PART III :

The Pokorski Group Story

III. 1. The Beginnings

Among those who have kindly shared with me their memories of their contacts with Stefan Pokorski the first to have met him on physics grounds was Zygmunt Ajduk.

At the time, however, one of the leading persons in the Chair of Theory of Elementary Particles was Grzegorz Białkowski, DSc.

Zygmunt Ajduk remembers Professor Białkowski very well:

> In 1961, I began my undergraduate studies at the Department of Physics and Mathematics of the University of Warsaw. It was not before 1965, however, that I came across Stefan Pokorski. Earlier in that year Stefan, having prepared his MSc thesis under the supervision of Grzegorz Białkowski, DSc, graduated with the MSc degree in Physics and started working under the Chair as an assistant. He read classes on mathematical methods in physics, which I and my fellow-students attended at our fourth year of physics studies. It was also then when I met Grzegorz Białkowski who suggested to me a subject for my MSc thesis to be prepared under his supervision under the Chair of Theory of Elementary Particles headed by Professor Wojciech Królikowski[1].
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> In 1966, after I had graduated with the MSc degree in Physics, I was employed under the Chair of Theory of Elementary Particles as a trainee assistant. A year later I was promoted to full assistant working under Dr. Białkowski. In 1969, when the Division of High Energy Theoretical Physics was spawned from the Chair of Theory of Elementary Particles, I continued my employment with this new Division and worked on my PhD thesis. Dr. Białkowski again suggested the subject for my thesis and was its advisor. In 1972, I graduated with the PhD degree in Physics.
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> Białkowski's Group was growing fast. We were all young, very active and full of enthusiasm to our research. Very frequently we met for discussions and seminars. Grzegorz Białkowski cared wholeheartedly for our scientific advancement. We admired him not only for his scientific achievements in his field but also for his general knowledge of physics as well as his interest in many other areas, poetry writing included. In 1971, Grzegorz Białkowski and Ryszard Sosnowski, published the first monography on elementary particles in Polish, entitled *Cząstki elementarne* [Elementary Particles][2].
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> The main subject of our research was phenomenological analyses of the collisions of elementary particles with protons and nuclei at high energies. Initially, we analyzed reactions leading to two-particle final states by using dispersion relations and peripheral, absorption, diffraction, and Regge models. Quite soon we concentrated our efforts on reactions leading to multiparticle final states in the multiperipherial, multi-Regge, and dual models.

[1] At the time, at the Institute of Theoretical Physics, research in theory of elementary particles was carried also within the Chair of Theory of Atomic Nucleus and Thermodynamics headed by Professor Józef Werle.

[2] Grzegorz Białkowski, Ryszard Sosnowski, *Cząstki Elementarne* [Elementary Particles], PWN, Warszawa, 1971.

Our contacts with the Warsaw experimentalists' group, who at the time actively participated in analyses of data from experiments at CERN, mattered greatly to our research. It is noteworthy that, at the time, analyses of multiparticle reactions were the chief research subjects at many physics research centres in the world.

We all participated in the Cracow Summer Schools of Theoretical Physics in Zakopane. Moreover, despite our meagre resources in convertible currency, many of us attended conferences, workshops, and schools on high energy physics, simply because quite frequently our fees and expenses were covered by the organizers of these events.

I, personally, participated in a school organized by the Dubna Joint Institute for Nuclear Research (JINR) at Popradske Pleso (Czechoslovakia, 1967), in the Edingurgh Summer School (1970)[3], and in the CERN-JINR School in Varna (Bulgaria, 1971). In 1970, I spent several weeks at the International Centre for Theoretical Physics, Trieste, Italy. However, at the time the most important for my research was my year-long postdoctoral internship at CERN (1972–1973) as it was then when I obtained quite important results in analyzing the overlap function, in particular for its spin structure.

Maria Krawczyk begins her recollections with the year 1969:

In 1968, my friend Inga Karliner and I chose for our MSc theses the field of theory of elementary particles. We started working on our theses under Professor Białkowski's supervision.

Inga could not finish her thesis since soon thereafter she and her entire family left Poland, forced to do so by the official anti-Semitic campaign that had begun in Poland in March 1968. Many years later, at a conference in the United States, I met Inga's younger brother Dr. Marek Karliner. By that time he had became a well-known Israeli physicist.

In 1969, I graduated with the MSc degree in Physics. I became an assistant to and then a graduate student of Professor Białkowski.

In the same year Stefan Pokorski was in CERN. He returned to Warsaw in the following year. I still remember my first conversation with him: he listened to me attentively and looked straight at me, piercingly.

Those years I worked on Regge theory that was an attempt to describe hadron strong interaction. The personal relations in our group were cordial and the attitudes very friendly. In 1975, at the celebration of my PhD degree, many persons began to address each other by their first names, what at the time was rather a rare habit in Poland, particularly within academic circles. Despite such informality, the official "Master" [Professor Białkowski] – "student" relations remained clearly discernible.

Jan Kalinowski received his MSc degree in 1973. He recalls:

In 1973, I graduated from the Faculty of Physics, University of Warsaw, under Professor Grzegorz Białkowski's supervision. My MSc thesis concerned central

[3] I still vividly remember that on that occasion Grzegorz Białkowski gave me some "pocket money" in convertible currency from his own funds. (ZA)

diffractive production in hadron colliders. It aimed at explaining the increase with energy in total proton-proton and proton-antiproton cross sections. At the time, strong interactions were thought by many physicists to be not tractable within quantum field theory. Instead, the S-Matrix approach was employed as a basis, while causality, analyticity, and unitarity were used as guiding principles.

III. 2. The Pokorski Era

III. 2. 1. The Early Years

In 1974, a very important discovery occurred in elementary particle physics. **Jan Kalinowski** tells about it:

> I remember well the excitement of the 1974 „November Revolution" when the discovery of a new quark – the charm quark – was announced. The quark picture was already more than ten years old, however this discovery has changed the quarks' perception from being merely building bricks necessary in order to understand quantum numbers of mesons and baryons, to quarks' being dynamical entities responsible for the fundamental interactions as well. Quantum chromodynamics – a quantum field theory of strong interactions – was born shortly thereafter.
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> I think Stefan Pokorski was the first person in Warsaw to appreciate the importance of the charm quark discovery. Soon later, it was becoming increasingly clear that the new field-theoretic picture offered a framework for real progress in particle physics.
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> Over the following years I have found it typical of Stefan that he did not just abandon the old theoretic language and jump onto a new one but he rather tried first to find links between the old one – which had its own successes anyway (yet its limitations as well) – and the new one that offered new avenues of approach to tackle the problem.
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> This was precisely what happened during the mid-1970s: Stefan attempted to build a bridge between the Regge picture – at the time dominating at our Institute of Theoretical Physics – and the new quark-parton language. It was why I happily accepted his proposal that I work on my PhD project under his supervision. This was how my scientific career actually started.
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> Although now I belong formally to a different chair of the Institute of Theoretical Physics (in fact, as a result of Stefan's long insistence), I do still feel to have been Stefan's student, and I continue to keep in close touch with him. And I do want things to stay this way.

Zygmunt Ajduk follows the thread of new quark physics:

> In 1974, the main subjects of world research in particle physics changed substantially, as physicists working in high energy theoretical physics concluded that the quark and parton models and the Standard Model of electroweak interactions were the principal ways to proceed. In experimental work at high energies the most important became electroweak processes and – for strong interactions – inclusive processes with large transverse momentum transfer.
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> Stefan Pokorski played a steadily increasing role in our Group. After he made his PhD (1967) and his habilitation (DSc; 1971), he readily felt the winds of change and engaged in research on new subjects in theoretical high energy physics. He has always had an enormous ability to switch to new subjects, to learn things instantaneously, and to plug himself into very active research in new areas.

Stefan Pokorski knew well that the road to significant results led through theoretical groups in Western laboratories. To this end, he established broad foreign contacts and cooperated with many physicists all over the world.

He was always counting on younger associates. Within a few years he built a vibrant and ever-growing group of his undergraduate and graduate students. After they had successfully completed their PhD theses they continued to work with him on subjects ranging from quantum chromodynamics and electroweak interactions within the Standard Model to physics beyond the Standard Model: supersymmetry, grand unification, string theory, additional spatial dimensions, and cosmology. Virtually all of them went for postdoc positions at universities and research institutes in Western Europe or in the United States.

Maria Krawczyk recalls:

> The turning point for me was my postdoc position at the Max-Planck-Institute for Physics, Munich, during the years 1977–1978. It was Stefan Pokorski who had arranged for this position for me. Before I left for Munich, he provided me with letters of recommendation and gave me much useful advice for which I had not even asked. In Munich, I worked on parton model and on photon-hadron interaction. These subjects delineated the direction of my research for the next twenty years. I made many friends in Munich, and these friendly links have lasted until today.

After the political thaw in Poland in 1980 and 1981 (the „Solidarity" heyday), General Jaruzelski imposed martial law in Poland on December 13, 1981. A very difficult period began for this country and it took eight years until the peaceful transformation of the political system to democracy had taken place after the semi-free general election in Poland on June 4, 1989.

During all these years Stefan Pokorski continued making top-notch science and continued caring about physics of elementary particles in Warsaw and the people involved in it.

Maria Krawczyk summarizes the importance of Stefan Pokorski stature as scientist in those years:

> When the political conditions in Poland were getting more and more restrictive, we frequently heard from Stefan Pokorski a phrase that did actually guide us. It still is etched onto my memory: "Do your job!" However, I am sure that in those dark years – to invent and to organize the Kazimierz Symposia was something much more than doing one's job; supporting many persons at the Hoża in their professional careers in theoretical physics was much more than doing one's job, too.
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> The late Professor Jacek Prentki of CERN once told me that Stefan Pokorski impressed him as the kind of person who "when he tells so and so, then things are or will be that way".

Jan Kalinowski is more specific on Pokorski's priorities in research:

Stefan was – and still is – very influential in initiating research in many new subjects at the Hoża. This situation had a very strong impact on my own career and – I believe – not only on mine. Through discussions and research, cooperation with him changed my scientific interests from dual quark models to electroweak interactions, Higgs physics, supersymmetry, and dark matter. He has always preferred to discuss ideas which were somehow related to experiments, and thereby could be tested, i.e. proved or disproved. He never wanted to work on formal ideas being far from experimental verification.

He encouraged us to travel to research institutions abroad. Close scientific contacts with foreign physicists and participating in international workshops and conferences were always considered by Stefan a must for a fruitful career in physics. I remember that, after my every return to our Institute from abroad, Stefan asked me repeatedly: „Where are you going next?" or „Have you already arranged for your next visit somewhere?"

It should be remembered that at that time travelling abroad was very difficult and quite expensive for us. But, of course, in the then situation of snail-slow scientific communication (no Internet, no e-mail, no xeroxing, very slow circulation of letters, limited access to scientific journals and preprints, etc.) such visits were vital to our learning of new research concepts and techniques developed at foreign research centers.

The 1980s were also a period of organizational change at the Hoża.

Zygmunt Ajduk recalls:

During the late 1970s, Professor Grzegorz Białkowski became increasingly interested in popularizing physics among the general public and in teaching physics at all levels. In 1980, he was one the founding fathers of the Society for the Advancement of Sciences. In 1985, he was elected Rector of the University of Warsaw. In 1989, he took part in the famous "Round-Table" political negotiations with the Communist regime officials that eventually resulted in the fall of Communism in Poland. In the historic general election on June 4, 1989, he was elected Senator. Less than four weeks later, he died suddenly on June 29, 1989.

After Professor Białkowski's untimely death, Professor Stefan Pokorski became Head of the Division of High Energy Theoretical Physics.

Unfortunately, I had not joined the new research activity led by Stefan Pokorski. Since 1981, I devoted most of my time to teaching and organizational work at the University of Warsaw. Happily, my teaching engagements have given me much satisfaction and have been highly valued by undergraduate students.

III. 2. 2. Stefan Pokorski – an Administrator

During the years 1984–1993, Professor Stefan Pokorski was the Director of the Institute of Theoretical Physics at the University of Warsaw.

Zygmunt Ajduk:

> During the years 1983–1987, I was Deputy Director for Teaching of the Institute of Theoretical Physics at the University of Warsaw. During that period, I worked closely with Stefan Pokorski, who was the Director of the Institute of Theoretical Physics in the years 1984–1993[4]. I was also involved in organizational work carried out at this Institute. Neither Pokorski, nor I particularly enjoyed this kind of work, but we knew it was necessary. And it proceeded very smoothly.
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> During those years Stefan Pokorski greatly contributed to arranging for the construction of an extension to the building at Hoża Street to vastly enlarge and improve office space available for the Institute of Theoretical Physics. Dr. Tomasz Gawron helped him a lot in this venture.
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> What I valued the most in Stefan was his courage in making difficult decisions. Subsequently, his decisions always turned out to be the right ones.

Zygmunt Lalak:

> An experience that comes to my mind when I am thinking about the late eighties and the early nineties at the Hoża is the extension and refurbishment of the part of the building in which the Institute of Theoretical Physics was located. During those years Stefan Pokorski was the Director of the Institute and, I think, the brave decision to start the construction work was his.
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> Resources were scarce. We had to empty the building and got squeezed into various "guest" offices in other buildings at Hoża Street. In the corridors whispers were frequently heard that the reconstruction was a disaster, that the end of the Institute was nearing, that it all was a total calamity. Somewhat surprisingly, one day the reconstruction simply came to be completed. The renovated building, augmented with new office space, although obviously imperfect, turned out to have been a real blessing to our Institute.

It was not only the Institute of Theoretical Physics where Professor Pokorski eagerly worked.

