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# JULIUSZ SCHAUDER — PERSONAL REMINISCENCES

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*Dedicated to the memory of my teacher, Juliusz Schauder.*

Juliusz Schauder was my teacher of mathematics in secondary school and also at the University of Lwów where I studied theoretical physics. I knew him during a period of about 10 years, but his tragic death interrupted this acquaintance just at the moment when it seemed that it might have been the beginning of a period of fruitful collaboration. Schauder looked to me as a prospective collaborator on mathematical problems of physics and for this reason he invited me to his advanced seminar about continuous groups. In these notes I would like to say what I remember about my dear teacher, who gave me the first impulse in the direction of mathematical physics (an impulse which I followed without his guidance and not necessarily in his direction). It occurred only recently, and completely independently of the present paper, that I came back to Pontryagin's book, which we studied at the seminar, in order to use it directly in my current work.

Before I give my personal reminiscences I would like to recall briefly what is known about Schauder's life (cf. [1] and [2]). I will not write here about his work, since this would take us too much aside (for this cf., e.g., [3] and [4]; unfortunately, neither text is in English: one is in French and the other in Japanese !). I will begin by quoting his friend and collaborator, Jean Leray (cf. [5], p. 11):

> *Cette oeuvre est en apparence diverse: elle apporte des contributions souvent fondamentales à quatre branches des mathématiques, qu'on a coutume d'étudier indépendemment l'une de l'autre. En fait, c'est une oeuvre d'une*

*grande continuité: Jules Schauder n'est pas un spécialiste; il remonte à l'origine des problèmes; il s'aperçoit qu'ils exigent de tout autres procédés que ceux qu'on a pris l'habitude de leur appliquer; sa pensée progresse, sans souci des cloisonnements qui compartimentent arbitrairement la science et qu'ont dû toujours bousculer les esprits vraiment originaux. Sa puissance intellectuelle s'allie aux plus belles qualités de caractère: il est un grand travailleur, très scrupuleux. Il étudie "les problèmes qui se posent et non ceux qu'on se pose"; son oeuvre n'est pas un jeu brillant, mais un rude labeur, qui finit par créer la méthode dont l'élégante perfection orientera l'avenir.*

As we shall see, all these observations conform very well to my experience of Juliusz Schauder.

PHOTO 1. Parents of Juliusz Paweł Schauder

Juliusz Paweł Schauder was born in Lwów on September 25, 1899 as a son of Regina and Zygmunt Schauder. His father was a lawyer in Lwów and also in Rohatyń where Juliusz attended primary school. In 1917, at the regular age of 18, Juliusz finished secondary school in Lwów and immediately afterwards was drafted into the Austrian army. He was sent to the Italian front and fought there until he was captured by the Italians as a prisoner-of-war. After the armistice 27,000[1] of

[1]The great number of prisoners was a consequence of the battle by Vittorio Veneto on October 24–30, 1918, and of the Italian actions afterwards, which led to the armistice on this front. When Steinhaus and Schauder were in Bologna in 1929, they saw there an interesting monument. As Steinhaus writes, [2], p. 108: "*In the middle of the town there is a fine town hall and on it*

the Austrian prisoners-of-war of Polish nationalily in Italy volunteered to join the Polish Army organized in France, and among them was Juliusz Schauder. With this army, the so-called Haller's Blue Army, he returned to Poland in 1919. His military service ended the same year, and in the fall he started to study mathematics and physics at the Jan Kazimierz University of Lwów. It is characteristic of his approach that he should have chosen both mathematics and physics, but he could not succeed in the study of both sciences because of the situation of physics at the Lwów University at that time. The university has in its history two theoretical physicists of the first rank: Marian Smoluchowski (1872–1917) and Wojciech (Adalbert) Rubinowicz (1889–1974). The first, however, left for Kraków in 1913, while the other, although he came to Lwów in 1923, was then a professor at Polytechnic. (He moved to the University only in 1937, and soon afterwards I became his student). At the time of Schauder's studies the chair of theoretical physics was for a few years temporarily occupied by an experimental physicist Stanisław Loria (1883–1958), who probably would not have attracted the attention of the mathematically minded Schauder.[2] Mathematics, on the other hand, had just then started its period of most flourishing development. Schauder's professors of mathematics were Stanisław Ruziewicz, Hugo Steinhaus, Eustachy Żyliński and, since 1922, Stefan Banach. Steinhaus writes in his Memoires [2], p. 99: *"Among the students, many were soon found who clearly distinguished themselves by their abilities: one such was Schauder, others were Orlicz, Halaunbrenner, Auerbach and Mazur"*.

