

XII Max Born Symposium
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Theoretical Physics

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FOREWORD

The XII Max Born Symposium has a special character. It was held in honour of Jan Łopuszański on the occasion of his 75th birthday.

As a rule the Max Born Symposia organized by the Institute of Theoretical Physics at the University of Wrocław were devoted to well-defined subjects of contemporary interest. This time, however, the organizers decided to make an exception.

Łopuszański's influence on and contribution to the development of theoretical physics at Wrocław University is highly appreciable. His personality and scientific achievements gave him authority which he used to the best advantage of the Institute. In fact we still profit from his knowledge, experience and judgment. Łopuszański's scientific activity extended over about half a century. He successfully participated in research on the most important and fascinating issues of theoretical physics. During his scientific career he met and made friends with many outstanding physicists who shaped theoretical physics to the present form.

For this reason, as well as the coincidence of the approaching end of the century, we thought that it would be interesting and instructive to give the symposium a retrospective character. We decided to trust the speakers' judgment and intuition for the choice of subjects for their talks. We just asked them to give the audience the important message based on their knowledge and experience.

The beginning of the XII Max Born Symposium had a particularly solemn character. It took place in Aula Leopoldina, the beautiful baroque hall in the main building of our University. In the audience were present the participants and invited guests. Seven speeches were delivered in honour of Professor Jan Łopuszański. Professors from Wrocław, Z. Bubnicki, Z. Latajka and J. Ziolkowski, spoke on the academic career of Jan Łopuszański and his activity in the Wrocław division of the Polish Academy of Sciences. Professor J. Lukierski, as a director of our Institute, welcomed all the guests and, as a friend of Jan Łopuszański, gave a very personal history of Jan's life, showing also some photos starting from his childhood up to recent days.

Professor K. Zalewski from Cracow still remembers Łopuszański's PhD defense at the Jagiellonian University where he was present in the audience as a young student. Professor R. Haag recalled some humorous stories

of his early meetings with Lopuszański. He underlined Lopuszański's honesty and sincerity in scientific research. It was Lopuszański who introduced him to supersymmetry, which resulted in a very influential paper by Haag, Lopuszański and Sohnius.

Among the guests of honour there was also Dr. Roland Kliesow, Consul General of the Federal Republic of Germany. He spoke of Lopuszański's contribution to German–Polish understanding. He considered Lopuszański as a man of deep knowledge of the German language, history and culture. At the time, when the political circumstances were unfavorable for German–Polish relations he co-worked with German scientists and helped to develop personal contacts and collaboration between German and Polish colleagues.

The opening session ended with a short piano recital given by the young pianist Michał Ferber.

The organizing committee takes the opportunity to thank warmly the sponsors:

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The organizing committee

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Jan Łopuszański – the Man and His Achievements

During the opening session of XII Max Born Symposium I had the honour and pleasure to present the life of Jan Łopuszański from his pre-scientific period in Lvov. Let me therefore first recall these first twenty two years of his life.

Jan Łopuszański was born on 21st October 1923, in Lvov, as the only child of Janina Łopuszańska, de domo Kuźmicz. His father, Władysław Łopuszański was, until Piłsudski's coup d'état in 1926, in governmental service, but after these events he left the state post, became the Head of the Local Landowners Association, and further the Director of the Insurance Company "Floryanka". The most well-known in the Łopuszański family were Professor Jan Łopuszański, Jan's uncle, who was the Head of the Ministry of Public Works in the 1920s, and also the Rector of the Lvov Institute of Technology, and Tadeusz Łopuszański, the Head of the Ministry of Religious Confessions and Education in the first years of independence. From the early years of Jan's life he had impeccable knowledge of the German language; the primary school education he mastered while being tutored by his German private teacher, Fräulein Henriette. The family of Jan Łopuszański belonged definitely to the upper class of Lvov's social circles. As a youngster he was neither interested nor involved in politics. Only from the perspective of many years, after the Second World War, did he recall complex and not always socially just relations between Polish, Ukrainian and Jewish communities. His traveling – a part of his duties as an international scientist – began quite early. For example in 1938 his summer vacation was spent in Italy, on the beach near Ancona.

In 1939 the Second World War started and Lvov was incorporated into the Ukrainian Soviet Republic. Jan attended the last classes of Soviet elementary school, the so-called "desjatiletka". However, he did not finish it. Under the accusation of participating in a subversive pupil's organization he was arrested and sentenced to 10 years of prison camp in Siberia. He was still in Lvov prison for the German offensive in June 1941. Only because of great luck and his very alert attitude, was he able to avoid being shot by escaping Soviet security forces. He escaped from prison a few moments before the beginning of the extermination of all prisoners. He confessed later that this was

the most dramatic, and the most fortunate, moment of his life, which left a trauma for the rest of his life.

During the German occupation of Lvov (1941–44) Jan finished the clandestine high school and passed maturity exams together with the well-known Polish poet Zbigniew Herbert. He also worked for his living in the research institute for epidemic diseases and provided his blood by feeding lice needed for medical experiments. This permitted him to avoid the exportation to forced labour in Germany. After the second arrival of the Soviets in Lvov, in 1944, Jan started to attend the Polytechnical Institute. After the death of his father he decided to move with his mother to Wrocław.

The second part of his life and his whole scientific career was linked to Wrocław University.