Zygmunt Ajduk elaborates on this:

> During the years 1991–1993, Stefan Pokorski was elected Chairman of the Polish Physical Society (PTF). During the same period, I was the Society's Secretary General. During our terms the Polish Physical Society passed and

[4] Before Stefan Pokorski's term as Director, Professor Andrzej Trautman was Director of the Institute of Theoretical Physics, University of Warsaw. I worked closely with him in 1983 and in the first half of 1984. (ZA)

enacted its new statutes, modernized its activities, and published information booklets on research in physics in Poland[5]. On Stefan Pokorski's initiative, prizes awarded by the Polish Physical Society have been named after deceased eminent Polish physicists. The new prize names contributed greatly to increasing the prestige and the recognizability of the PTF awards.

Stefan Pokorski has always understood the importance of popularizing and promoting physics. He wrote several popular articles published in Polish journals on physics such as "Postępy Fizyki" [The Advances in Physics], "Delta", "Fizyka w Szkole" [Physics at School], and "Wiedza i Życie" [Knowledge and Life]. Many times he lectured at Science Festivals in Warsaw and at scientific sessions held at various institutions and societies. He was the chief organizer of several symposia opened to the public on such occasions as the 50th anniversary of CERN in **2004 and the primary launching of CERN's Large Hadron Collider in 2008. Since 2009 he has been one of the organizers of the Cracow–Warsaw LHC Workshops.**

Stefan Pokorski has been honoured with many scientific distinctions, awards, prizes, titles, and medals.

[5] *Physics Research in Poland – A Directory*, edited by Z. Ajduk, OWN, Poznań 1992, 1996.

III. 2. 3. Stefan Pokorski – the Transition Initiator

During the 1960s, Dr. Stefan Pokorski worked on the phenomenology of strong interactions. During those years it was the main area of research in many leading theoretical physics centres and it was closely related to experimental results obtained with high energy accelerators. After several years he realized that the way to go was quantum field theory, the kind of theoretical research that at the time – though somewhere else – resulted in formulating the Standard Model of electroweak interactions.

At the Institute of Theoretical Physics at the University of Warsaw, Stefan Pokorski initiated his Group's transition from research in phenomenology of strong interactions to research in electroweak interactions, although not totally free from phenomenology.

Zygmunt Lalak looks rather unenthusiastically at strong interactions, even from today's perspective:

> In strong interactions there still are many unsolved problems and various ideas that have not been explored to the end. There are the so-called "hopeless problems". Roughly speaking, these are relativistic bound states of strong interactions. Computer simulations do not suffice; the most advanced computers and algorithms cannot crack such problems. Many people who worked on these exotic problems simply disappeared from the foremost scenes of physics.
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> The main development course of the most modern particle physics deals with electroweak interactions. The fabulous Higgs boson remains in this stream.
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> At the Hoża the transition began in earnest, I think, in the early 1980s, when Stefan Pokorski started writing his book *Gauge Field Theories*.
>
> I should like to emphasize that Stefan Pokorski has always remained a physicist. By this statement I understand the following: Stefan, as theoretical physicist, began in phenomenology, and he keeps looking at much-mathematized theories from the point of view of physics, i.e. of what one can get out of these theories.

III. 2. 4. New Blood

During the 1980s there were a number of freshly graduated young physicists who joined the Division of Theory of Elementary Particles of the Institute of Theoretical Physics at the University of Warsaw.

Bohdan Grządkowski, who graduated in 1981, recalls:

> When, in 1981, having written my MSc thesis under the supervision of Professor Stefan Pokorski, I graduated with the MSc degree in Physics, it was not obvious that I would be employed at the Institute of Theoretical Physics at the University of Warsaw. There was nothing else I wanted more because the Institute was the place where my lecturers, who I so much admired, worked and where the job consisted of – what I liked the most – theoretical research.
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> Realizing that my future at the Institute was not certain, I wrote to several universities in Western countries enquiring about possibilities to be accepted for postgraduate studies. I received several encouraging replies of which the most attractive was the one from Professor Peter Higgs at the University of Edinburgh, offering me a graduate student position.
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> However, my situation was far from being clear. On the one hand there was still a chance that I would become employed at my beloved Institute of Theoretical Physics, but on the other hand I could not expect that Professor Higgs would keep the graduate student position open for me for a longer time. So, I went to Professor Pokorski seeking his advice. He frankly told me that I should stay in Warsaw. He said he would recommend for me to go if it were to Oxford, Cambridge or Harvard, but not to Edinburgh... He said that he envisaged for me to learn more in Warsaw than in Edinburgh. So, I stayed in Warsaw. Soon, I received an assistant position at the Institute of Theoretical Physics. Now, for more than thirty years, I have remained grateful to Stefan Pokorski for the advice he gave me at that time.

Jacek Pawełczyk, who graduated 1983, recalls:

> My adventure with high energy physics began in 1981 while I attended Professor Pokorski's lecture course on quantum field theory and theory of elementary interactions. His lectures, held in the IPJ22 lecture hall at the Hoża, were extremely popular. To us – young students – the subject seemed very much up to date – we had all heard about the new discoveries at CERN and about the theoretical physicists' keen interest in the "magic" Yang–Mills fields. Jan Kalinowski held classes coupled to Pokorski's lectures.
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> Having listened to several lectures I asked Professor Pokorski to accept me as his MSc student. He agreed to be my thesis supervisor and told me to work on horizontal symmetries within the Weinberg–Salam Theory – as we then called the Glashow–Weinberg–Salam Model.
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> On December 13, 1981, martial law was imposed in Poland and all university classes were suspended for several weeks. My fellow students and I convinced Dr. Andrzej Czechowski (who was then helping Professor Pokorski in preparing the book on gauge field theories) to hold clandestine lectures to continue the interrupted Pokorski lectures.

Marek Olechowski, who graduated in 1983, remembers Stefan Pokorski while an undergraduate student:

I recall my first conversation with Stefan Pokorski in October 1981. I was a fourth year undergraduate student and was about to choose my "specialization". I was considering two areas: general theory of relativity and theory of elementary particles and elementary interactions. Finally, when I decided on the latter, I approached Professor Pokorski after his lecture and asked him if he would accept me as one of his MSc students. I recall that he asked me only one question: "Do you have good marks?" I said – „Yes, Sir". Then he asked me a more precise question: „Well… But… good, or very good?" When I answered „Very good", he decided immediately: „OK, you're in".

At the time I was an undergraduate student. Most of the fourth year undergraduates were interested in theoretical physics, vacillating between theory of gravity and theory of elementary particles as the field for their MSc theses. I chose the latter because it seemed to me to be a much broader theory, being expanded more dynamically, and with much better prospects for the arrival of new and more precise experimental data. For all the years since then, I have been happy that I had made the right choice. In the last thirty years very many interesting things happened in the physics of elementary particles and fundamental interactions.

Theory of elementary particles attracted many very talented undergraduates. Over a few years approximately ten young physicists joined the Pokorski Group as employees of the Institute of Theoretical Physics. Almost all of them still work as scientists at the Faculty of Physics at the University of Warsaw.

The presence of so many young physicists always leads to very frequent and very vivid scientific discussions. Consequently, each of us talked about the things he/she had just found interesting. These were pre-Internet times, so we could learn about the most recent novelties in physics only from preprints received at the Institute Library under exchange schemes. At the library there was a waiting list for the preprints.

However, even a most careful reading of the preprints did not suffice. More solid foundation of our knowledge in the field was absolutely necessary. Professor Pokorski cared about our acquisition and expansion of knowledge. In sequence, he selected each of us to learn well about a particular subject and later to present this subject in much detail to him and to the colleagues from the Group. Such internal mini-seminars usually turned into heated discussions. It was only through such discussions that we came to a real understanding of the given problem.

Stefan Pokorski always knew the important subjects to learn and to work on. He travelled to many centres of theoretical particle physics where he discussed physics with many people. Generally, it seems to me that travelling to and talking with other scientists, broadens perspectives, teaches other points of view, and then results in new ideas.-

Usually we conducted our own research in small teams of members interested in the same problem. The results of such cooperation differed.

Sometimes a single publication evolved, sometimes several papers evolved. This way I wrote a number of papers together with other members of our Division (now Chair) without the participation of Stefan Pokorski. Obviously, more than one subject expired – simply died – with no publication to appear from our efforts.

Very frequently, however, it was Stefan Pokorski who initiated our work on specific subjects. Sometimes he arrived single-handed to a well-defined problem, sometimes the problem crystalized during common discussion. Discussions with Pokorski on research topics were always detailed and long. In most cases they ended with a written summary and a list of things to do. Usually, he showed optimism. In the summaries his optimism showed by his emphasis to the new and interesting aspects of the results we had already achieved. In the research planning his optimism showed in his expectation to get immediate numerical results, while I – for example – expected the results after a week or two of intense work. Perhaps it was his deliberate way to motivate us to work harder and still harder.

Pokorski's rather unique ability was to formulate new ideas and… we worked on those diligently. However, he did not impose a new idea and then disappear-to await-the results. He had constant interest in our work, talking to us many times, tracking and discussing the tiny details of our progress and of our difficulties as well – even the numerical technicalities. He suggested ways to resolve the snags. He was the master at all times.

On the basis of his ideas we – first – obtained interesting results, and second – perhaps most important – made these topics do-able. In this context it should be borne in mind that one can ask very interesting questions with no answers ever to be found…

Krzysztof Meissner joined the Pokorski Group after having started as an experimentalist.

I began my undergraduate studies at the Faculty of Physics of the University of Warsaw, in Fall 1980. A year later, during the "Solidarity" heyday, a month-long student strike was staged at the University of Warsaw, our Faculty of Physics included. I took part in this strike. During the strike close ties flourished among the students of different years and academic staff. I remember that Professor Jerzy Pniewski, then the Dean of Physics, brought us freshly baked bread every day. Almost every evening, concerts or lectures on various interesting subjects were staged for the students on strike.

In 1983, when I was a third year undergraduate student, I met Professor Janusz Zakrzewski. He offered to send me to an internship in experimental particle physics at DESY, Hamburg. During the Summer 1983 vacation, I stayed at DESY for almost three months, taking part in an experiment. Subsequently, along with other members of DESY's JADE Group, I became co-author of a paper on a measurement of the strong interaction constant. This notwithstanding, parallel to my experimental work, I had become increasingly certain that my future was with theoretical physics.

In the following academic year I met Professor Stefan Pokorski who suggested for me to join his group to write my MSc thesis. However, after I had finished my fourth year of undergraduate studies, Professor Zakrzewski sent me (again as an experimentalist) to CERN, to the UA2 Group. 1984 was a

memorable year for CERN since it was then and there that the W- and the Z-bosons were discovered.

When I returned to Warsaw my career became further sealed by the just published paper on the lack of anomalies in string theory and by Professor Pokorski's resulting decision that it was the proper research area to enter. Still, in 1985, I wrote my MSc thesis on the asymmetry in W- and Z-amplitudes in electron collisions.

Zygmunt Lalak's road to the Pokorski Group was not typical.

Officially, I joined the High Energy Theory Group at the University of Warsaw at the end of 1985, to work on my PhD project under Professor Grzegorz Białkowski's supervision.

Earlier I had obtained my MSc degree from the Warsaw University of Technology [Politechnika Warszawska, PW]. At that time, ambitious undergraduate students were encouraged to pursue individualized programs of studies under supervision of experienced researchers. I was somewhat disappointed by the programs offered by staff members of the Physics and Mathematics Department of Politechnika Warszawska; I began searching for a prospective PhD thesis advisor elsewhere.

Grzegorz Białkowski was then Professor at the Faculty of Physics of the University of Warsaw. He was a popular figure at our department at Politechnika Warszawska, too, since for many years he lectured there. That is why I decided to try to talk to him and ask him for an advice about what I should do. He was a very busy man, so it took me a while before I managed to talk to him in his office. During my earlier unsuccessful attempts, I met Stefan Pokorski, who shared the office with Białkowski, several times. However, I had no opportunity to discuss physics with Professor Pokorski at those times.

When I finally spoke to Professor Białkowski and explained my situation to him, he quickly encouraged me by saying that theoretical particle physics was a subject definitely worth my efforts. He agreed to be my PhD thesis advisor. Later, I concluded again and again that Białkowski was perfectly right: theory of elementary interactions turned out to be the most interesting and the most inspiring subject in physics I have ever encountered.

Bohdan Grządkowski recalls:

During the early 1980s (soon after I had decided not to go to Edinburgh), Professor Pokorski initiated a series of his lectures, in fact the first up-to-date lectures on quantum field theory at the Faculty of Physics, University of Warsaw. His lectures attracted many young talented people, who in Stefan Pokorski, saw their unique chances to closely encounter modern theoretical physics of elementary particles. The lectures actually applied the general strategy of Stefan Pokorski: he himself and those who listened to his lectures were simply learning together the details of new trends in quantum field theory. It was a demonstration of the lecturer's honesty – he mustered the courage to admit that he did not understand every detail of this and that.

Thus we had been taught a creative approach to science. From Stefan

Pokorski we all have learned that real physics is being created in the process of asking questions and making attempts to answer those questions – frequently in an inept way. It was just these lectures which coalesced our Group – The Pokorski Group.

Zygmunt Lalak remembers:

Originally, I was assigned to the project of hadron collisions at medium energies. Those were important yet difficult problems, solutions of which, in many cases, have remained unknown until the present time. However, it was becoming increasingly clear that the road to real progress in particle physics led through the careful studies of gauge theory of electroweak interactions and its generalizations.

In 1986, I was lucky to obtain a fellowship funded by George Soros, the Hungarian-born tycoon, and I went to Oxford, UK. There, at the Department of Theoretical Physics of the University of Oxford, I abandoned my earlier research in strong interactions at medium energies and I began studies of supersymmetric extensions of the Standard Model. My first paper done at Oxford was on supersymmetric dark matter. At the time the prime theoretical example of dark matter was the photino – the supersymmetric partner of the photon. Particle cosmology and supersymmetric extensions of the Standard Model have remained the main subject of my research ever since.

After a year spent at Oxford I had to return to Warsaw to renew my so-called service passport and to solve my obligations for military service. The Polish Army wanted to train me as military engineer... My passport was taken away and I was not allowed to leave the country. Fortunately, my earlier position at the University of Warsaw stayed „hibernated" since I had left for Oxford and for that reason was able to restart my research career in Warsaw rather easily.