In October 1923 Schauder obtained his Ph.D. in mathematics on the basis of his first paper. It was published in 1926 [6] in English (all his later papers were published in German or in French). In 1925 he started working as a teacher of mathematics in a secondary school. He taught first for two years in Przemyślany (60 km from Lwów), and then (several years later) in Lwów up until the Second World War. This was quite a heavy burden, but in spite of it he worked very intensively in mathematics, and on January 17, 1928 he was able to make his

*a "bulletin of victory" engraved in stone. It gives fantastic numbers of prisoners and guns taken in 1918 by Vittorio Veneto. It is generally known that, after the Hungarian army turned for home, the Austrian troops decided to do the same and laid down their arms to go home through the Alps. But small Italian detachments in cars, pushing their way through disordered crowds of soldiers, who had mostly long ago laid down arms, barred the way and enrolled them into captivity completely unnecessarily. At that time, the Italian staff was in Vienna.*" But these great numbers turned out to be useful for the Polish cause. Together with Poles from France and America the Polish Army in France became a considerable force of 6 divisions. Afterwards, it helped Poland greatly in the fighting around Poznań, Toruń and Lwów.

[2] I learned from K. Maurin that Władysław Orlicz, who was a student of physics at the University at approximately the same time as Schauder, once said that when he went to Göttingen to prepare his Ph.D. in theoretical physics, he realized that his education in Lwów had been absolutely insufficient. He therefore resigned from becoming a physicist, turned, like Schauder, to mathematics, and went back to Lwów.

"habilitation" (*veniam legendi* ) to become a 'private docent' at the university; the title did not mean money and so economically nothing had changed. Schauder started, however, to give special lectures at the University and soon became an influential member of the emerging (and later world famous) mathematical school centered around S. Banach and H. Steinhaus. Other leading members of the school were Stanisław Mazur, Władysław Orlicz, Stefan Kaczmarz, and, somewhat after, Stanisław Ulam and Marek Kac.[3] Many years later Ulam, describing some special features of the mathematical life in Lwów during the years before 1939, wrote that he remembered

> *a mathematical session with Mazur and Banach lasting 17 hours without interruption except for meals. ... Much of the mathematical work was carried on in a way not usual in American mathematical centers. The mathematicians in Lwów met not only in their classrooms and offices but spent long hours every day in two coffee houses (Szkocka and Roma) which served as informal meeting places. They discussed problems over coffee or beer, and marble table tops and napkins took the place of blackboards. It was hard to outlast or outdrink Banach during these sessions. He was always there. The weekly (Saturday night!) meetings of the mathematical society, where papers were presented, provided the more formal discussions.* (cf. [5]).

Around 1935 Schauder obtained the position of a senior assistant under Professor Steinhaus. In 1937 the full staff of the Department of Mathematics of Lwów University was as follows ( cf. [7], p. 77 ; as for a document, I give all the details in translation):

Department of Mathematics; 4 St. Nicholas Street, 2nd floor, tel. 211–79.

Division A

| | |
|---|---|
| Head: Prof. Dr. Eustachy Żyliński | 11a Supiński St. |
| Sen. Assistant: Doc. Dr. Herman Auerbach | 6 Konopnicka St. |

Division B

| | |
|---|---|
| Head: Prof. Dr. Hugo Steinhaus | 14 Kadecka St. |
| Sen. Assistant: Doc. Dr. Juliusz Schauder | 2 Zaścianek St. |
| Dep. Assistant Volunteer: Helena Plamitzer | 32 Gipsowa St. |

