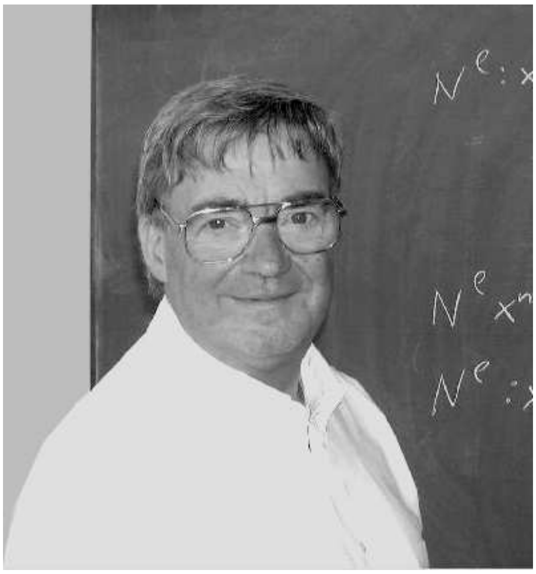
IN MEMORY OF JULIUS WESS (1934 – 2007)



Julius Wess[1], one of the world's most prominent Austrian theoretical physicist, former Director of W. Heisenberg Institute in Munich, member of the International Advisory Editorial Board of the Ukrainian Journal of Physics and President of the Scientific Council of the Austro-Ukrainian Institute for Science and Technology in Vienna, died of a stroke on August 8, 2007 in Hamburg, Germany.

Julius Wess was born on December 5, 1934 in Oberwölz, a small town in the Austrian state of Styria. He belonged exactly to that generation of Austrian students who went through their secondary education (Gymnasium, Realschule) in the first decade after the Second World War and started their university studies and usually had a quite turbulent education, especially during the years immediately following the liberation from the Nazi regime. Nevertheless, Julius Wess became one of those physicists who gave back to Europe her role in science, when Europe was recovering from the enormous intellectual brain drain especially in the German speaking countries.

The scientific path of Julius Wess only in its earliest stages led through an Austrian University: He received his Ph.D. in 1957 in Vienna, where he was a student of Hans Thirring. His Ph.D. examiner was the famous physicist in the field of quantum mechanics, Erwin Schrödinger. It is not too surprising that the start of the career of J. Wess coincided with the arrival of Walter Thirring in Vienna, from whose school so many Austrian physicists have benefitted. His scientific career brought him first to CERN. In 1966, he became an associate professor at the Courant Institute of the University of New York. In 1968, he was a full professor at the Karlsruhe University. In 1990, he left Karlsruhe to become Director of the Max-Plank-Institute for Physics (Werner Heisenberg Institute) in Munich and a professor at the Ludwig-Maximilians University. After his retirement, he worked at DESY in Hamburg.

In 1973, Julius Wess together with Bruno Zumino discovered that there is some extension of the notion of symmetry to a more general notion called supersymmetry, which was then generalized in terms of the differential geometry of a superspace and called supergravity. The main novelty was that the multiplication rule for elements of the symmetry algebra which was till now effected by commutators has been supplemented also by anticommutators in the new extended supersymmetry algebra. The infinitesimal transformations generated by this algebra can change bosons into fermions and vice versa.

In fact, the supersymmetry has been independently discovered by three groups of authors: Yu. Gol'fand and E. Lichtman (1971); D. Volkov and V. Akulov (1972); and J. Wess and B. Zumino (1973). The motivations

[1]See also the book "Julius Wess" in the Series "Classics of World Science", Vol. 5.- TIMPANI: Kyiv, 2002; it may be ordered by e-mail: mss@bitp.kiev.ua.

and starting points used by the three groups were quite different:
– Golfand and Likhtman initially reported the construction of a super-Poincaré algebra and a version of massive super-QED. The formalism contained a massive photon and a photino, a charged Dirac spinor and two charged scalars (spin-0 particles). Likhtman found algebraic representations that could be viewed as supersymmetric multiplets, and he observed the vanishing of the vacuum energy in supersymmetric theories.
– Contributions from the Ukraine were made by Volkov and Akulov, who tried in 1972 to associate the massless fermion – appearing due to the spontaneous supersymmetry breaking – with a neutrino. Within a year, Volkov and Soroka gauged the super-Poincaré group, which led to elements of supergravity. They suggested that a spin-3/2 graviton's superpartner becomes massive on "eating" the Goldstino that Volkov and Akulov had discussed earlier. A mathematical basis for the work of Volkov and collaborators was provided by Berezin's and Katz's paper (published in 1970), where graded algebras were studied thoroughly. In his memoirs, Volkov also mentioned the impact of Heisenberg's ideas on the making of the Volkov–Akulov supersymmetry.
– In the West, a breakthrough into the superworld was made by Wess and Zumino in 1973. This work was done independently, because western researchers knew little if anything about the work done in the Soviet Union. The prehistory, on which Wess and Zumino based their inspiration, has common roots with string theory – another pillar of modern theory – which was referred to in those days as the "dual model": around 1969, the dual-resonance model of strong interactions, found by Veneziano, was formulated in terms of four-dimensional harmonic oscillators. Nambu advanced the idea that these oscillators represent a relativistic string. After that, the scheme was reformulated as a field theory on the string world sheet. The theory was plagued by the fact that the spectrum contained a tachyon but no fermions, and it was consistent only in 26 dimensions. These problems motivated the search for a more realistic string theory.

Although the world-famous theory of J. Wess with B. Zumino on supersymmetry has not yet found a direct experimental verification, its basic ideas seem to be an unavoidable ingredient in all modern speculations from the unification of the basic interactions of elementary particles to the, so far single, successful attempt of string theory to include the theory of gravity into an all-encompassing fundamental theory of Nature. A definite test about the realization of supersymmetry in Nature is expected from the Large Hadron Collider at CERN, which is expected to start data taking in 2008. Here, one hopes to discover the predicted superpartners of the known elementary particles of the Standard Model. It is very saddening that Dmitrij Volkov and Julius Wess died before they could have observed the ultimate test and a possible proof of their revolutionary theory.

"They came up with quantities that you could measure and you could observe," said Roman W. Jackiw, a professor of physics at the Massachusetts Institute of Technology.

The understanding of anomalies, to be avoided in quantum versions of field theories, the basis of our interpretation of physical processes, will forever be linked to the name by Julius Wess as well.

Also the seminal work on supergravity (general relativity including supersymmetry) has received the decisive contributions from Dmitrij Volkov and Julius Wess. This culminated in 1976 with the publication of two papers by Ferrara, Freedman, and van Nieuwenhuizen; and Deser and Zumino. These authors assembled various "superelements" that were in circulation at that time, by completing the elegant construction of modern supergravity.

In the last years, Julius Wess worked on non-commutative geometry and influenced, to a large degree, the renewed interest in this field, where, like supersymmetry and supergravity, he has opened new horizons of the physical thinking.

The community of physicists in Ukraine regrets to have lost someone who not only was an eminent physicist, but also a friend and colleague to many of us.

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