I quickly saw that the only person at the Department vigorously involved in study of the extensions of the Standard Model was Stefan Pokorski. He attracted and gathered around him a number of bright and ambitious young people. Doubtless, he was offering an inspiring environment that stimulated interest in hot topics in the theory of elementary interactions.

In the meantime, Professor Białkowski, my official PhD thesis advisor, became the Rector of the University of Warsaw. Consequently, he detached himself from active research. In fact, he encouraged me to integrate into the Pokorski Group. In June 1989, Grzegorz Białkowski suddenly died. I had to find another thesis advisor.

My key conversation with Stefan Pokorski was short and to the point. He knew my research interests and agreed to take over advising my PhD thesis. At the time he had many bright graduate students, so he did not have to take me in. Stefan's decision saved my PhD graduate studies and thereby my career in science. I was truly grateful to him then and, having spent many years in research in theoretical physics, I truly appreciate today the decision he made then.

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In 1987, **Janusz Rosiek** joined the Pokorski Group:

I began working under Professor Pokorski in October 1987. It was not an easy time for me. I was a very ambitious student and I always dreamed about a scientific career in theoretical physics. The more difficult the subject, the better; therefore, I wanted to work in quantum field theory, even though I did not know much about it.

Generally, during undergraduate studies it is not always easy for a student to choose a good subject to work on and it is even harder to find a good advisor – one simply does not have sufficient knowledge at this stage.

I decided to prepare my MSc thesis under Professor Ryszard Rączka but it proved not to be a good choice – the subject he suggested to me was very exotic and far from the mainstream high energy physics, certainly not good as a first research work for a young physicists. This notwithstanding, I finished my thesis and graduated with the MSc during Summer 1986, but eventually I grew frustrated with the collaboration with my supervisor and I began to look for better options.

After I spoke with my colleagues, the new choice became obvious to me. Professor Stefan Pokorski appeared to me as a scientist who was very active in modern particle physics and well-known internationally. He had a quite large research group, and – above all – he had the reputation for good influence on young people's scientific careers.

It was not easy to join his Group but after interviewing me he agreed to take me in. One year after graduating with the MSc, I was employed at the Institute of Theoretical Physics as a junior assistant.

It constituted a real breakthrough for me – I finally felt that I was in the right place. Following Professor Pokorski's advice, I started to work on something I felt was both important and exciting: the phenomenology of the extensions to the Standard Model; first the extensions of the Higgs sector and then the supersymmetric models. Actually, I have been working on various aspects of this kind of physics for more than twenty years now, and I still do not feel bored.

At the beginning, Professor Pokorski indicated to me the subject of radiative corrections to the masses of supersymmetric Higgs particles. These corrections – as calculated earlier by other authors – were unexpectedly large. The problem was very important from the point of view of chances for discovering supersymmetric Higgs boson at CERN's LEP accelerator, which at that time was about to be put into operation. There were already a number of papers on this subject, some better, some worse, and sometimes even disagreeing with each other. We decided to calculate everything as systematically as possible, including all the known intervening effects without approximations. The subject required a lot of tedious calculations, so I was working on it with another PhD student of Pokorski's, Piotr Chankowski. It took us quite a while – I needed five years to get my PhD degree but that was certainly not time lost. In the process I learned a lot. Together with Stefan Pokorski and Piotr Chankowski, we wrote six good papers which – after almost 25 years – are still being cited by other researchers and are considered to be classic papers in the field. Three of the papers we published when I worked on my PhD amassed now more than 200 citations each and the numbers are still growing. The set of Feynman rules for the Minimal Supersymmetric Standard Model (MSSM) and the computer codes I wrote at the time still remain a core basis of my scientific research and are being used by several other researchers in this area.

Mikołaj Misiak remembers his first contacts with Professor Stefan Pokorski vividly:

> I heard about Professor Stefan Pokorski for the first time in 1986, while finishing the third year of my undergraduate studies at the Faculty of Physics of the University of Warsaw.
>
> I knew I wanted to specialize in theoretical elementary particle physics and I started collecting information on different groups I could try to join. Being one of the so-called individual students, I asked the Head of these studies, Professor Marek Cieplak, to give me his advice. He told me that in terms of international recognition, the group led by Professor Pokorski was perhaps Number One in Warsaw. However, he estimated the chances for any finishing MSc student to become a member of this group as close to null since many recent graduates had been employed in this group in the previous years[6].
>
> I hesitated for a while, but from the beginning of the following academic year, I began attending Professor Pokorski's lectures on fundamental interactions. I had no background knowledge on quantum field theory, so I could not understand a thing from the first few lectures. However, it was evident to me that most secret mysteries of Nature were being outlined, and that I should do my best to access those. Soon later, I asked Professor Pokorski whether he would be willing to supervise my MSc thesis. He told me to see him in his office in a few days for a short interview. I entered his office, was led through a front office, which made me realize that he was the Director of the Institute of Theoretical Physics. For a start, he told me to read two papers: one on supergravity theory and one on string theory, and to return later. I read the two papers twice forward and once backward with no effect – I could understand nothing.
>
> After I reported "No progress, Sir", he gave me a more realistic task to read the Bjorken and Drell handbook on quantum field theory over the coming Christmas. Next, I kept xeroxing and reading chapter-by-chapter the proofs of his book *Gauge Field Theories* that became world-famous shortly afterward[7]. Reading this book was supposed to be a preparation for my studies of chiral anomalies in the decoupling limit. Instead, I completed another work on a related (but much simpler) subject, namely Pauli–Villars regularization in theories with no decoupling. Simultaneously, Professor Pokorski arranged for my involvement in the research project of Dr. Lech Mankiewicz on vacuum polarization effects in strong gravitational and electromagnetic fields around cosmic strings.
>
> It was quite difficult to decide the title for my MSc thesis on these two subjects. However, two publications that resulted from the two projects testified to Professor Pokorski's excellent supervising of an MSc student who needed to learn quantum field theory from the outset.
>
> In conformity to Professor Cieplak's expectations, the 1988 employment selection rules were established in a purely quantitative manner (on the basis of marks achieved during the undergraduate studies), irrespective of which group a fresh graduate was applying to. Both openings turned out to be filled by applicants to the Pokorski Group: Olaf Mańczak and me. Both of us already had

[6] It should be noted that at the time there were no regular PhD postgraduate studies at the University of Warsaw but the University's Institute of Theoretical Physics was offering regular employment to one or two freshly graduated MSc students per year. Subsequently, completing doctorate (PhD) and habilitation (DSc) in a prescribed time was necessary to keep the job permanent. (MM)

[7] Till now this textbook constitutes a basis of my knowledge on quantum field theory. (MM)

offers from DESY, Hamburg, to work as PhD students at testing hadronization routines of the JETSET computer code suite. Rejecting this offer was not an easy decision for me given the huge difference in financial conditions – in favour of DESY, of course. I asked Professor Pokorski whether or not he expected I would have a chance of continuing as a theorist after completing my PhD at the experimental ZEUS Group at DESY. He answered that chances for it were slim. That was a sufficient reason for me to choose Warsaw.

Shortly afterwards, Professor Pokorski became my PhD thesis advisor. He gave me a splendid subject for my PhD thesis. It was not a single, very specific topic but different types of analyses of processes in which quarks change their flavour. He told me straight out that he could not teach me technical aspects of flavour physics but he wanted to learn details thereof from me. Consequently, I was self-learning the new stuff. However, very few thesis advisors used to give their graduate students so fantastic research subjects as Pokorski did in my case.

I saw Stefan Pokorski to discuss my work rather infrequently: once every two or three months. I did not ask him for more frequent meetings because I preferred to work out problems alone. When we met, he always asked me to teach him what new I had learned. I tried… Frequently, he interrupted: "No, it can't be so, it's impossible to be in the way you're explaining it to me. There must be a different way around." Such criticisms were very helpful to me. I went back to the books, learned more and later explained the problems to him in a different way. Then he snapped: "All right, now I can imagine it is that way." It was much more of a partnership relation rather than a "professor (boss)–graduate student" one.

Simply speaking, Pokorski knew very well the current scientific literature in his field. He knew what people at very good centres of theoretical particle physics worked at and he knew what they did not understand. It seemed to him that even a graduate student would solve these problems. He cared very much that these problems be finally worked out. And finally one of his graduate students would solve them. He was deeply involved and very helpful in this process. Such was his way of looking after his graduate students.

Every one of us remembers his lectures at which he was telling and explaining to the audience what he had just learned on the newest problems in particle physics. His lectures were always most inspiring. And his most recent lectures inspire us now. One thing should be made clear here: Stefan Pokorski frequently worked on his own ideas and solved them himself.

My recollections here are focused on my MSc and PhD theses, although we had no common paper that would have resulted from those. Later, I did not work much with Stefan Pokorski. We have written but two common papers: one when I was at my first postdoc position at the Technical University Munich and another when I was back in Poland just after my second postdoc position at the University of Zurich. In this respect, I was not a typical member of his Group.

III. 2. 5. Kazimierz Symposia and PLANCK Meetings

A very important component of Professor Pokorski's and of the Pokorski Group activities have been organizing of and participating in international symposia and conferences. A very prominent place among those were the annual Kazimierz Symposia on Physics of Elementary Interactions held in the charming small town of Kazimierz upon Vistula (Kazimierz nad Wisłą), sometimes called also Lower Kazimierz (Kazimierz Dolny).

Zygmunt Ajduk recalls quite nostalgically:

> Since 1977, together with Grzegorz Białkowski and Stefan Pokorski, I worked on organizing different workshops, symposia and conferences. I was also editor or coeditor of the proceedings published after these events.
>
> The Symposia on Physics of Elementary Interactions played a particularly significant role in our scientific activities. The idea of these annual meetings was conceived by Grzegorz Białkowski, Stefan Pokorski, and Ryszard Sosnowski. The organizers of the Symposia were the members of our Group and the members of experimental groups from the University's Faculty of Physics and the Institute for Nuclear Studies in Warsaw. In the years 1977–1994, seventeen Symposia were organized. They always commenced in the last week of May and were held usually in the small town of Kazimierz upon Vistula in the "Architect's House" residence[8]. Proceedings of the Symposia were published continuously during 1977–1993, usually by the University of Warsaw Printing Unit (until 1987) or World Scientific, Singapore (since 1988).
>
> Those years, particularly before the fall of Communism, foreign currency funds at our disposal for scientific cooperation with Western research centres were extremely limited. In this situation, the Kazimierz Symposia were one of the very few "windows on the world" creating opportunities for us to discuss research in physics with scientists from many countries. Young physicists from Poland and other Eastern Block countries always attended in large numbers. Thanks to foreign contacts established by Polish physicists working in particle physics, we were able to invite to these symposia numerous outstanding physicists from all over the world. In fact, when the Kazimierz Symposia became internationally renowned, many scientists kept coming to them on their own initiative. The atmosphere at the Symposia was always wonderful, having been enriched by the unique charm of the little town of Kazimierz upon Vistula.
>
> I was always impressed by Stefan Pokorski's determination to carry on with organizing these Symposia every year and to ensure their very high scientific profile. There were many problems with arranging for accommodation and food for so many participants, but finally, after every Symposium, we breathed a sigh of satisfaction that we had been successful again. We managed to have the Symposia even in 1982, and 1983, i.e. during the years of martial law in Poland.
>
> The 1988 Jubilee Kazimierz Symposium, organized on the 50th **anniversary of the legendary Warsaw conference "New Theories in Physics", was particularly important and well-attended. Three Nobel Prize**

[8] With two exceptions: in Jodłowy Dwór (1980) and Warsaw (1991). (ZA)

winners in Physics (two of them in later years) were among the lecturers at this Symposium: Subrahmanyan Chandrasekhar (Nobel Prize: 1983), David Gross (Nobel Proze: 2004) and Yoichiro Nambu (Nobel Prize: 2008).

Maria Krawczyk warmly recalls several of the Kazimierz Symposia:

The Symposia in Kazimierz upon Vistula were a historic achievement of Stefan Pokorski. Our colleagues, particularly those from the former Eastern Block, still remain grateful to Stefan for those conferences. So do we, too.

Kazimierz upon Vistula is a unique place… I recall a discussion in 1977, on the choice of the conference venue called by Grzegorz Białkowski and Stefan Pokorski. The beautiful town of Kazimierz upon Vistula clearly won the spot, obviously at the end of May and the beginning of June – when fruit trees blossom all over the place.

In a sense, we all started at that place. Four of those conferences very strongly imprinted my memory. First, when I presented (for the first time!) the results of my own work (strangely enough I do not remember which year it was!). Second, in 1982, when, during martial law in Poland, several US physicists came and later were in trouble. Third, in 1984, when I was called out from the inaugural lecture to go hurriedly back to Warsaw as my husband was just unexpectedly released from jail, having been imprisoned for his "Solidarity" activity, i.e. clandestine publishing of an underground periodical titled "CDN" ["To Be Continued"]. The fourth of the best-remembered Kazimierz Symposia was for me the Jubilee Symposium in 1988, in which many famous physicists participated.

Jan Kalinowski:

Stefan Pokorski played the fundamental role in organizing and promoting the Kazimierz Symposia in during the 1970s and 1980s. For young Polish physicists the Symposia were an invaluable source of their knowledge of current physics and, in most cases, were their first opportunity to present their own research results to an international audience of physicists. The Symposia helped many of us to get better-known in the physicists' community and to arrange for our visits and/or postdoc positions in the West.

Jacek Pawełczyk:

The 1988 Jubilee Kazimierz Symposium was attended by Professor David Gross. We were all very much impressed by the air of great physics surrounding him, the deep understanding of physics and the uncompromising approach to it he projected. – "It is a mathematical masturbation" – he replied to Włodek Piechocki's question: „What do you think about the p-adic string?", and immediately dragged on a big cigar and… enveloped himself in the smoke of his greatness.