[3]We read in Steinhaus' *Memoires* [2], p. 108: *"In the fall of 1929 we went for a congress to Bologna. From Lwów came: Antoni and Zbigniew Łomnicki, Stożek, Ruziewicz, Żyliński, Banach, Chwistek, Kaczmarz, Nikliborc and Schauder. The congress was successful — there came, among others, Hilbert, Weyl, Kellogg, Landau, Hadamard, Lichtenstein, de la Vallée-Poussin, Serge Bernstein, Khinchin, Menshov, Lusternik and Haar".*

Division C

| | |
|---|---|
| Head: Prof. Dr. Stefan Banach | 23 Zyblikiewicz St. |
| Dep. Assistant M. A. Kazimierz Szałajko | 7 29$^{th}$ of November St. |
| Sen. off. Messenger: Józef Góral | 26 Mochnacki Str. |

As we see, we have here only three professors and two docents; all the other active Lwów mathematicians mentioned (or not mentioned) above were not included on the university payroll, (they belonged to Polytechnic or other schools). Although Schauder had the low position of a senior assistant, his inclusion in the above list was rather a distinction.

* * *

Let me now come to my direct personal reminiscences. It was probably in September of 1933 that I met Schauder for the first time. I remember this moment very well : Dr. Bednarowski, the director of our school (the III State Gymnasium in Lwów, named after King Stefan Batory), presented to the Class IV A, of which I was a pupil, a new teacher of mathematics, Dr. J. Schauder. I remember how he stood before the blackboard: he was a little bit stiff and shy, with his high forehead and intelligent, noble face. He was not tall, had blond hair, and his skin was a little yellowish and pale with small wrinkles, although he still looked young ( he was then 34, while I was 13). At first sight, his features looked slightly Semitic to me; this impression, however, disappeared rather soon. (I write about this impression since it happened to be so important for his fate later on). As an "A" class, ours was purely Catholic and Polish, only "B" classes had Jewish and Ukrainian students or those of other religious denominations. (The division was according to religion, not nationality, and was, I think, the unhappy idea of our director). I never noticed in our class anyone having reservations about the new teacher because of his Jewish extraction, although relations between nationalities and faiths in Poland and in Lwów were not, in general, always the best. But my classmates quickly found out that "Schauder" means in German "horror" ("zgroza" in Polish), so the new teacher obtained the nickname "Zgroza". He was usually kind–hearted and relaxed, but sometimes he would become a little nervous and stiff with bad students; so that in those rare moments when he spoke quickly and with some impatience, his nickname seemed to be appropriate. Obviously, we had no opportunity to learn of his higher scientific abilities from the elementary mathematics which he taught us. Our school was of the so–called "old classical" type, which means that it had Greek and Latin in its curriculum, but little mathematics and almost no physics. This type of 8$^{th}$-grade gymnasium system was just then in liquidation; my class was the last of this system, while my younger brothers were already attending the new school system, without Greek but with more mathematics and physics. When I think now

about Schauder's pedagogical abilities in secondary school, I cannot say that they were remarkable. We noticed the difference when comparing him with our previous teacher of mathematics, the old Roman Chobrzyński. A small group of scientifically minded colleagues to which I belonged, and which had founded, in the 2nd grade, a "Scientific Circle" ("Kółko Naukowe"), was very upset by Chobrzyński's retirement and death. He had had a spark of humor and we were enthusiastic about his exercises, which were based mostly on the old Austrian Kranz' book of problems in mathematics for secondary schools. From the time of Schauder's teaching I do not remember such emotions, although I do remember that his teaching was solid, systematic and very clear. I also remember the textbooks written by Banach, Sierpiński and Stożek; they were all excellent: clear, concise, and interesting. Especially remarkable was the book on geometry, the largest of all. Schauder used these books in teaching, although he did not follow them very closely.

