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A Biographical Memoir by

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Biographical Memoir

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April 15, 1922–December 28, 2010

BY MANUEL CARDONA, SIDNEY NAGEL,
RICHARD ZALLEN, AND KAREL ZAVETA

JAN TAUC WAS BORN ON April 15, 1922, in Pardubice, a city in eastern Bohemia, which was then part of Czechoslovakia and is now in the Czech Republic. At the time of Jan's birth his father was an accountant at the regional headquarters of the post office. His mother was also born in Pardubice and had many relatives living in the area. His brother, Ladislav, was four years younger than Jan. After the horrors of the First World War, the years after Jan's birth were a time of relative prosperity and hope, soon to be shattered by the depression. Since Jan's father was a public servant, they were sheltered from the direct impact of the depression and lived essentially happy, albeit modest, lives. Jan attended the five-year elementary school and the first year of secondary school (*Gymnasium*) in Pardubice but then his father was transferred to Opava, a city in the Sudeten-Silesia.

Opava's population was two-thirds German, but both ethnic groups lived together quite peacefully until Hitler came to power and exhorted the German population to see the Sudetenland as a German territory that must return to the "Reich." The return took place in September 1938 after the Allies signed the ominous Munich Agreement. Although the original agreement stipulated that Opava was supposed to remain in Czechoslovakia, Hitler suddenly changed his

mind. One morning in October 1938 the Taucs were told by the occupying forces to be gone by that evening. They took a few suitcases and left by train to stay with relatives in Pardubice.

Eventually Jan's father secured a job in the post office headquarters in Brno (the capital of Moravia) and Jan earned a three-year scholarship to continue high school studies in Nîmes (southern France). Unfortunately he could only attend that school for one year. During what was supposed to be the start of Jan's second year, Hitler occupied the Czech part of Czechoslovakia, which became Protektorat Böhmen und Mähren, and Jan was not allowed to return to France.

In the fall of 1939 the war started. Jan was extremely fortunate that Hitler viewed the Czechs with great contempt and denied them the "honor" of serving in his army. Jan was allowed to finish high school in Brno but by the time he finished, the Germans had closed all Czech universities. He was nevertheless able to attend a two-year professional electrical engineering school and was subsequently forced to work until the end of the war in a big weapons factory in Brno.

Jan's interest in science, especially physics and mathematics, started during his early childhood when he read textbooks and popular books and built equipment to perform experiments in his apartment. This, of course, generated some problems with neighbors and relatives, but his parents were always very supportive. His one year at the lycée in France showed him a somewhat different approach to education than that provided in Czechoslovakia; the French system tried to delve more deeply into the foundations, especially in mathematics, whereas the Czech approach was more practical and was oriented toward problem solving. He illustrated this point by recalling a discussion with a professor in Nîmes who urged him to prove a theorem. Jan simply insisted that

it was obvious. The amalgamation of both types of approach probably had a great influence on his future way of teaching and doing research.

During the war, Jan privately but intensely studied college-level mathematics, using mostly German books, many written by famous mathematicians and physicists. The end of the war resulted in enormous numbers of students trying to enter the reopened Czech universities and a shortage of teachers (many of whom had died in the concentration camps) and facilities. It was acceptable, even encouraged, to skip classes and register directly for the exams. From his private study Jan already knew much of the material and took advantage of this situation to finish his undergraduate studies at the Czech Technical University in just two years. In 1949 he obtained a doctoral degree for his theoretical and experimental work on dielectric antennas.

In 1947 he married Vera Koubelova, from southern Bohemia, the sister of a friend who had been a classmate at Nîmes. They had two children, a daughter (Elena, born in 1951) and a son (Jan, born in 1954).

Jan's first job after graduation was at a government-supported research institute with a mission to develop electronic technologies (such as television and microwaves), using equipment and documentation left behind by the German army and declassified information from the West that became available after the war. The institute was located first in Tanvald, a mountainous region of northern Bohemia, which was the location of the former German army center. There Jan became involved in microwave detectors that the Germans had developed for the 10 cm wavelength band, using germanium. When the news of the invention of the transistor reached Prague, he used the germanium of those detectors to build the first point-contact transistor in Czechoslovakia and decided to stay in that field. He wrote some articles

about the transistor and its applications, trying to popularize the new technology (the articles were later published in a booklet, *Krystalové Diody a Triody*[1]), but the quality of the available germanium was not good enough for any serious research. Jan did not have access to better germanium nor was the management of his organization interested in the problem.

After their victory in the 1946 elections, the communists participated in the government but did not have a majority there. In February 1948 the Communist Party staged a coup, known in the West as the Czech Coup and in the communist world as Victorious February, after which they, together with the members of "regenerated parties" of the national front, took over most of the cabinet posts. (One of the few noncommunist ministers was Jan Masaryk, the son of the founder of the republic. He was found dead two weeks later.) Václav Nosek, minister of the interior, transformed the country into a communist republic, by purging the forces of order of noncommunist elements. For Jan one of the consequences of the coup was a ban on his travel to England after he had obtained a one-year fellowship from the British Council to work with Professor Mott in Bristol in theoretical solid-state physics.