*

The formula for the Kazimierz Symposia evolved over time.

Jan Kalinowski:

With the historic change of the political system in Poland, the easing of travel abroad, and the advent of electronic communication in Poland, the original motivation behind the Kazimierz Symposia faded.

Zygmunt Ajduk:

During the 1990s, after the political transformation in Poland, new opportunities arose for a larger participation by scientists from Poland in international conferences. Consequently, it was possible to broaden the "formula" for the Kazimierz Symposia.

In 1993, the International Institute of Theoretical and Applied Physics (IITAP) was established in Iowa State University, Ames, Iowa, under UNESCO's auspices to support and promote theoretical and applied physics in the developing geographic areas. Its goals were perhaps similar to those of the International Centre for Theoretical Physics (ICTP, founded by Abdus Salam) in Trieste.

In 1994, Stefan Pokorski visited Iowa State University where he met Professor Kenneth E. Lasilla, who in previous years had attended the Kazimierz Symposia in Poland. Stefan Pokorski, Ken Lasilla and Professor James P. Vary, Director of the IITAP at Iowa State University decided to organize the next, 18th **Kazimierz Symposium in Ames. This symposium, called "Particle Theory and Phenomenology", was held in May 1995, in Ames, jointly with** The Madison Phenomenology Symposium, organized by University of Wisconsin, Madison. It was a very successful conference. Ken Lasilla was later the main editor of its Proceedings[9].

Plans were made to continue such symposia; the next one was planned to be held somewhere in Asia. However, those plans were not realized.

In the 1990s Stefan Pokorski started to seek foreign partners to organize conferences devoted solely to theoretical particle physics. In September 1994, we organized in Warsaw a US–Polish Workshop "Physics from Planck Scale to Electroweak Scale". Tomasz Taylor from Northeastern University, Boston, MA (once Stefan's graduate student) and Howard E. Haber from University of California, Santa Cruz, were very instrumental in organizing this Workshop.

9 *Particle Theory and Phenomenology*: **17th International Kazimierz Meeting on Particle Physics : The Madison Phenomenology Symposium : Iowa State University, May 1995. K.E. Lasilla *et al.*, Eds. World Scientific,** Singapore-New Jersey-London-Hong Kong**, 1996. (There is a mistake in the title of this book; it should read … 18th … (ZA))**

Proceedings of this Workshop were published in a book[10]. In its Preface the Editors wrote:

> There certainly exists physics beyond the Standard Model! Very few, if anybody, would disagree with this supposition. It may well be that such pressing questions as about the rationale for the replication of fermionic families or the origin of fermionic masses have their solution at a much higher energy scale than presently explored experimentally, may be even at the Planck scale. There is at present only one framework, well-motivated theoretically, which allows for extrapolation in energy in a concrete and predictive way. This is supersymmetry combined with the idea of grand unification of all elementary forces, realized as GUTs or string models.

Zygmunt Ajduk:

> Second US-Polish Workshop "Physics from Planck Scale to Electroweak Scale" was organized in Warsaw in March 1996, and the Third Warsaw Workshop "Physics from Planck Scale to Electroweak Scale" in April 1997. Stefan Pokorski decided then to start a collaboration on such conferences with **Ignatios Antoniadis (École Polytechnique) and Hans Peter Nilles (Bonn). Later on other European research groups from CERN, CEA Saclay, ICTP and SISSA (Trieste). Madrid, Oxford, Padua and Pisa joined in as well.**
>
> Finally, the Workshops turned into the annual European Meetings "From the Planck Scale to the Electroweak Scale" (Planck Meetings in short), organized in various European countries. Two of them, the 1998 and the 2002 meetings, were held **in Kazimierz upon Vistula, and another one, the 2007 meeting, in Warsaw. The next Planck Meeting will be held in Warsaw between May 28, and June 1, 2012.**
>
> **In addition to the Workshops and Meetings mentioned above, we were the organizers or co-organizers of several other international conferences in Warsaw: 28th International Conference on High Energy Physics, 1996, attended by 850 physicists from all over the world; Physics in Extra Dimensions, 2001; The Photon, 2005; Physics and Detectors for Linear Colliders, 2008; String Phenomenology, 2009; Scalars, 2011.**

Jan Kalinowski:

> Since Nature, and Stefan, too, abhor a vacuum, a new incarnation of the Kazimierz Symposia, called shortly "Planck Meetings", was conceived by Stefan Pokorski in 1997. The Planck Meetings keep high the Kazimierz Symposia tradition of the vivid exchange of ideas in particle physics and of promoting young physicists from Warsaw.

Marek Olechowski:

> I participated in a dozen of the symposia held in Kazimierz upon Vistula. The

[10] *Proceedings of the US–Polish Workshop Physics from Planck Scale to Electroweak Scale*, Warsaw, Poland, 21–24 September 1994. Editors: Pran Nath, Tomasz Taylor, Stefan Pokorski. World Scientific, Singapore-New Jersey-London-Hong Kong, 1995.

one I remember the best took place in 1983. There are two reasons for this. First, it was for the first time that I gave a lecture in front of an outstanding and numerous international audience. Second, the first – just arrived – experimental data from the LEP collider at CERN about possibly observed W–bosons were presented. At the breaks between the Symposium's sessions hot debates flared whether or not the presented data constituted a sufficient evidence, or only a circumstantial one, for the existence of the W–bosons. Sixteen months later the Nobel Prize in Physics was awarded for this discovery. The short time elapsed between the discovery and the related award of the Nobel Prize was a record for brevity. It clearly indicated how important a time it was in physics for elementary particles and interactions.

The significance in contemporary physics of Stefan Pokorski and that of his Group allowed him to initiate another series of annual international conferences "From the Planck Scale to the Electroweak Scale" organized in different European cities. The first Meeting of the Planck series was held in Warsaw in 1994, and the fifteenth one will be again in Warsaw, in 2012.

Zygmunt Lalak:

Conferences have been an important activity of the Pokorski Group. They allowed us to keep in touch with the international scientific community. The conference I remember best is the first one from the Planck Meeting series which was held in Kazimierz upon Vistula in 1998. It was then when Professor Ignatios Antoniadis gave one of the first talks ever on physics of large extra dimensions (known today as the "ADD scenario"). The Planck series of conferences have grown to become one of the most important European meetings on particle physics.

III. 2. 6. International research grants

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Zygmunt Ajduk :

The research in basic science in Poland is financed almost entirely from the state's budget. This source was always too scarce and we have tried to find additional financial support from international funds.

The beginnings were difficult. In 1976–1980, we received two research grants from the US National Science Foundation. The projects were coordinated by J. Werle and S. Pokorski (Warsaw) and by A. Bohm (Austin) and J. F. Gunion (Davis).

The situation changed for the better in the 1990s. In 1996-2000 we received three research grants from US-Poland Maria Sklodowska-Curie Joint Fund II. The projects were coordinated by S. Pokorski, B. Grządkowski, Z. Lalak (Warsaw) and H. E. Haber, M. Dine (Santa Cruz), J. F. Gunion (Davis), B. A. Ovrut (Philadelphia). In the same period of time the Stiftung fűr Deutsch-Polnische Zusammenarbeit financed two research projects of B. Grządkowski.

In 1998–2006, we realized nine scientific projects in the French-Polish Programme Polonium. This collaboration was coordinated by Z. Lalakand S. Pokorski (Warsaw), and I. Antoniadis, R. Grimm, S. Katsanevas, C. Savoy, E. Dudas, J. Mourad (France).

In 2011, the collaboration agreement was signed between University of Warsaw and CERN for the years 2011–2014. The research project called *Search for Beyond the Standard Model Theory of Elementary Interactions in the LHC Era* is coordinated by S. Pokorski (Warsaw) and I. Antoniadis (CERN) and financed from Polish side by a grant from the National Science Centre.

In the early 1990s, talks were started about the participation of Polish scientists in various science programs of the European Union. In 1994–1997, we had our first success – we were co-opted to two research networks in the 3rd Framework Programme; the Warsaw subnodes were headed by S. Pokorski. In the year 2000 it became possible for Poland to join officially and practically the 5th, 6th, an 7th **Framework Programs of the European Union.**

In the years 2000–2011 our Chair of …. received nine EU grants within the science networks scheme. These grants have decisively helped us to expand our international cooperation and exchange. Foreign physicists were repeatedly coming to Warsaw for shorter and longer research stays. In the science networks, involving usually about ten European centres each, the Warsaw nodes were headed by S. Pokorski, M. Olechowski and Z Lalak, why the sub-nodes by M. Krawczyk and J. Kalinowski.

Of the particular importance was the grant within the Transfer of Knowledge scheme entitled "P**article Physics and Cosmology: The Interface". S. Pokorski was the grant's coordinator. This multinational grant, operated in the years 2006-2010, aimed at integrating our group into the interdisciplinary research linking elementary particle physics, astrophysics and cosmology. Seven international workshops on elementary particle physics and cosmology were organized in Warsaw. Fourteen foreign physicists were temporarily employed at our Chair for periods ranging from two months to two years, while eight of the Chair's physicists worked**

at leading European centres in Geneva, Paris, and Munich, for periods of time ranging from two to eighteen months.

The large number of international projects realized in the last fifteen years by our small group was a real success and a confirmation of the international recognition of our group.

Personally, a number of times I worked as Administrator of Polish and international research grants.

III. 2. 7. *Gauge Field Theories*

Mikołaj Misiak:

I was the first Stefan Pokorski's student to read his book *Gauge Field Theories* as a primary source to prepare the MSc thesis. He had just received the galley proofs of his book from Cambridge University Press, and I successively xeroxed these proofs in his front office to use the copies as my basic textbook to learn the subject. Subsequently, I asked him several questions that might have helped in clarifying the text.

This monographic book by Stefan Pokorski is quite a sophisticated one. The author assumes (as he clearly states in the Introduction) that the reader commands the knowledge of quantum field theory at the level of the famous handbook *Relativistic Quantum Fields* by J. D. Bjorken and S. Drell.[11]

That is why Pokorski's book would not be the first in the sequence of textbooks one should read to learn the subject; perhaps it would be the second in this line, and as such it still wins the competition. I remember a good story about this book. During the 1990s I had a friend, a theoretical physicist from Harvard University, who was told that a specific problem, for which he was seeking an explanation, was described in Pokorski's book. He ran to the university bookstore, browsed the book, found the stuff, and immediately purchased the book. I'm quite sure such a situation might well repeat itself in 2012.

The second edition of Pokorski's *Gauge Field Theories* (2000) includes a new longer chapter on weak interactions and on the Standard Model. This chapter is regarded as very useful and trustworthy by those who study and/or work on these subjects.

Very little, if anything, from this book has become outdated. The book is mostly about the lasting, tangible fundamentals of gauge fields that have not changed and will not change: non-Abelian theories of fields, renormalization, chiral groups, anomalies, weak interactions, the Higgs mechanism, effective theories, path integrals, etc. Physics will progress, some small modifications may be introduced here and there, but these theories will always remain good approximations valid in the 100 MeV to 100 GeV energy range.[12]

To write such a book, the author must have accumulated his own knowledge in many different ways: by learning textbooks, monographs, numerous scientific papers, doing his own research, having a clear and apt concept, and to have kept thinking a lot on the subject. Stefan Pokorski wrote this book in his own, unique way. Many of the problems that are described there do not belong to usual textbook material but are more often treated in journal publications only. It is much harder to find and to understand such problems by reading separate papers for they routinely refer to earlier ones and the latter refer to still earlier ones, and so on. A good handbook should allow the reader to avoid such tedious searches.

[11] It is noteworthy that only several chapters of the Bjorken &Drell book, first published in 1965, now appear to be out of date. Similarly, quantum mechanics can still be learned very well from the fabulous handbook *Quantum Mechanics* by L. I. Schiff, first published in 1949, and later in 1955 and 1968. (MM)

[12] It is like the fact that laws of Euclidean geometry remain valid as a perfect approximation in most of the present-day physical analyses, except for those in cosmology or studies of strongly gravitating objects. (MM)

Gauge Field Theories by Stefan Pokorski has been written with particular attention to make all the explanations clear and complete. It is so, thanks in part, to the contribution of a number of Pokorski's students who diligently repeated and checked thoroughly all the calculations and the resulting formulae. Their contribution to the book has been acknowledged in the Introduction.

III. 2. 8. Research abroad

In the reminiscences of all the members of the Pokorski Group, their stays in research centres in Western countries are prominently present.

Marek Olechowski:

Longer and shorter stays abroad, in the West, were a very important part of the scientific work of every one of us.

My first postdoctoral position was at the Max-Planck-Institute for Physics, Munich. I went there in 1988, just after I had received my PhD degree. I obtained this position on the recommendation from Professor Pokorski. Obviously, a good recommendation letter from a well-known scientist has always been of the greatest importance in getting the first postdoc.

At this point I would like to tell a story from the now seemingly distant past. The letter from the Max-Planck-Institute, Munich, offering me the postdoc position and requesting an answer within a couple of days reached our Faculty of Physics when I was on sick-leave. Those days there was no Internet, no cellular phones. I had no wire-line phone at home. My colleague, Jacek Pawełczyk, was unable to contact me quickly, so he immediately decided to send the accepting letter by fax in my name.

My stay at the Max-Planck-Institute, Munich, gave me the opportunity to get in touch with many great physicists. Among others, I met Hans-Peter Nilles and through him Michael Schmidt from Heidelberg. My scientific collaboration with Hans-Peter Nilles turned out to be long and most productive. Togethe, we wrote 15 papers. Through my cooperation with him I engaged in research on multidimensional theories, including M theory that is a generalization of string theories, as well as on orbifold compactification and supersymmetry breaking mechanisms. Later, I continued working on these subjects at the Hoża together with some of my colleagues and my graduate students. Several papers I wrote with Hans-Peter Nilles (including one co-authored by Stefan Pokorski) arouse a considerable interest among the researchers in the field.