My father was then also a teacher of mathematics and logic and a docent at Lwów university ( a year later he became a professor of philosophy at the University and stopped working at a secondary school), so I know how hard a teacher's work was at that time. My father went to school every day at 8 o'clock in the morning and came back at about 1 in the afternoon, very exhausted. I understand therefore what a heavy burden it was for Schauder to teach while working intensively in mathematics during the afternoons and at nights. Schauder knew my father, and sometimes we met each other by chance on the street or in a park. I was always surprised at how relaxed and in what a good mood Schauder was after the strain of the school. In particular, I remember that one day my father took me to the Scottish Coffee House (my father used to play chess there with Herman Auerbach, an outstanding chess player) and we met Schauder there and talked to him for a short while. This was in 1935, since Schauder spoke about his journey to Moscow for an International Conference in Topology, in September 1935; the next year he went to Oslo for the International Congress of Mathematicians. His longest and most important trip abroad was, however, in 1932, before he came to our school. He had obtained a Rockefeller Foundation scholarship and went first to Leipzig (for the academic year 1932–1933) to Leon Lichtenstein, and later on (in April 1933) to Paris, where he collaborated with Jean Leray. The result was the famous memoir [7] for which Schauder and Leray obtained the grand international Metaxas prize for mathematics in 1938. Two other famous contributions were: The "Schauder fixed point principle" [8] (which he proved before he came to our school), and the "Schauder method in the boundary problems for partial differential equations" (this was done while he was a teacher in our school). The latter method was first developed in the classical setting of Hölder spaces; it involved the derivation of the so–called Schauder estimates for linear elliptic second–order operators (cf. [10]).

The same general ideas were used later by Schauder in another important direction: for proving the existence of generalized solutions to some nonlinear problems. This involved the introduction of so–called Sobolev spaces, the derivation of the Schauder estimates in this setting, and finally the applications of topological techniques (cf. [11], where the case of quasi–linear elliptic equations with continuous coefficients in $R^2$ is discussed and [12], where quasi–linear hyperbolic equations are treated).

PHOTO 2. Juliusz Schauder in a group of participants of the First International Topology Conference in Moscow, September 4 – 10, 1935. (*Top row*: E. Čech, H. Whitney, K. Zarankiewicz, A. Tucker, S. Lefschetz, H. Freudenthal, F. Frankl, J. Nielsen, K. Borsuk. *Bottom row*: K. Kuratowski, J. Schauder, St. Cohn-Vossen, P. Heegaard, J. Różańska).

Steinhaus comments on the development of Lwów mathematics in those years as follows (cf. [2], pp. 116–117):

> *The character of Lwów mathematics changed conspicuously. Specialists began to develop in different fields: Mazur worked in linear methods of summability, Auerbach in differential geometry, Schauder in partial differential equations, Kaczmarz and Orlicz in orthogonal series, Nikliborc in celestial mechanics and figures of equilibrium; to mention only a few examples.* ( ... ) *It was possible to distinguish "schools". The school of Banach was*

*occupied with the theory of operators, the school of Kuratowski (at Polytechnic up to 1934) with topology, the school of Chwistek with mathematical logic; I tried to direct my students into the direction of probability theory and applied mathematics.*

Steinhaus further mentions, pp. 157–158, that:

*In 1938 when Henri Lebesgue became doctor honoris causa at Lwów University, in his official speech he mentioned that the Metaxas prize was shared by Leray and Schauder. It was a great distinction for our docent since the prize went to those who in recent years had made the most outstanding contribution in mathematical analysis. Leray also visited us the same year; he was a charming Frenchman of unusual elegance and culture.*

In January 1937, in the middle of the 7th grade, my father and I decided that I should quit our "classical" school and go over to a mathematics and natural science ("matematyczno–przyrodnicze") gymnasium. (It was the No. I State Gymnasium, named after Nicolas Copernicus. The No. III Gymnasium was at Batory Street 5 and the No. I, at Kubala Street 1. These streets formed a corner, and the buildings of both schools touched each other. The opposite corner was made with the short Fredro Street, at which other end the Scottish and Roma coffeehouses were located). Thus, for almost two years, I lost contact with Schauder.

It was October 1938 when we met again, in completely different circumstances. In May 1938, I finished the Ist Gymnasium and in October became a student of physics at the Jan Kazimierz University. During the first year of study I had only two mathematics courses: one, Professor Żyliński's *Introduction to Analysis* (with exercises), and one with Professor Banach *Analytical Geometry with Exercises* (this was, unfortunately, the only course I ever had from Banach).