Already at the beginning of his studies in Lvov he realized that his interests and research activities were linked more to pure science; his choice was the field of theoretical physics. After his arrival in Wrocław in 1945 he immatriculated as a student of physics at Wrocław University. At that time there were in Wrocław only three lecturers of physics all three from Lvov: Professors Stanisław Loria and Jan Nikliborc, and Roman Ingarden, the son of a famous philosopher, who became Loria's assistant. Jan Łopuszański obtained his master degree in 1950, and in 1952 he became a lecturer. His scientific career developed quickly; after defending his Ph.D. thesis in Cracow in 1955 Jan obtained the position of Docent and finally, in 1959, was nominated to the post of Professor in Physics.

The first eight years of the scientific career of Jan Łopuszański was devoted to the problems of statistical physics. He studied the statistical models of cosmic rays and cosmic cascades. By applying the theory of stochastic equations he obtained concrete solutions, providing good hints on how to compare the theory with experiment in cosmic rays physics.

1958 began a new period in the scientific career of Jan, related to three one-year research visits abroad: Utrecht University (1958), New York University (1961/62) and the Institute for Advanced Study in Princeton (1964/65). His new scientific passion was quantum field theory. In Utrecht he studied soluble field-theoretic models; two years later, in New York he became involved in the mathematical foundations of quantum field theory. In Princeton, Jan, together with Helmut Reeh, started the main scientific subject of his life: the problem of symmetries in classical and quantum physics. In particular, in 1965 with H. Reeh, Jan obtained important results concerning so-called spontaneous symmetry breaking in quantum models, which is related to the famous Goldstone theorem and the existence of degenerate physical vacua. Further, during his visit to Stony Brook in 1970/71, Jan studied the mathematical properties of generators in axiomatic field theory, and obtained the classification of all possible generators of internal symmetries. Unfortunately by introducing too restrictive assumptions he discarded the possibility of a new symmetry – supersymmetry. However, when, in the early 1970s,

supersymmetry appeared as a new idea, transforming bosonic into fermionic fields, Jan was very well prepared to consider the classification theorem for all physically allowed supersymmetry generators. In 1975 his most famous paper appeared, written with R. Haag and M. Sohnius during his stay at Karlsruhe University and CERN, entitled “All possible generators of supersymmetries of the S-matrix” (Nucl. Phys. B **88**, 257 (1975)). In this paper appeared the first classification of four-dimensional supersymmetry algebras which are permitted by the axioms of local quantum field theory and the relativistic scattering theory described by the so-called S-matrix. This paper is at present the most well known single publication in the domain of theoretical physics from Wrocław after the Second World War – at present it has over 300 citations by other authors.

Now the scientific recognition of Jan’s outstanding research results is complete. In 1976 Jan Łopuszański became the corresponding member of the Polish Academy of Sciences. He continued his research, in particular by considering further the notion of central charges, the mathematical object in supersymmetry scheme introduced by him earlier. He collaborated with Polish (M. Wolf) as well as foreign (D. Buchholz) specialists in algebraic methods, and visited several times the Max Planck Institute in Munich and the universities in Göttingen and Bielefeld. In particular Łopuszański obtained the rigorous definition of nonlocal symmetry charges as well as the definition of generators in the presence of massless excitations.

In the early days of his employment at Wrocław University Jan Łopuszański was already involved in administrative duties. He was elected in 1957 the Deputy Dean of the Faculty of Mathematics, Physics and Chemistry of Wrocław University, and in the period 1962–1968 a Dean of the Faculty. In the period 1954–1968 Jan Łopuszański also worked in the branch of the Polish Academy of Sciences in Wrocław. The most essential period, however, for theoretical physics at Wrocław University is the period 1970–84 when Jan Łopuszański was the Director of the Institute for Theoretical Physics. On one side he promoted new research domains (supersymmetry, quantum field theory) which engaged theoretical physics in Wrocław in front-line research in the world. Another important side of Jan’s activities as director of the institute was very just handling of personal matters, with a unique and proper blend of tolerance and firmness. One can call the years 1970–1984 the golden period of theoretical physics at Wrocław University, characterized by a lot of contact with research centers abroad and quick development of new branches of research. From this period I would like only to mention the contacts with Stony Brook University and the head of theoretical physics there, Prof. C.N. Yang, Nobel Prize winner in 1957. In the late 1970s at least half of the members of the Institute for Theoretical Physics at Wrocław University visited Stony Brook, and obtained important scientific results in the framework of this scientific collaboration.

In the period 1984–1994 until retirement, Jan Łopuszański was an unquestionable moral authority, not only among his colleagues at the Institute, but also at the University of Wrocław as well as in the community of physicists in Poland. In 1986 he became a real member of the Polish Academy of Sciences, and in 1996 was nominated, as the only physicist from Wrocław, the real member of the Polish Academy of Arts and Science in Cracow. In that decade he publishes two books on "Spinorial Calculus" (PWN Wrocław, 1984) and "An Introduction to Symmetry and Supersymmetry in Quantum Field Theory" (World Scientific, Singapore, 1991). The last book also contains collected results from Łopuszański's research papers during 25 years on the subject of symmetry and supersymmetry.

The academic year 1993/94 was the last before Jan's retirement. He was not happy with his new situation after leaving university without any didactic and academic duties. Since 1996 he has again been employed at the institute, with a part-time contract, and every semester presents a monographic lecture on recent scientific developments. He is also scientifically active and in 1998, began preparing his new book about the research results obtained in the collaboration with P. Stichel and J. Cisko.

Now Jan approaches 75 years. He is quite often present in our institute, and very much interested in all scientific and human developments. His ability to give much advice on all important matters was always very essential for me personally. I hope that we shall be able to enjoy Jan's presence among us and his warm and friendly personality for many years in the Institute for Theoretical Physics.

Jerzy Lukierski