Mikołaj Misiak:

Professor Pokorski followed the further careers of his former students with great interest and dedication. Most of us were employed at the Hoża. After we graduated with PhD degrees, we were travelling to foreign research centres working on contracts, while being on unpaid leave from the University of Warsaw.

Stefan Pokorski took advantage of his international recognition in physics to arrange for longer research stays at foreign research institutions for every member of his Group. That proved to be the most important stage to our scientific development and also very helpful for practical reasons. Usually, he talked to people at various research centres telling them that he had a very good graduate student whom he wanted to send there. Many times he invited scientists

from abroad to the Hoża, and they talked to us, as if they were interviewing us for jobs.

It sometimes happened that we went for short stays at foreign research institutions even before we graduated with PhD degrees. In my case, Professor Pokorski suggested and arranged for my several stays abroad during the early stages of my PhD study – when I was not experienced and not known. I attended a summer-school at the International Centre for Theoretical Physics, Trieste, drew on the busy research atmosphere of CERN, and finally completed a significant part of my PhD calculations during a four-month stay at the University of Zurich with the group of Professor Daniel Wyler.

Such experiences are common for the present-day students in the European Union, but during the transition time of the early 1990s in Poland, the Pokorski Group was quite exceptional in this respect. It was not like it is today when fresh graduates send simultaneously fifty applications to different places all over the world.

Stefan Pokorski has always been very helpful in our scientific development. Even currently, he provides letters of recommendation when we want to stay for a longer time at another university or an international laboratory. Similarly, he helps us to arrange formalities on the Polish side, when the relevant regulations become more and more bureaucratic each year. His opinions are always being considered with great attention.

Zygmunt Lalak:

Professor Pokorski put a lot of effort into arranging for shorter or longer visits of the members of his Group to foreign institutes. These stays were the formative experiences for all of us. However, one point should be made very clear. It is not the case that we "borrowed" ideas from the abroad. We were being invited to foreign centres because we had original ideas to offer.

Janusz Rosiek:

While staying abroad, I could see how very well-known Stefan Pokorski actually was. I was still a young man, obviously not well-known. However, it was enough to say that I was Stefan Pokorski's student to become someone recognizable and to be treated as a potentially valuable partner in discussion or in scientific collaboration. It was very comfortable and really helpful to feel Stefan Pokorski's shadow over all of us.

*

To return or not to return to Warsaw from the stays abroad, that was not the question.

Jan Pawełczyk:

I never imagined I could live permanently in a country where people were not able to pronounce the Polish word „najśliczniejsza" [loveliest].

Janusz Rosiek:

I spent all together quite some time abroad: 1994 in Valencia, 1995–1996 in Karlsruhe, 2000-2002 and 2004 in Munich, plus dozens of shorter stays elsewhere. I visited most of the important high energy physics laboratories in many countries – CERN, DESY, SLAC, and many other labs. I gave seminars at each of them. However, I was never really tempted to stay abroad for good; nor did I apply for any permanent positions outside Warsaw. There were a number of reasons for this. First, I always felt good in Poland; all travels were for me just travels, not chances to leave forever. Second, my position at the Institute of Theoretical Physics at the University of Warsaw was a quasi-permanent one from the beginning of my employment. If I decided to stay abroad permanently I would have to face the risks of an uncertain situation, fights for temporary positions, etc. Third, the Institute of Theoretical Physics was always well funded. While working there, one could live reasonably well by Polish standards and support a family. One's university salary was usually augmented with money from grants and by money earned during scientific travels abroad. Fourth – and most importantly – I never saw a real scientific reason to leave for good. I took pride in being a member of a strong and internationally well-known research group, I never had problems with publishing papers in good journals, I was being invited to international conferences, I easily found good collaborators in my research. In general, I pursued my career – in later years even without direct support from Stefan Pokorski.

I still travel a lot. Every year I spend at least 2–3 months at various foreign universities and laboratories – it is more than enough to keep lively contacts and to be up to date with the scientific developments in our field.

By the way, Stefan Pokorski, even while approaching his seventies, is traveling more than any of us. He does not seem to be slowing down and it is amazing how scientifically active he continues to be.

Mikołaj Misiak:

The duration of my long-term stays at CERN, at the Technical University Munich, University of Zurich, and the Karlsruhe Institute of Technology sum up to almost ten years. I have often been asked by my foreign colleagues why I had never applied for a university's permanent position outside of Poland despite my clear chances of success and obvious financial advantages. While in my responses I usually referred to personal reasons, it is fair to say that those would not have been sufficient, had the scientific excellence of the Pokorski Group not been so high, and the research environment within it so comfortable.

Maria Krawczyk summarizes it shortly, but to the point:

Scientific stays abroad have played an extremely important role in my scientific career – they have always inspired me to work on new topics. The

question: “Why in those years did we return to Poland?” I leave the question unanswered as an obviousness.

III. 2. 9. Into the 1990s and Beyond

Marek Olechowski:

One of Professor Pokorski's most important abilities, and quite amazing, was his initiation of theoretical work on new and exciting subjects. It was his choices of hot topics that led us to the results that became known in our field and valued worldwide.

One of these topics was the spontaneous breaking of isospin symmetry in supersymmetric models. It was the first topic I worked on in my scientific career after I graduated with the MSc in 1983. My paper with Stefan Pokorski, published in 1988, was one of the two first papers in which the observed hierarchy of the third generation quark masses was related to the vacuum expectation values of the Higgs fields and not to the Yukawa couplings. We continued our studies of this topic in several papers that followed. One of these, written in cooperation with Carlos Wagner and Marcela Carena, has been widely known and cited more than 500 times; it is Pokorski's most frequently quoted paper – and mine, too. The scenario worked out in this paper is called the "large $\tan\beta$ scenario". The large value of $\tan\beta$ we suggested is one of the hypotheses now being tested in experiments carried out at the Large Hadron Collider at CERN.

Another very interesting topic concerned non-universal soft supersymmetry breaking terms. The necessity to include such terms arises when one tries to construct phenomenologically acceptable supersymmetric models for Grand Unified Theory – GUT – including the SO(10), or larger, symmetry group. Stefan Pokorski and I investigated models of this sort together with our foreign collaborators: H. Murayama and F. M. Borzumati. Initially, our studies on this problem resulted in 2–3 papers, the first one co-authored only by Stefan Pokorski and published in 1995. This problem, initiated 17 years ago, continues to be the subject of much research. My latest paper of 2011 with Stefan Pokorski and Marcin Budziak (my former PhD student) concerns just this subject.

So far Stefan Pokorski and I published together 25 papers. At the beginning only we two were their authors. Later, more and more frequently, other people, mostly from other countries, contributed to our papers and co-authored them.

Maria Krawczyk:

During the 1980s and 1990s, I worked on quantum chromodynamics. In more detail, I worked on a description of strong interactions at a fundamental level. I collaborated closely with the group of experimentalists from the University of Warsaw who then worked at DESY. Plans were drawn to explore proton's structure showing up in deep inelastic scattering experiments carried out using the HERA collider there. I showed that photoproduction, intitially regarded as a troublesome background in such processes, was itself an interesting phenomenon revealing the structure of photons. Subsequently, studies of processes of this type led me to theoretical work on the possible production of Higgs particles first in the HERA, then in the LEP colliders, and finally in prospective photon colliders planned for the future.

Our research activities in this field resulted in organizing the Warsaw 2005 Jubilee Conference called "PHOTON – One hundred years later" – to mark the Centennial of Albert Einstein's hypothesis about the photon. The conference was attended by many eminent physicists including David Gross (2004 Nobel Prize winner), Roger Penrose and the Directors of CERN and DESY. Studies concerning photons were incorporated into the European Union's research program EURIDICE, and I was one of the coordinators of it.

Zygmunt Lalak:

After I had received my PhD degree in 1990, I went to Philadelphia to work on cosmology at the University of Pennsylvania. In 1993, I obtained a postdoc position at the Department of Theoretical Physics, University of Oxford. As the next step, which became available to me with the help of Stefan Pokorski, I joined – as a postdoctoral fellow – the group led by Hans-Peter Nilles at the Technical University Munich. These were the years of my very intensive and fruitful studies in several areas of modern theory in physics – first of all in supergravity theory and string theory which then looked as the most promising ways to unify all fundamental forces including gravitation.

At the beginning of 1998, I started at a research associate position at CERN's Theory Division. It was then that my links with CERN opened. During this stay my close collaboration with Stefan Pokorski began. Its subject was supersymmetry in theories in five and more space-time dimensions. We co-authored a number of papers, several of which turned out very successful.

My lasting close collaboration with Stefan has indeed been an experience, always arousing curiosity and inspiration. He always insisted on beginning the analysis of a problem with the basics, and then on the full and proper physical understanding of each step of our, often abstract, calculations.

The topics we were working on were very popular at the time. Almost every day new submissions to electronic archives appeared with their titles and results falling close to the stuff we were laboriously working through. This put certain pressure on me to rush with the publication of our available results. I remember starting each day with surveying new submissions and then furiously typing pages of notes in order to speed up the publication of the paper we were working on. Stefan always stayed calm. Even if, from time to time, I found some of our ideas in somebody else's paper, he kept telling me that it was simply an encouraging confirmation that we proceeded in the right direction, toward a great discovery. Slowly, I learned that one should not worry too much about the work done by other people and that reading too many newest papers may be counterproductive.

Janusz Rosiek:

In 1992, I received my PhD degree and – with Professor Pokorski's support – I successfully applied for several postdoctoral positions. First, I went for one year (1994) to Valencia where I worked with Professor Jose Valle. Then I followed with a two year-long Humboldt Fellowship within which I worked (1995-1996) at the University of Karlsruhe with Professor Wolfgang Hollik. I

wrote several papers with the two, without Stefan Pokorski's participation in these.

I addition, with Stefan Pokorski we worked out and published two other papers. These proved to be quite significant ones since they have now gained approximately 200 citations each. These two papers have been very meaningful to me for in them I switched – for the first time – from the Higgs physics to phenomenology of the so-called rare decays (although still in the frame of supersymmetric models). Until today this is the subject which has remained the main topic of my research.

Jacek Pawełczyk:

In 1993, Stefan Pokorski, Zygmunt Lalak and I wrote our last common paper on phase transitions in the non-supersymmetric and supersymmetric versions of the simple Nambu-Jona-Lasinio (NJL) model in finite temperature.

Mikołaj Misiak:

My feeling at the time was that I did not understand quantum field theory well enough, and I preferred to work in phenomenology in order to gain more knowledge, even though model building would have been more attractive conceptually. Stefan Pokorski, then my PhD thesis advisor, accepted this, and suggested that I work on radiative B-meson decays. It was a hot topic those days due to a disagreement between the Harvard/Caltech and the Toronto groups concerning values of the two-loop anomalous dimensions responsible for a few-times enhancement of the decay rate (unmeasured at the time).

As a preparation for the two-loop enterprise, I completed a couple of one-loop calculations, publishing two papers on ε'/ε and $K \to \pi^0 e^+ e^-$ in the two-Higgs-doublet model (the latter paper with my younger colleague, Zbigniew Płuciennik). Two other papers on two-loop effects in $B \to X \gamma$ and $B \to X l^+ l^-$ followed.

I wish to stress that it was Stefan Pokorski who suggested the ideas for all the four papers that formed my PhD thesis. This notwithstanding, he refused to be the co-author of these papers, arguing that he had not been involved in the calculations. The same happened earlier in the case of my MSc-thesis-based paper on Pauli–Villars regularization. Pokorski indicated plainly to me that no policy of automatic co-authorship by the thesis' advisor was practiced in his group. Consequently, we had no common publication until I began my first postdoc in Munich. At the time it was not clear to me, but it must have been clear to him that the two-loop papers were destined to become standard references and earn hundreds of citations. In the view of this, his decisions of no co-authorship should really be appreciated.

In Spring 1993, I started my first postdoc at the Technical University Munich in the group of Professor Andrzej Buras. Again, the help from Stefan Pokorski in arranging for this job was crucial.

Parallel to my stay at the Technical University Munich, Stefan Pokorski spent several months at the nearby Max-Planck-Institute for Physics, Munich. It was the first time we two had worked together, joining forces with Andrzej

Buras and his graduate student, Manfred Münz. A phenomenological analysis of radiative B-decays we performed together aimed at systematizing and clarifying various issues in earlier analyses of these phenomena. We were not sure whether our paper that contained no brand new results would make its way to a respected journal like “Nuclear Physics B”. It did – and it became a standard reference that amassed over 300 citations. The role of Stefan Pokorski in the success of this paper cannot be overestimated.

My further advancement as scientist was largely independent of Stefan Pokorski. I remained in flavour physics, concentrating on precise calculations of the Standard Model contributions to new-physics sensitive observables, while Pokorski’s research focused on properties of supersymmetric models and other extensions of the Standard Model. There was only one more paper we wrote together with Stefan Pokorski and Janusz Rosiek; it was a handbook review article on rare flavour-changing processes in supersymmetric models. Similarly to our previous common papers, it has become quite popular.

I have been a member of the Pokorski Group for more than twenty years now. I should like to stress that I have enjoyed enormous freedom in choosing my own research paths, yet I have always been sure of his continuous support at every stage of my scientific career, especially when his recommendation or initiative affected my grant applications, research stays abroad, or even the prizes I received.

III. 2. 10. Physics Beyond the Standard Model

Janusz Rosiek:

In 2001, I successfully defended my habilitation thesis (for an equivalent of DSc degree) and for the following several years I did not work closely with Stefan Pokorski. I spent almost three years in Munich and wrote several papers on rare decays there with Professor Andrzej Buras, Head of a group at the Technical University Munich.

During those years Stefan Pokorski pursued research interests different from mine. He wrote quite a famous paper on deconstruction models, which initiated a new trend in the field that was quickly followed by many authors.

This paper struck me then as something very unusual. There has been a quite common opinion floating around that theoretical physicists and, mathematicians, as well, usually produce their greatest ideas when they are young, and in later years they only expand on their early thoughts. To me, such an original and inspiring paper worked out by Stefan Pokorski at a later stage of his scientific career is still something extraordinary.