* * *

The second academic year began after the outbreak of the Second World War: Poland was invaded in September 1939, first by the Germans, and then by the Soviets, and Lwów appeared to be in the Soviet zone. Lwów was included by force into the Ukrainian Soviet Republic and the University became the "Lviv State Ivan Franko University". Formally the Ukrainian language was introduced, but this was not strictly observed everywhere, at least during the first year. The first trimester started more or less according to previous Polish rules; later on the system was changed from trimestrial to semestrial, and all the studies were reorganized according to the Soviet model. In this first trimester I had the following lectures and exercises in mathematics:

| | | |
|---|---|---|
| Prof. H. Steinhaus | 4 hours | Ordinary Differential Equations |
| Prof. H. Steinhaus | 2 hours | Seminar in Analysis |
| Doc. J. Schauder | 4 hours | Theoretical Mechanics and Exercises |
| Doc. H. Auerbach | 2 hours | Potential Theory and Exercises |
| Doc. S. Mazur | 2 hours | Differential Geometry and Exercises |

I have Schauder's signature in my index book; it is the only material thing I have directly from him. Unfortunately, I do not remember much of his course, except that it was clear and systematic, in the rigorous mathematical style of Leon Lichtenstein. Steinhaus recalls an interesting detail about the Soviet occupation of Lwów (cf. [2], p. 182): "*When Saks, Schauder and myself wrote down "Polish nationality" in a form which everyone had to fill, it was said that we did this in fear of the Polish police. But it was not said aloud, only whispered around*". Although all three were of Jewish origin, they had proved their Polish convictions also by their military service and by fighting for the Polish cause: Steinhaus and Schauder as volunteers in World War I (Steinhaus in Piłsudski's legions, Schauder in Haller's Blue Army), while Saks fought in the Silesian Uprising in 1919 and also in September 1939 (I remember him in an army coat).

In the winter and spring of 1940, deep changes occured at the university. My father was shifted from philosophy to German studies and the philosopher Ajdukiewicz to physics for medical students; but the teaching of mathematics and physics was not only increased by new Ukrainian and Russian professors and assistants, but also by some Polish refugees from Warsaw and Kraków. In physics the new professors were V. Milianchuk and Z. V. Chraplywy, both students of Rubinowicz. Steinhaus (cf. [2], p. 186) writes about this time:

> *Banach became the dean of the Physico–Mathematical Faculty. He recognized collaboration as the best method; maybe because of this it was possible to arrange professorships for Saks and Knaster, which was not easy since Soviets had a disinclination for people from Warsaw. There were the following heads of chairs: Banach, Schauder, Żyliński, Zarzycki, Mazur and myself; professors without chairs (the same as extraordinary professors or associate professors): Saks, Knaster, Chwistek, Auerbach and Orlicz; docents: Eidelheit, Szpilrajn and Wojdysławski. It was really a very serious team and in normal times we could have done much with such a group. It was possible to replace the (Polish) Mathematical Society by introducing scientific sessions of the Faculty, and it was also possible to publish volume IX of "Studia Mathematica" with the only modifications that, except for the original text, each paper had to have a Ukrainian summary. After*

*Lavrentev's visit*[4] *, some of us became collaborators of the Kiev Academy (Banach, Schauder, Mazur, Saks, Zarzycki and myself). It was important for us since we became entitled to several hundred rubles each month, which together with the university salary enabled us to have a tolerably good life.*

