nucleus; statistical theory of nuclear excitation; nuclear temperature.

Elementary particle physics: quark model; 'bag' theory of nucleons.

Main publications

Weisskopf V.F., *Berechnung der natürlichen Linienbreite auf Grund der Dirac'sen Lichttheorie* (with E. Wigner). «Z. Phys.», *63*, 51 (1930); Weisskopf V.F., *Über die Selbstenergie des Electrons*. «Z. Phys.», *89*, 27 (1934); Weisskopf V.F., *Self-energy of the electromagnetic field of the electron*. «Phys. Rev.», *57*, 472 (1940); Weisskopf V.F., *Statistics and Nuclear Reactions*. «Phys. Rev.», *52*, 295 (1937); Weisskopf V.F., *Schematic Theory of the nuclear cross-section* (with H. Feshbach). «Phys. Rev.», *76*, 1550 (1949); Weisskopf V.F., *Theoretical Nuclear Physics* (with J. Blatt). J. Wiley Publisher, New York (1952); Weisskopf V.F., *Knowledge and Wonder*. New York, Doubleday, Publisher 1962; Weisskopf V.F., *Hadron Decay processes and the Quark Model*. «Nuovo Cimento», X *50*, 617 (1967); Weisskopf V.F., *A new model of Hadrons* (with A. Chodos, R. Jaffe, K. Johnson, C. Thorn). «Phys. Rev.», *9* (1974); Weisskopf V.F., *Physics in the XX Century*. M.I.T. Press, Cambridge (1972); Weisskopf V.F., *Concepts of Particle Physics* (with K. Gottfried). Oxford Press, New York, Oxford 1984, 1986; Weisskopf V.F., *The Joy of Insight*. New York, Basic Books, 1991.

Commemoration – What makes Victor F. Weisskopf unique in the 20th century is his being a great scientist and an exceptional mentor who was endowed with a nearly unmatchable humaneness. Scientific Europe owes him an enormous debt. CERN (European Subnuclear Research Center) had him as a scientific, moral and effective leader in the crucial years of its younger existence, from 1961 to 1965. During these years, CERN was the first European scientific enterprise to find itself in competition with the colossal USA. His responsibility as Director General of CERN was decisive for creating that which today is known throughout the world as the 'spirit of CERN', which means scientific excellence. In Subnuclear physics Europe is top rank, thanks to the great Weisskopf. To us young fellows he said: *Guys, when one day you will have the opportunity to speak about all that I've done in my life, please forget titles and honors. Tell instead about something I did in physics.* This is what I will try to do now, having had the privilege of knowing him when he was at the peak of his scientific strength. He was my teacher and an unwavering supporter of my scientific activity. He loved to recall his first steps. And what steps! I will recount the most beautiful episode. This was how the calculations of 'virtual' reality got started. We physicists call it 'radiative effects'. It was he, in fact, who was the first to venture into the unexplored territory of the phenomena called ‘virtual’. Let us imagine an instrument so full of power that it could observe any phenomenon; even within the intimate heart of matter itself. An instrument from which nothing can hide. Well, almost nothing. This super-powerful instrument would never be able to observe directly the phenomena we call ‘virtual’. Prior to the 1930s, it would have been impossible to imagine the existence of this reality. And yet – now that it has become daily bread in our laboratories – it seems to be practically taken for granted. Start with a single grain of coffee. It is made up of billions and billions of atoms. Each atom has, as an external ‘cloud’, one (if it is Hydrogen) or many electrons. The electron is endowed with an electric charge. The taste of coffee depends on this charge. The light of a light bulb is emitted from the electrons of atoms that constitute the filament of the light bulb. If the electron did not have an electric charge, it could not produce light, which is made up of ‘pieces’, ‘quanta’, which we call ‘photons’. It has been noted that photons that are emitted from one electron can be absorbed by other electrons. If this was not so, how could we detect them at all? It is from this question that ‘virtual’ reality is born. If it is true that an electron can emit a photon, could the same electron absorb that very same photon? The answer is affirmative, but the phenomenon is not observable. In fact, if we could actually observe that photon, the electron could no longer absorb it directly. This is a very simple example of ‘virtual’ reality. Even though it is not directly observable, it nevertheless produces calculable and rigorously reproducible effects. This is what the young Weisskopf discovered. The history of this formidable new reality is incredible. In contrast to the very simple ‘virtual’ phenomenon I have just described (thanks to ‘hindsight’), the young Weisskopf – driven by his interest to understand the ‘radiative effects’ – calculated a very complex ‘virtual’ phenomenon, called ‘vacuum polarization’, and concluded that the effect was small, but that one day it might be measurable. In 1947, a physicist, Willis Lamb, and one of his collaborators from Columbia University (New York), measured the much simpler virtual effect I described above; they discovered that it was 10 times greater than predicted by the young Weisskopf. And of the opposite sign. It is easy (with ‘hindsight’) to understand the reason. The more complicated the virtual phenomena at stake, the smaller are their measurable effects. When Lamb measured the virtual effect that bears his name, Weisskopf estimated the value and sign very quickly. It was a calculation much simpler than that which he had done years before. The contributions of Weisskopf to the progress of physics and of scientific culture are so many that a conference would be necessary in order to review all of them. Let me close by recalling a few of his substantive contributions to making CERN a great European Lab. In the era dominated by BubbleChamber-Technology, he encouraged the construction of the highest intensity negative beam; this allowed the discovery of the first example of Nuclear Antimatter, the discovery of the time-like structure of the proton and the first search for the third lepton. It is thanks to Weisskopf that the high-precision neutron missing mass spectrometer was invented and constructed at CERN; this allowed the direct measurement of a basic quantity (the so-called ‘mixing’ angle) in the structure of the Subnuclear particles called ‘vector’ and ‘pseudoscalar’ mesons. This ‘mixing’ is still of great interest because it requires the most advanced theoretical understanding in Subnuclear Physics, the so-called ‘instantons’. These are just a few examples strictly related to my own research work. Consider how many fellows he has encouraged, inspired and guided, and you will understand why Victor Weisskopf as a physicist and a leader in Europe and in the world will be unique in the history of Science of the 20th century.

Antonino Zichichi