Maria Krawczyk:

For several years I have been working on a non-supersymmetric extension of the Standard Model, allowing for the existence of a light Higgs particle, which would explain the difference between the extremely precisely measured experimental data on muon's anomalous magnetic dipole moment and the prediction for it in the Standard Model. However, it took me a couple of years to bring the theorists' community to the idea that a very light Higgs particle, which might explain this discrepancy, is not excluded by the data. Finally, my initiative to organize a CERN workshop on searching for CP-symmetry violation effects and on the non-standard Higgs model met with a good response.

Marek Olechowski:

When I was an undergraduate student I chose theory of elementary particles and not (although I also considered it) theory of gravity as my specialization. Later, when working on M theory, I studied also theories of gravity and supergravity. I wrote a number of papers bordering theory of gravity and theory of elementary particles – some with Krzysztof Meissner from our Group and, later, some with my graduate students.

Later, the topics of my research and the majority of the papers I wrote – particularly those I wrote together with Stefan Pokorski – have been directly related to supersymmetry. This has also been the case for a large fraction of the papers authored by other members of the Pokorski Group.

Stefan Pokorski stated many times that we should not be at all shy as we have been among the world's foremost centres of theoretical high energy

physics. I think our contribution to supersymmetric theories has really been very substantial. There can be no doubt whatsoever that Stefan Pokorski has been the driving spirit behind our achievements.

Krzysztof Meissner:

Starting 1987, Stefan Pokorski and I published several common papers on string amplitudes and modular symmetry. In 1989, I defended my PhD dissertation on string amplitudes based upon those papers.

In 1990, I left for a one-year postdoc position at CERN. There, I began my cooperation with Professor Gabriele Veneziano. Together, we wrote several papers on string-originating symmetries in theory of gravitation. It was only in the mid-1990s, during my second postdoc at CERN, that I stopped working on string theory. My research interest definitely shifted to gravitation and Early Universe.

Looking back, I can sincerely say that – although for a longer time I have not been directly involved in the Pokorski Group – my scientific career was shaped and developed thanks to my staying in touch with this Group and – for sure – thanks to the invaluable guidance provided to me by Stefan Pokorski and my personal contacts with him.

Jacek Pawełczyk:

In 1985, I was drafted into the Polish Army and I did national service for one year. When I returned to the Hoża, I learned that a new attractive field had opened in theoretical physics. It was string theory. Professor Pokorski immediately took interest in it, and suggested for Krzysztof Meissner and me to make our PhD theses in this field. That way I became a string theorist – at least I think of myself this way.

In 1989, after I had graduated with the PhD degree, I went to the Weizmann Institute in Israel for a postdoc position. There, I came across many outstanding physicists – Shimon Yankielowicz, Yaron Oz, Adam Schwimmer, Itzchak Rabinovicz, and Cobi Sonnenschein – with whom I later worked. At the seminars given by Ed Witten they were not ashamed to take notes attentively while sitting in the front row. Almost no professor-student distance was noticeable in the conversations. That seemed to me to have been the key to many scientific achievements of the Israeli scientists. During my stay at the Weizmann Institute the gap in my knowledge, separating me from “true” theoretical physics of fields and strings, became very clear to me.

In 1991, after I had returned to Warsaw from Israel, Stefan Pokorski declared that he had lost his interest in string theory because it seemed to him to be unphysical, i.e. totally detached or at least very remote from experiment. Consequently, our scientific cooperation loosened considerably.

During the early 1990s string theory drifted towards formal considerations. During 1994–1995, the work of many string theorists resulted in formulating the duality and in the discovery of D-brans and the role thereof within string theory. In 1998, I held a temporary position at the Technical University Munich where I began my cooperation with Stefan Theisen. I also restarted my cooperation with

my old friends in Israel.

Since 2009, I have been working on string unification, i.e. closer to experiment. Nowadays in our Group it is only me and my few graduate students who work in string theory. Sporadically, someone else joins us. It may well be that one day Stefan Pokorski and I shall again write a paper together.

The string theory by itself is very interesting. However, the problem with it is that – despite all hope and effort – it is extremely hard to find its relation to the experiment. Twenty years ago there was hope for string theory at very high energies and in ten or more dimensions to become a theory from which everything could be calculated – literally, up to the last comma. Unfortunately it turned out that there may be myriads of such theories – 10 to ever increasing powers, like 100 or more. Who cares what this number is? And this is the big problem.

Zygmunt Lalak:

Stefan Pokorski promoted originality. Many new ideas have emerged from our seminars and discussions. For example, together with Stefan Pokorski and Adam Falkowski we invented a new and original method of supersymmetrization of the Lagrangians defined in spaces with branes[13].

Stefan Pokorski has another ability or even a trait that is very important for a research group leader. He realizes quickly and clearly when the decline phase of a problem or even of a whole research domain commences. He knows where and when to stop.

Stefan Pokorski continues to work very intensively. Currently, he works predominantly on electroweak symmetry violation. This subject is linked to many experiments now being carried out at CERN's Large Hadron Collider, i.e. to the quest for "signals" of new physics beyond the Standard Model, e.g. supersymmetry and the Higgs boson.

[13] Branes are subspaces with a smaller number of dimensions than the background space. (ZL)

III. 2. 11. Particle Physics and Cosmology

Marek Olechowski:

Another problem, which I worked on repeatedly in cooperation Stefan Pokorski, was dark matter. It all began with the visit to Warsaw, on Pokorski's invitation, of Paolo Gondolo who then worked at Uppsala University, Sweden, and who he met at a conference. For several weeks in Warsaw, Paolo and I worked together on numerical programs to compute relic abundance of dark matter. Then we continued for a longer time co-working remotely through the use of e-mail. Each of us wrote his own computer program and performed separate computations. Comparing our results helped us to eliminate errors in the two codes. We wrote only one common paper and that was published in the proceedings of a 1992 conference in Dallas, Texas. Shortly afterwards, we each went our own way.

I used the results computed with my program in many subsequent papers. Dark matter, constituting about 20 percent of the energy density of the Universe, poses an extremely important scientific problem. The sheer existence of dark matter proves the necessity of reaching beyond the Standard Model. In the physics of fundamental interaction, dark matter is something we do not know yet, but it is certainly worth exploring.

At the "Dark Side of the Universe" Conference in Rome in 1993, I presented a talk that met with considerable interest from Sandro Bottino, Head of a research group in Turin. He invited me to pay a short visit to his group. While I was there, he urged me to apply for a fellowship from the Italian Instituto Nazionale di Fisica Nucleare. I complied. I obtained this fellowship and stayed with his group in Turin for a year. We wrote several papers together with Sandro and his graduate students. They were experts on dark matter detection while I seemed to be the expert on supersymmetry.

Two years ago, Stefan Pokorski, Krzysztof Turzyński, I (all from our Chair), and James D. Wells – an American working at CERN, and Laura Covi from DESY started another collaboration on dark matter. We have already written a couple of papers together.

Janusz Rosiek:

In 2006, Stefan Pokorski received a huge European Union-sponsored Transfer of Knowledge grant for his Group to be used to shift and to apply the Pokorski Group's expertise in particle physics to cosmological applications. It was a big boost to our Group. For the four years of the grant's duration, we had postdocs funded by the European Union. Many distinguished guest-scientists visited our Group to hold discussions with us and to give lectures or seminars. We became a lively centre of international scientific exchange and cooperation in this new area of physics. In addition, we had at our disposal an extra source of funds to cover our travels to foreign centres.

In 2008, Stefan Pokorski suggested that he would cover my visit to CERN from this grant, thereby making possible my two month stay at CERN. This stay has revived my research activity. We have started a new project on unitarity violation in W-W collisions, which now is related to the Large Hadron Collider, the most important source of new, previously unreachable, experimental data. This project is being continuously developed with Stefan Pokorski, me, and a few of our students and colleagues. Moreover, we have recently made a return to rare decay physics. Consequently, my scientific cooperation with Stefan Pokorski has intensified again, parallel to my work with my other collaborators.

Zygmunt Lalak:

In 2006, Stefan Pokorski won a European Union grant to study the interface between particle physics and cosmology. Together with a number of people from the Pokorski Group, I have been involved in this research directed by Stefan. Thus, a new direction in the activities of our Group had opened and resulted in a number of valued publications.

In addition to research, the work within this grant involved a nontrivial organizational effort. As a part of this project, Stefan Pokorski undertook holding in Warsaw seven medium-size international workshops on particle cosmology over the period of four years. We tried to negotiate a partial waiver of this obligation, unsuccessfully. *Nolens volens*, we organized the whole series of workshops. To these workshops we invited many outstanding particle cosmology physicists who shared with us their knowledge of cosmology and their true passion for cosmology. At the end, the project turned out very successfully.

Currently we work on particle cosmology, i.e. on the cosmological implications of the theory of fundamental interactions. In this theory it is assumed that the same fundamental interactions have acted both in Early Universe and today, obviously in different conditions; one has to account for the expansion of the Universe. In fact, at high temperatures and at large density cosmic matter was in a very different phase. The indications are that in Early Universe all elementary particles existed in free, unbound states, while elementary interactions were of a rather simple form. In the pre-hadronization phase the fundamental form of matter was quark-gluon plasma supplemented with leptons.

There are expectations that one day it will be possible to show that electroweak, strong, and gravitational interactions can be unified. We are looking for observables, in the cosmological context, in which the synergy between fundamental interactions and gravitational ones will be significant. One such phenomena was inflation. The Universe inflation is a useful cosmological hypothesis that can explain various problems in the Cosmological Standard Model. On top of that, the cosmological inflation should be able to explain the appearance of primordial fluctuations of quantum nature in the Universe, i.e., to some extent, the generation of primordial structures. The latter requirement puts some constraints on the fields and couplings within the inflation models. These aspects of the cosmological inflation are extremely interesting theoretically and – most importantly – can be verified experimentally. Different signals being registered by dedicated orbiting observatories testify to the earliest phases of our Universe.

Our other research topic is dark matter. Dark matter is widely believed to exist and various arguments for it come from a number of independent sources. If it is to be a dust-type matter, then it must be in the form of a thin gas of massive particles. One has to find what kind of particles those could be. The hypothesis that these might be supersymmetric particles has been very attractive to many theorists and even more so because the supersymmetry theories predict the existence of an exotic but stable massive particle that interacts with a low intensity, comparable to weak interactions (Weak Interacting Massive Particle; WIMP).

During the late 1970s and 1980s, CERN was the leading European centre in research on dark matter. Dimitri Nanopoulos – then a postdoc fellow – was one of the persons leading the calculations of this type at CERN.

The particle cosmology type of theoretical considerations constitute a part of the Pokorski era. Stefan Pokorski initiated the research of this type in Warsaw; there had been nothing like that, before.

As it has already been said here many times, Pokorski has been sensitive to phenomenological aspects of even the most abstract theories – and dark matter is such an aspect. Stefan and others in his Group, myself included, have been working on this subject.

One can always ask what the prospects for experimental discovery of dark matter (and indeed the whole range of related phenomena) are, what could be tested, and what quantities measured. For many years now, dark matter seemed to be within our reach, in a hand stretch. It does not prove to be the case. Cryogenic crystal-type detectors have been built to register dark matter particles hitting Earth. There were a few very carefully-worded announcements, e.g. from the Soudan Mine Lab in Minnesota. Nothing definite, yet.

Strange it may seem, until very recently there was little dialogue between astronomers and astrophysicists on the one hand and quantum field theory physicists, like ourselves, on the other. For the former supersymmetric particles or axions of the latter were rather exotic stuff. They dealt mainly with long-lived particles: protons, neutrons, neutrinos.

Nowadays, I have been learning from Stefan Pokorski the physics of flavour, the new stuff which has opened a new chapter in my research.

III. 2. 12. The Atmosphere

Bohdan Grządkowski:

We have all learned from Stefan Pokorski that what importantly matters is only what each of us has done in physics, and whether he/she really creates physics or only talks about it. Playing smart at seminars was of no significance to him. It was rare for him to praise any of us. From him I have adopted such an approach, although I am not totally sure how efficient it is.

Jacek Pawełczyk:

In our contacts with Professor Pokorski the distance was palpable, but it was exceptionally small compared to customary relations between employees and university professors in Poland.

Marek Olechowski goes into more detail:

When I started my employment at the Hoża, there were many young physicists under Stefan Pokorski. He did his best to treat us equally. I remember a situation after he had arranged for three invitations for short stays abroad. Rather than deciding himself, he left the decision to us. We chose to decide by draw. Consequently, Michał Spaliński and I went for two weeks to a university in Rome and from there to the International School of Subnuclear Physics in Erice, Sicily.

Later, the "equal" distribution applied to payments from grants. From young graduate students we had gradually become less young, but more independent scientists and hence the formal arrangements (e.g. the participation in grants) became the function of the intensity of our scientific collaboration with Stefan Pokorski.

Professor Pokorski always encouraged us to eagerly present the results of our work. Sometimes he almost ordered me to do so, for I preferred to work rather than to talk or to write about my results.

I recall an unusual incident. In 1996, I was to give a talk at the International Conference on High Energy Physics (ICHEP '96) in Warsaw. A few days before the event, my car was broken into. Among the stolen things was my laptop (whatever it then meant) with my fully prepared talk and the results that had taken me several months to obtain. In desperation, I phoned Stefan Pokorski to excuse myself that in such circumstances I was unable to give my talk at all. He replied calmly: "Don't exaggerate! You actually need two days to prepare your talk anew." And, indeed, two days were enough to do so.

Many times Professor Pokorski said he was taking up lecturing only on such subjects about which he himself wanted to learn more. The merit of such a situation was obvious: the obligation to lecture systematically on a major subject was enforcing one to self-learn more[14]. Such was the case with Pokorski's

[14] I, too, applied this method. However, I noticed another advantage of it: the newly acquired knowledge seems more captivating and easier to transferring it in an interesting way and it is remembered more easily. (MO)

lectures, which I attended as an undergraduate and later as a graduate student or a young scientist. He first learned many aspects of quantum field theory and of the Standard Model and subsequently he taught us these topics.