Although the situation in physics and mathematical sciences looked well and Lwów was one of the four best supplied cities in the Soviet Union (with Moscow, Leningrad and Kiev), the general situation was quite depressing. Massive deportation and arrests produced general uncertainty and anxiety. Steinhaus writes ([2], p. 190): "*Everyday I awoke with horror, when returning consciousness after the sleep reminded me that I was in a prison.*" This explains his words above: "in normal times we would ... ". Now the curriculum was strictly prescribed, and I could not choose my courses freely as before. Schauder had the chair of mechanics in the Department of Mathematics, but lectures of Theoretical Mechanics for physicists were given by physicist Milianchuk. Schauder's name did not occur in my new index–book; in mathematics, I only recognize there now the following names: Auerbach, Stark, Raabe, Szpilrajn, Eidelheit, Orlicz and Nikliborc. There was one exception in the rigid program of study: a few professors led special advanced seminars with invited participants. As I said at the beginning, I was invited by Schauder to his special seminar on continuous groups. I remember the moment of this invitation well. It was probably April or May of 1940 and I was just finishing my second year of studies. I was sitting in the lecture room of the Department of Mathematics and was preparing my exercises for mathematical analysis led by Dr. Antoni Raabe, who was killed in 1942 by the Nazis in Auschwitz. Suddenly Professor Schauder came in and asked me whether I would be interested in participating in his seminar. I was surprised, since we had not had much contact in the last few years. He was so friendly and full of smiles that I could not refuse, although I did not know much about the continuous or Lie groups. He said that we would start from the beginning, on the base of the new Pontryagin book [15]. He also said that he would like to have some theoretical physicist collaborate with him on these problems in the future. I agreed to his proposal with pleasure, considering it a distinction. In the next week Schauder secured a few copies of Pontryagin's book, and gave me one (I have it up to now, it is a black book of yellowish low quality paper, much thinner than the second Russian edition of 1954, and it corresponds to the English translation in the American edition).

I do not remember when the seminar began; probably it started in the fall of 1940. It met two hours a week, and the subject was rather hard for me. There were

[4]During 1940–1941 the following Soviet mathematicians visited Lwów: P. S. Aleksandroff, M. Krein, L. Lusternik and S. Sobolev. On the other hand in 1940, Banach, Mazur, Schauder and Saks attended a conference on Functional Analysis in Kiev.

only a few participants, and it seemed that for all, except Schauder, the topic was new. Pontryagin's book is wonderfully written, and with great pedagogical skill; nevertheless it was highly abstract for me at that time. It represented, however, my first contact with modern mathematics; a wonderful introduction into mathematical thinking and methods. I think that without this early schooling I would not have become a mathematical physicist. I therefore consider Schauder as one of my principal teachers; (the others were Rubinowicz in Lwów, and later on Weysenhoff and Gołąb in Kraków in 1945). The year 1940–1941 was the period of our closest contact. We met not only at the seminar, but frequently also on Zielona Street on our way home (I lived then at 19 Pawlikowski St., at the end of Zielona Street, and Schauder at 29 Tarnowski St., one of the side streets of Lwów. Our discussions (which were not merely casual) drew us closer to each other, and that in spite of the 21 years difference in age: he was then 41 and I was 20. But he did not tell me yet about his scientific plans in physics.

* * *

On June 22, 1941, the Germans attacked the Soviet Union and after 8 days Lwów was occupied by the German army. The University was closed, as well as most of the other schools. Immediately after occupying Lwów a special detachment of the German police troops killed a large group of Polish university professors and their families: 42 persons altogether, and among them 25 professors and docents (among mathematicians, the professors Ruziewicz, Bartel, Stożek and Łomnicki were killed). In October 1941, I started to work in a small optical factory on Zadworzańska Street, while my father became a teacher in a lower school of chemistry. I did not hear anything of Schauder. He disappeared somewhere, as did all the Jews and Poles of Jewish origin, because of their terrible persecution and the extermination by the Nazis. The persecution started immediately after the occupation of Lwów, but the establishment of the Jewish ghetto and the concentration and extermination camps (such as the Janowski camp in Lwów) took some time. So in the meantime some small percentage of Jews succeeded in hiding among the non–Jewish population which frequently helped them in spite of the great danger of being executed if discovered. I remember that in one of the first days of the German occupation I noticed a large detachment of German infantry and artillery in gigantic caterpillar transporters on Zielona Street. Suddenly I met there Doc. Max Eidelheit, one of my teachers of mathematics. He said to me that he, being of Jewish extraction, was hiding, and that Professor Schauder had probably also escaped any direct persecution so far; but he was not sure about Auerbach and others. Later on, all three were killed (Eidelheit in 1941 and Auerbach in 1942; about Schauder I will write below), as well as many other Polish mathematicians

of Jewish and non–Jewish extraction: Kołodziejczyk, A. Łomnicki, Bartel, Stożek, Ruziewicz, Lindenbaum, Kerner, Saks, Schreier, Wojdysławski.