Zygmunt Lalak:

Stefan Pokorski has always been open-minded and appreciative of new ideas. It is what continues to be most attractive in scientific cooperation with him.

The Pokorski Group held frequent meetings at which current issues in particle physics and newly published interesting papers were reported and discussed thoroughly. These informal meetings (for several years being held in the conference room next to his director's office) offered us stimulating intellectual excitement after the official, usually rather boring, seminars held at the Institute of Theoretical Physics twice or sometimes three times a week. At the meetings of our Group while the atmosphere was very much relaxed, it always remained crystal clear who was running the show.

The inner seminars of our Group continue once or twice a week. Stefan Pokorski – when not abroad – comes to them regularly. He always makes interesting comments to the talks he attends.

The atmosphere in the Group was always friendly. More experienced members of the Group were extending their hospitality to newcomers. From the early days I remember well my conversations with Jacek Pawełczyk who was always ready to offer his good advice. Later, we had a paper together.

Professor Pokorski spared no effort to arrange for shorter or longer visits of the members of his Group to foreign institutes. For all of us these were formative experiences.

It so happened that I travelled a lot. Behind the scenes I was often criticized for being away for long periods of time and therefore not being very useful in teaching and doing local chores. Professor Pokorski consoled me several times, telling me that there always was a „something for something" balance. He reminded me of the old truth that travels teach one skills that might prove to be the right key to making wise decisions.

Perhaps the best way to summarize Stefan Pokorski's method, which over the years made our Group very successful, is to say that at the start of our every quest for a problem's solution, there had to be a clear statement: "We are absolutely ignorant about this problem, and therefore we shall not be ashamed to ask even the simplest and the most obvious questions." I am not sure how original this recipe was. I am, however, sure of its necessity.

Jacek Pawełczyk:

When I was preparing my MSc thesis I typically met Professor Pokorski once a week to discuss the progress of my work. In 1983, after I had graduated, I was employed at the Branch of the University of Warsaw in Białystok, a city in eastern Poland. However, after merely three months, I managed to get transferred back to Warsaw. It became possible only thanks to Professor Pokorski. He spared no effort to arrange for the transfer of my employment. In Warsaw, I began preparing my PhD thesis under his supervision. The following two years I spent

attempting to work out theoretically the intricacies of the strongly interacting Higgs boson, loop corrections to the Weinberg–Salam Model, and on discussions on several chapters of the manuscript of the book Stefan Pokorski was preparing at that time[15]. After a while, I became tired of the Weinberg–Salam model and less interested in seminars and conferences.

I still remember well an unpleasant incident in Winter 1984. Together with my colleagues I attended the Winter School of Theoretical Physics in Karpacz (The Karkonosze Mountains), organized by the Institute of Theoretical Physics at Wrocław University. The weather was excellent whilst some lectures bored. So, a few of us skipped several sessions and went skiing. One of us fell ill and we took meals to him from the school's canteen a couple of times. The canteen personnel notified the school's organizers about it. The latter accused us of stealing food and playing truant. Tempers flared. When we returned to Warsaw we were notified that the Rector of the Wrocław University wrote an official letter simply reporting on us to the Rector of the University of Warsaw. We were shocked… Despite the overwhelmingly grim atmosphere of the 1984 Polish People's Republic, the Karpacz School organizers did decide to officially report on a couple of unruly post-graduate students!

Of course, it all landed on Professor Pokorski's directorial desk. As I was not at hand, he unloaded his fury on Michał Spaliński. On the next day, when I arrived at the Institute, he had already calmed down. He told me off: "How long will I be in trouble because of you, damned guys?" And that was the end of the affair; we suffered no consequences. The incident could have ended in a totally different manner, perilous to us, in Poland ruled by General Jaruzelski. I remain grateful to Stefan Pokorski to this day.

Janusz Rosiek:

The Group led by Professor Pokorski – when I joined it – was quite numerous: about ten persons at various levels, from undergraduates to DSc's. The atmosphere in the Group was very good, which was a bit of a surprise to me.

Earlier, when I was looking for a new thesis advisor to replace Professor Rączka, I heard differing opinions about Stefan Pokorski: he was good in promoting his students but he was quite tough and unpleasant in many situations. However, in the years that followed I have never seen any serious open conflict inside the Group.

Professor Pokorski – The Boss – always protected his people and truly cared about them – as long as they stayed fair to him and other members of the Group; dishonesty or internal fights, being the only thing I felt he would not tolerate. That did not mean he was always gentle to everybody – I heard harsh words from him certainly more than once, but always when I, too, had a feeling that I was not working hard enough for a longer period of time or did something improper – so Professor Pokorski was simply correct in chastening me. He did not, however, stay angry for long. Once I started doing what I was supposed to do, the atmosphere improved immediately.

When we were young, Professor Pokorski repeatedly used his international contacts to send us to various elementary particle physics schools and conferences. It was often exclusively on his own initiative because we usually did

[15]Stefan Pokorski, *Gauge Field Theories*, op. cit.

not know which events or places were really worth attending or visiting. It would have been much harder to apply to these schools on one's own, without his support.

Inside the Group, personal relations were quite friendly; however, usually not very close as we did not maintain much contact among ourselves outside of work. I think most of us never seriously clashed with any other member of the Group. I heard about some personal animosities (rather natural in such a large group of people) but these were rarely seen. Even then, they were much milder than personal disputes at other workplaces. I myself always felt quite comfortable in the Group and was never tempted to even think about leaving it.

I find the Hoża and the Pokorski Group a great place to be a physicist. If I had a chance to go back in time to the mid-eighties and to choose again, I would – with no doubt – ask Professor Pokorski to be my thesis advisor once more. Later in this "relived" time I would do a few things differently, but these would be related more to my own choices than to my relations with my Boss and my Mentor. I am really very grateful to him for the many ways he helped me in my work – and in my life. And, after all those years, after hundreds of discussions, many common papers, and – true – some heated discussions, even some clashes, I simply like Professor Pokorski personally. For those who know him it is not such an obvious thing… He is helpful and fair but he keeps his distance and does not get very friendly with younger colleagues even as the years pass. He never asked much about personal lives of his people as some do, etc. etc. I certainly hold Stefan Pokorski in very high esteem.

As I read my notes again, I find them sounding quite serious – no jokes, no anecdotes… However, this is also a part of the life and the mood at the Hoża. The Institute of Theoretical Physics and the Group were always the places for work, without much socializing. To some extent it has also been an imprint of Stefan Pokorski's style: "Physics is important, other things are secondary to it." At least such is the attitude he has kept projecting.

The only anecdote I can recall is related to this generally serious mood. Several years ago in Kazimierz, during a session dedicated to Professor Pokorski's 65th anniversary, we – his former students and by then his co-workers – were thinking about giving him a birthday present. But what gift could be given to a physicist who works mostly in front of the computer screen? After a while and a few bad ideas, somebody suggested that it might be something related to a hobby. Then we began to dig into our memories to find a hobby of his – and we came to the conclusion that we did not know of a single one – unless it was physics. If he had other hobbies, he concealed them very well. This did not help us much in choosing the gift.

But perhaps it is the way to become a famous physicist.

PART IV :

Tributes by Physicists from Abroad

Guido Altarelli, Theory Division, CERN:

Physics is an international activity. In all major universities or research centers there is a Department of Physics. Theoretical particle physics is a much smaller community. Thus in every such place there are a few prominent figures who are directly associated in my mind to that place.

When I think of Warsaw, I see Stefan Pokorski (and very few other people). In recent years we met at CERN many times. I also was in Warsaw on several occasions, the last time a couple of years ago. I like Stefan's company very much. In many respects Stefan is similar to me: not easy to get excited, with a long experience in our field and a broad research profile which spans over much of particle physics.

I plan to be back in Warsaw in June and I look forward to meeting Stefan in his natural environment. We will celebrate his anniversary together.

Happy Birthday Stefan!

Guido Altarelli

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Ignatios Antoniadis, Theory Division, CERN:

Events :

- If I remember correctly, I first met Stefan Pokorski about 25 years ago in Paris where he was coming from time to time to visit Tran Truong, who at the time was the group leader of the particle physics group at the Centre de Physique Theorique (CPHT) of the École Polytechnique. I was CERN fellow at that moment and I returned to CPHT in the Fall of 1988.
- In April 1989 he invited me to Warsaw for a very small workshop on string theory along with 4–5 other colleagues from Western Europe. The political situation in Poland was very confusing at that time, as it was the transition period, a few months before the first free elections. Moreover the building for the Institute of Theoretical Physics had not been finished and in general the working conditions were not in good shape, but still the workshop went very well, the local participants were very interested and we were offered very warm hospitality. One evening Stefan even invited us to his home for dinner.
- Since then, I visited Poland very frequently, for seminars and as a participant in several conferences, workshops and schools organized by Stefan and his Group. Later, in 1999, I received a grant in the context of a French-Polish exchange program (POLONIUM) that subsequently we managed to keep for about ten years (Zygmunt Lalak being in charge from Stefan's Group).
- In 2000 my collaboration with Stefan's Group passed into a new phase with its participation in a European network that I was coordinating, along with a dozen other institutions from all over Europe. This network has been renewed in every EU Framework Programme since then and gives a boost to the interactions of the Warsaw Group with the other institutions.
- In 1994 Stefan started a new series of annual conferences entitled "From Planck scale to electroweak scale" (in short "Planck"), which became extremely

successful as one of the main events of Beyond the Standard Model physics. Recently, it became part of our European network and **receives** special funding.

My view:

- Stefan is a great man and physicist. He has made remarkable contributions to a wide range of fields going from the current Standard Model of elementary particles to all theoretical proposals for Beyond (supersymmetry, supergravity, compositeness, extra dimensions, strings, etc).
- He is remarkably super-active: publications, collaborations, students, organization of conferences and scientific events, ability to have successful grant applications (Polish and European). Recently he obtained a new Polish grant that allows him and his Group's members to visit CERN frequently.
- He built an excellent theoretical High-Energy Group in Warsaw by forming and bringing brilliant people with a wide spectrum of interests under generally difficult conditions. His Group in Warsaw is now well established and internationally known.
- He cares about his place and his country. I am sure he could have left the country permanently on several occasions before and after the political change. Instead he preferred to stay and to create a school of his perception.
- I admire him and I regret that our collaboration remained rather at an administrative level, with of course many discussions on physics, but I never had the privilege of having a concrete scientific collaboration with him.

Ignatios Antoniadis

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Andrzej J. Buras, Institute for Advanced Study, Technical University Munich:

I met Stefan Pokorski for the first time during my MSc studies in Warsaw in 1970. His advice on the one pion exchange model (OPE) was very instrumental for my thesis and I remain very grateful to him for his support in those, for me, very difficult times. While I had a few interactions with him in the 1970s and the 1980s at CERN and the Max-Planck-Institute for Physics, Munich, our contacts became closer only after our common work in 1993 in the framework of another OPE: we applied operator product expansion, to the rare decay $B \to X_\gamma$. Although none of us had worked on this decay before, we succeeded in writing a very influential paper together with his PhD student, Mikołaj Misiak and with my PhD student, Manfred Münz. period Apparently influential, at least judging from the 354 citations so far earned by this paper. Our second paper appeared in 2011, this time on fermion masses. Another one should appear soon.

Stefan Pokorski is undoubtly – in the eyes of the international community – the most visible and the best known Polish theoretical elementary particle physicist in the last thirty years. Even if there are a number of excellent particle theorists in Poland, it is Stefan Pokorski who has shaped the landscape of activities in Poland in the application of quantum field theory to high energy processes or equivalently to phenomena at the shortest distance scale explored by humans. His many papers on strong interactions and electroweak interactions

within the Standard Model and – particularly during the last twenty years – in the extensions of the Standard Model belong to the classics of our field and have had a very important impact on the development of new ideas and methods. His contributions in the context of supersymmetric models, Grand Unification models, models with extra dimensions and heavy fermions in the context of flavour physics and theories of fermion masses should be strongly emphasized. These contributions, while being of theoretical nature, turned out to be of great significance to phenomenology, with important implications for experiments such as those performed at most important laboratories in Europe, USA, and Japan during the last twenty years and now carried out at the Large Hadron Collider at CERN.

Very importantly, Stefan Pokorski built the Warsaw school of theoretical elementary particle physics, which for the last three decades has been very active at the frontiers of particle physics. Consequently, several young, excellent Polish scientists could meaningfully contribute to the development of our field. In this context one should mention Pokorski's excellent book *Gauge Field Theories* which continues to be used around the world, not only by students and young researchers, but also by more senior particle theorists like me.

Even if the number of papers we have written together does not look too impressive, I have always been very impressed by discussions with Stefan and his very deep and critical insight into the outstanding questions in particle physics. Therefore I was very delighted when two years ago Stefan accepted my invitation to visit my group as a Distinguished Scientist at the Institute for Advanced Study, Munich. I am looking forward to coming years with the hope that Stefan will be visiting us more regularly.

Stefan, the discussions with you, not only about physics, have always been very inspiring for me. I am sure that having soon more time for research we shall write numerous papers together, at least as influential as our first paper was.

Happy Birthday to you, Stefan.

Andrzej Buras

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Marcela S. Carena, Fermilab:

It is a great honor for me to be part of Stefan Pokorski's 70th Birthday celebration.

Stefan is a brilliant scientist, a superb mentor, a first-class collaborator and a true and caring friend. I would like to share with Stefan and those close to him a few thoughts of what being his friend and collaborator has meant to me.

I have been one of the many very lucky scientists who benefited enormously from Stefan's wisdom, both in physics and in life. When I met Stefan 20 years ago at the Max-Planck-Institute in Munich, I was interested in physics but I had a totally different perspective of what doing research was about. Then I had the fortune to become Stefan's collaborator and that had a profound effect on my perception of physics.

Stefan taught me to think about physics problems in a novel way, he taught me to ask the right questions and to always put my findings in perspective, keeping in mind the broader picture of what particle physics was all about. Stefan, with his passion for physics and his warm and caring personality, changed my attitude towards research and made it possible for me to be successful in my career. The many long discussions we used to have at dinner at the

"Studenten Stadt Tribühne" are today still vivid in my mind, they have not only shaped me as a scientist, but were the beginning of a friendship I have treasured throughout the years. It did not matter if the discussions were on a specific physics problem or on the sociology of our field, Stefan was always there as a fatherly figure providing guidance and challenging my imagination. In the past twenty years Stefan has remained an invaluable collaborator and a true friend.

In physics I have had fun working with Stefan on several topics ranging from the unification of forces in supersymmetric theories and the prediction for the – at that moment not yet discovered – top quark mass, to gravitational interactions in theories of extra dimensions. More than ten years ago we wrote a paper on the Higgs mass implications for supersymmetric theories, a topic very much in vogue today. Stefan, my husband Carlos Wagner, and I have had many very fruitful collaborations, and through Stefan, we came to know many outstanding members of the Warsaw Theory Group. We are glad to count Marek Olechowski and Piotr Chankowski among our collaborators. Stefan has built a strong group at University of Warsaw that is internationally highly recognized and has been driven by his unique personality.

Dear Stefan:

Thank you for the many times you cared for me and for the many enjoyable moments we have shared along life's winding path. Happy Birthday to you. And many more to come!

Marcela Carena

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Émilian Dudas, École Polytechnique, Paris:

I first met Stefan Pokorski in 1994 when I was a postdoc at CEA-Saclay. He was then visiting Carlos Savoy at CEA for six months.What immediately impressed me most from him, even though I was a young postdoc, was that Stefan did know exactly what I was working on; he knew most of the literature in the field, and who was doing what. He immediately proposed an interesting common research project, related to my own work, and invited me for a two month stay at the Max-Planck-Institute, Munich, where he worked at the time.

Our discussions evolved to a very fruitful collaboration which withstood the passage of time and led to some nice papers that seriously guided my scientific activity later on.

Stefan became probably the most frequent visitor to CPhT– École Polytechnique. He was involved in the works of several of our PhD students and postdocs. I, for my part, visited Warsaw University for four months on one of Stefan's grants. Over the years our daily coffee-time discussions were among the most pleasant and fruitful physics discussions I had.

The most striking fact about Stefan is that he has always been as enthusiastic and eager to discuss physics as a graduate student. Although I have had the privilege to know and to work with other first class physicists, I don't think I know any other person who would have kept intact over the years such a remarkable interest in discussing physics and coworking on new ideas.

Most important of all (as I am sure his former PhD students and close coworkers will be expanding upon), his high-energy group at Warsaw University is what it is today – a top place in Beyond the Standard Model Physics –thanks

to the incredible energy Stefan Pokorski invested in building and keeping alive a group in conditions under which very few people could have succeeded.

Happy Birthday, Stefan!

Émilian Dudas

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Adam Falkowski, Orsay:

Stefan Pokorski was the advisor of my MSc and PhD theses in the early 2000s.

One of my memories from these days is a slip of the tongue, I believe, or something of that sort. The two of us were discussing a physics problem and at one point stopped and set to reconvene the following day so as to make some clarifying calculations in the meantime. When I expressed doubts whether it was feasible to complete the calculation in one day, Stefan said: „Well, a day has 24 hours, *plus* the night". Somehow, I took this advice seriously at the time (to this day I prefer working at nights) which embarked me, I recon, on a reasonably successful career.

The moral from this anecdote is that Stefan Pokorski has a unique way of getting the best out of the person he interacts with. I guess, one important element in this is the feeling of reciprocity: anyone working with him feels he's giving his best, too. The proof is that our collaboration lasts to this day: during the last eleven years we have written 16 publications together, the most recent ones in the summer of 2011.

Adam Falkowski

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Christophe Grojean, Theory Division, CERN:

My first encounter with Stefan Pokorski, with Stefan's work, I should say, dates back to 1995 when I was a graduate student at the École Normale Supérieure in Lyon.

I was learning quantum field theory and Stefan's book *Gauge Field Theories* was a close companion of my days and my nights; this new, modern, abstract, and theoretical approach to physics would become my way to deal with Nature for the rest of my life. At the same time my roommate was preparing for the *agrégation* in physics. He spent all of his time with the physics of the 19th century but now he could have had access to the secrets contained in Stefan's book that I was slowly studying. Every time he saw Stefan's book on my desk, he could not understand that these numerous pages, full of Kabbalistic-like equations, but without any pictures, were describing our most advanced and accurate knowledge of Nature at the smallest possible distances ever explored.

One year later, I moved to Saclay as a PhD student. I was extremely lucky that Stefan visited the Service de Physique Théorique for several months. I began working with him. I am pleased that our collaboration is still going on today, more than sixteen years later.

I remember one thing that struck me when I started working with Stefan; he was always traveling: one week in Paris, the next one in Germany, a few days back in Warsaw, before flying to Fermilab or to CERN. As all the quantum particles he had been studying, he had become delocalized in space and was moving at almost relativistic speeds!

Christophe Grojean

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Howard E. Haber, Department of Physics, University of California, Santa Cruz:

On the occasion of Stefan's 70th birthday, I would like to convey my heartfelt gratitude for the many years of friendship and intellectual inspiration. Stefan's remarkable leadership and pedagogy was responsible for unleashing a generation of young, enthusiastic and creative Polish theorists. Because of Stefan's personal efforts to build new international relationships, Stefan brought me into this vibrant community of Polish theorists, which led to a number of new collaborations that enhanced my own the particle theory research. This provided a number of opportunities for Stefan and his colleagues to visit Santa Cruz, and also gave me the chance to visit Warsaw.

Over the years, I have been inspired by Stefan's keen theoretical insights, and I have benefited greatly from his wonderful textbook on Gauge Field Theories, his many papers on new physics beyond the Standard Model, and many enlightening discussions. I am most grateful for his kind hospitality during my various visits to Warsaw, and I greatly appreciate his many words of encouragement during my particle physics career.

Finally, on a personal note, I am the grandson of grandparents born in Eastern Poland who managed to survive the many atrocities inflicted during the early to middle part of the twentieth century. For this reason, I am especially moved by the stories of Stefan's family and their remarkable survival during the darkest hours of the past century. Thanks in part to their determination and courage, Stefan was able to become an outstanding theoretical physicist. This is a gift shared by his many students, postdocs, colleagues and friends.

So, I raise up my glass to toast Stefan's 70th, and to send my best wishes for continued success as we attempt to unravel some of Nature's best kept secrets in the exploration of the Terascale. I look forward to many more years of friendship and collaboration.

Howard Haber

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Stuart A. Raby, Ohio State University:

In honor of Stefan Pokorski's 70th birthday I decided to describe briefly my interactions with him and his Group at Warsaw University.

I believe that my first contact with Stefan took place in 1989 at a workshop held in the small town of Kazimierz. This was the first of many excellent workshops on physics beyond the Standard Model, organized by the Warsaw Group, that I attended. The workshops were typically small, but very stimulating intellectually.

Stefan Pokorski has been one of the internationally recognized leaders in the field. He is the author of a well-written textbook on gauge field theory. He has been a driving force in different theoretical directions such as supersymmetry, supergravity, and Higgs physics. He showed how to deconstruct extra-dimensional field theories; thereby obtaining simple renormalizable models.

His works on grand unification, supersymmetry breaking, and cosmology are well known. In addition, he has single handedly tutored and trained a whole cadre of particle physicists by their interactions with him either as students or as postdocs. Many of these physicists are themselves leaders in the field and several are now on the faculty at Warsaw University.

With all of the above, I also want to acknowledge the fact the Stefan has become a dear friend. I have always very much enjoyed my stays in Poland. I am additionally very thankful for the Raby Fest which was held as part of the Planck 2007 conference. I was happy to attend the Pokorski Fest in 2002 in honor of Stefan's 60th Birthday and I look forward to many more Pokorski Fests in the future.

Stuart Raby

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Adam Schwimmer, Weizmann Institute:

During the summer of 1990, a time of dramatic change in Eastern Europe, I had the opportunity to visit the Theoretical Physics Group at Warsaw University. Being familiar with many of his papers, I was aware of the first rate work Stefan Pokorski was doing. What came as a total surprise for me was the existence of a very active, enthusiastic group of young physicists he gathered in Warsaw. The atmosphere in the seminars of the Group was remarkable, reminding me of what one reads about the "heroic times" of Physics, by the competence, intellectual curiosity and total dedication to Physics under not very easy external circumstances. Most of the Group were students of Stefan. I remember especially Krzysztof Meissner and Jacek Pawełczyk who were very young students at the time.

The role Stefan played, not only as a first rate physicist, but also as an outstanding educator who created an excellent school, is admirable.

Adam Schwimmer

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Tomasz Taylor, Northeastern University, Boston, MA:

Stefan Pokorski was my PhD thesis advisor in 1981. Hence, I am one of his first doctoral students. Outside the Hoża the world was coming apart, yet at our

Institute a relative calm prevailed. Stefan's trait was always to stay calm and to preserve common sense. At the time, this made it possible for us to focus on research work and to overcome many obstacles.

For novice graduate students theoretical physics looks usually as a "crystal mountain" full of climbing problems that either have already been solved or are too difficult to climb. Thanks to Stefan I came to understanding that a difficult climbing route requires a patient step hacking without losing one's broader perspective. With such steps one may climb the summit.

Quantum chromodynamics that I learned from Stefan has remained the main area of my research. After I left Warsaw, I admired from afar a whole generation of graduate students whom Stefan introduced to supersymmetries or even to string theory. I have had the privilege to belong to the school of theoretical physics that was created by Stefan Pokorski.

Many happy returns, Stefan. I wish you many more years of success and satisfaction with your students.

Tomasz Taylor

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Carlos E.M. Wagner, University of Chicago:

I met Stefan Pokorski twenty years ago, in 1992, at the Max-Planck-Institute, Munich. We overlapped there for almost two years, in which Stefan essentially taught me all of what one needs to know to work in particle physics. He always insisted on the fact that, although it is not difficult to write an article on particle physics, it is difficult to bring good quality and new ideas into a paper. That is the secret for progress and success in this field.

Stefan was a living example of such concepts. Confronting any problem, he liked to stop and think deep about its meaning, about what had already been done and which questions were still open. What I learned from him is that particle physics could be challenging and fun at the same time, that it was necessary to get a clear understanding of the results one obtains before publishing them, and that one should never rush in getting them published. Those years in Munich were like a new PhD for me. They transformed my personal view of physics, an experience which I shared with my partner in physics and in life, Marcela Carena.

In Munich I worked with Stefan on what I believed to be the most important subjects in high energy physics at that point in time: the prediction for the top quark mass within reasonable unified scenarios (together with Bill Bardeen, and Marcela), as well as the Higgs and supersymmetry particle spectrum within those models (with Marek Olechowski and Marcela).

In the years 1992–1993, the top quark mass was still a mystery, and it was gratifying for all of us that its first measurement in 1995 revealed a value consistent with those predicted in the minimal unification scenarios. Each of those papers has today more than 100 citations and one of them more than 500!

Later, at CERN, we worked together on more details of supersymmetric models, including work in 1997–1998 on the information one can get from the particle spectrum and Higgs mass measurements (with Piotr Chankowski and Marcela). This last work is acquiring relevance, now in 2012, when CERN is

seeing what are perhaps the first hints of a Higgs, with a mass consistent with masses allowed in the minimal supersymmetric extensions.

Since the time I wrote those papers with Stefan, I have travelled many miles, worked on tens of different subjects with many different collaborators. At any step, Stefan's words resonated in my memory. I always tried to look for new ideas and confront them with what is known. I developed some taste for what looks like solid progress in the field, and try to pursue it, even if I was not always successful. I don't think this would have been possible, had I not met Stefan. I wish I could have again one of those nice conversations at the "Tribühne" in the Munich Studentenstadt. I was only 30 years old, and Stefan made a strong impression on me. I hope I can transfer to my students and postdocs at least a half of what I learned on those days.

During those years, and also later, I participated in the Kazimierz Symposia, organized by Stefan and his coworkers in Warsaw, as well as in meetings in Warsaw. I always enjoyed the scientific atmosphere very much, as well as the beautiful places in Poland. One thing that puzzles me is the length of the bed sheets at the Kazimierz residence. Why don't they cover the whole mattress?

One more thing impressed me from Stefan: his ability to support his young collaborators, not only in physics but also in life, with good advice for their decisions. I still remember when back in the year 2000 Marcela and I needed to make a relevant decision regarding our jobs. We were really lost, but it was Stefan's advice which allowed us to make progress in that direction. We ended up having two staff positions at CERN, even when we were only „fake Europeans", and tenured positions in three other excellent research centers in Europe and in the United States. Needless to say, we could not enjoy all those wonderful opportunities, and we had to made a choice, but it was Stefan who, in a certain sense, made this possible – and we are grateful to him for that.

Even when I have not been in close contact with him in the last few years, Stefan remains as a role model for me. He was able to keep the excellent Warsaw Group alive, while maintaining an outstanding professional career there and elsewhere. He formed an excellent group of students, who also made important independent contributions to the field. I was a postdoc and I collaborated with him, but in a certain sense, I feel also like his student, as well as his friend.

I wish Stefan a very happy 70^{th} Birthday, and I am looking forward to its celebration in Warsaw.

Thanks for everything, Stefan!

Carlos Wagner

PART V : Papers by Stefan Pokorski and his Group

V. 1. List of the most-cited scientific papers authored or co-authored by the persons associated with the Pokorski Group

V. 2. A selection of papers by Stefan Pokorski (.pdf)

V. 3. Full list of scientific papers authored or co-authored by Stefan Pokorski

PART VI : Biographical Notes