Many months later – it was already 1943 – I came across Schauder himself in the street.[5] He looked pale and yellowish, but not much worse than usual. We were on lower Grodecka Street; we walked along slowly, observing in the distance the green hill of St. Yur (Jur=George) with its Greek–Catholic cathedral; and below it was a crowd swarming around something (a market place, or a circus?), so probably it was early autumn. I was made very uneasy because of his rather semitic appearance (as it seemed to me at that moment), and I told him that it was dangerous for him to go about on the streets, where many people, and especially the police, could recognize him as a Jew. He said that he looked "Aryan", but that although some danger existed, of course, he could not stay at home all the time, where he had to lie hidden in a covered bed during the daytime. He said that his wife and daughter were in Warsaw and that he wanted to go there by any means. (His wife was killed by the Nazis; his daughter escaped this fate, being rescued by nuns in a cloister). I said that Warsaw was not less dangerous than Lwów and that the journey would be dangerous too. But he asked me if I could help him to get false documents of high quality, since he had no good papers. I promised to do what I could, and we parted.

At that time, as well as before the war, I was a member of the ZNMS (the Society of Independent Socialist Youth, which was a subsidiary of the Polish Socialist Party, the PPS). The PPS, which was then underground, was one of the four political parties that formed the Polish Exile Government in London, and the underground Delegate of the Government for Lwów was also a member of the PPS (Dr. Adam Ostrowski, later Director of the Publishing House PIW, now deceased). With the help of my colleagues from the organization (Przemysław Ogrodziński, Maryna Fiderer and others) it was easy to organize help for Schauder. They contacted him and he obtained excellent documents, probably also some money, tickets and other help. (Active in this assistance was the Department for Helping Jews "Żegota", of

[5] I learned from A. Granas, that Professor S. Mazur, in his unpublished reminiscences of Schauder, wrote that Schauder had visited him almost every week during 1943, and that they had had mathematical discussions (among others, about developing the results and methods in the variational calculus intiated in their joint Note during the Oslo Congress); one of Schauder's other mathematical interests at that time was quantum mechanics. On the other hand, according to K. Maurin, Professor W. Rubinowicz once told him that during this time of hiding from the Germans in Lwów, Schauder visited him several times (on the corner of Zielona and Pawlikowski Streets) and asked him some mathematical questions about the initial value problem for differential equations, in which Rubinowicz was also an expert. As a student of the Clandestine University, I, as well as my father, was also a frequent visitor at the Rubinowicz home at that time; but I never met Schauder there, and I do not remember if Rubinowicz told me about his visit. The comments of these professors show that, in spite of the prevailing terrible conditions, Schauder was working – or at least trying to work – in mathematics.

the AK, the Home Army to which we all belonged). A few days before Schauder's planned departure for Warsaw, we met again. He thanked me for everything and said that the only thing he still needed was the possibility to take a bath before his journey. In the home where he was hiding, there was no bathroom. I said that in my apartment (I lived then in a small room at 10 Rycerska Street) there was no bathroom either, but that in the factory where I was employed there was a conveniently located one, so he could come and have a bath. But on the fixed day and hour he did not arrive. Shortly afterwards, I learned through our organization what had happened. Schauder was on his way to Zadworzanska Street when he was suddenly arrested. He was taken to a prison with which we had some clandestine contact, and through the organization some messages and help were transmitted to him. But a few days later a transport of Jews was taken from prison to the Kleparów Railway Station. There Schauder tried to escape from the police and was killed on the spot. This was probably in October 1943.

In the present year 1993, exactly 50 years have elapsed since Juliusz Schauder's premature and cruel death. 50 years is longer than his life–time — he lived only 44 years. During these 50 years his name has become known among mathematicians and mathematical physicists as one of the great names in the history of mathematics. He animated mathematics through unifying work in four branches of mathematics, not through superficial but by deep threads. We know that he wanted to go further in the direction of theoretical physics, but his death prevented the full realization of his life dream. The memory of this great man and mathematician will be cherished forever.

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