Czechoslovakia's institutions of higher learning were reshaped to follow the Soviet pattern. During the "bourgeois" period, research had been performed mainly at universities and industrial laboratories. The communists transferred most research to a central organization called the Czechoslovak Academy of Sciences (ČSAV) with the leadership closely tied to the Communist Party. The ČSAV included the Institute for Technical Physics in Prague whose director realized the potential of research in semiconductors and was eager to start work in that direction. Jan was surprised to be offered a job as the head of the new semiconductors department but

readily accepted it, a decision that was not without political problems.

The political requirements at the academy were not as strict as at the universities. Apparently Stalin had realized that demanding a high level of communist ideological orthodoxy would drastically decrease the pool of talent available for research. Scientific and technical research was considered important for the future of the communist system (a fact that when realized delighted many Western European intellectuals). Though he was not active in organizations that opposed the regime, Jan was not on very good terms with the communists and many considered him unacceptable even for a scientific leadership position at the ČSAV. He just wanted to be left alone with his science and to not make any commitment to an organization that he deeply disliked for many reasons, including their perpetual lying (he later compared it with Orwell's Animal Farm) and cruelty. He refused to join the Communist Party and did not display much enthusiasm for its ways. Moreover, just before the communists took over, his younger brother, Ladislav, got a French fellowship to study biology at the École Normale Supérieure, married a French woman and settled in France, where he eventually became the director of the CNRS Institute of Neurophysiology in Paris.[2]

Thus Jan started working at the Institute for Technical Physics (later renamed Institute for Solid State Physics), still often referred to by the name of the street "Cukrovarnicka," or "sugar factory." It was located in a building, built in 1922, that had housed the research institute of the sugar industry until the 1940s. Jan was unaware that there was a feud going on between the director of the institute and the head of the personnel department who had strong political loyalties and connections and wanted to have Jan fired as politically unreliable. Fortunately the director won and Jan was allowed to

stay although his standing with the party remained strained. He managed to put together a group of talented and dedicated people, mostly experimental and theoretical physicists, some chemists, a few engineers, and supporting staff, which eventually amounted to over 40 employees.

The director of the institute, J. Backovsky, was interested in the work of Jan and his group, which he considered important for the institute as well as for his personal advancement. He thus protected Jan from political pressure and supported his research. It was a perfect symbiosis. Backovsky knew that Jan was interested only in science and had no ambitions concerning higher political or administrative positions; he thus presented no danger of becoming a rival to his own aspirations. Jan's work at the institute was recognized by a national prize in 1955. The following year he defended a thesis on the generation of electromotive forces in semiconductors and became a doctor of physical and mathematical sciences.[3]

To overcome the isolation imposed by the communist system, Jan wanted to travel and establish scientific contacts with researchers in other countries. The international community was moving forward quickly, receiving enhanced government support because of the so-called Sputnik effect.[4] But the party had Jan on the blacklist and did not allow him to travel abroad even within the communist bloc. His status was not that of a "travel cadre" (communist jargon of the day). Light at the end of the tunnel appeared in 1956 when Z. Nejedly, the president of the ČSAV, met with Soviet Academician A. F. Ioffe, famous for his pioneering work on semiconductors and the leader of Soviet research in the field. He told Nejedly that he had read some of Jan's papers, liked them, and wanted to meet him.[5] This probably casual remark by a high-ranking Russian academician immediately and completely changed Jan's situation. Within days he was

sent to Moscow and Leningrad. It seems that he was removed from the blacklist and overnight became a travel cadre. The following year he was allowed to travel to Britain to visit several universities and laboratories.

In 1958 Jan was allowed to attend the fourth International Conference on the Physics of Semiconductors (ICPS) in Rochester, New York. Before going to Rochester, Jan had managed to get approval for the bold proposal to hold the fifth ICPS in Prague in 1960. In Rochester, Jan met the stars of the field, including the inventors of the transistor: Bardeen, Brattain, and Shockley. They gave friendly consideration to the Czech proposal, which was accepted by the Semiconductors Commission of the International Union of Pure and Applied Physics in the following year. The organization of this conference was a challenging task for Jan's relatively small group. It was one of the very few East-West scientific exchanges in those days and had a predicted attendance of 700 members. Jan's group had no experience with such large international meetings and had no expertise in handling the concomitant East-West problems: visas, rates of exchange, and last but not least, the simultaneous translations that were still common those days. In spite of these problems the conference was a great success and encouraged the powers-that-be to organize a number of similar East-West meetings (Moscow, Warsaw, et al.). The Tauc group was able to report important results related to the band structure and the optical properties of semiconductors.

After finishing his Ph.D. at Harvard, one of the present authors (M.C.) was beginning to work on this field, and at Prague he realized that he had been "scooped" by Jan's group. In spite of the tremendous strain in running the conference, Jan found time to talk to M.C. (then a 26-year-old boy) and discuss their common results and their interpretation. It was the beginning of a strong friendship that lasted until Jan's

demise. While preparing this memoir M.C. came across an article by Jan[6] that starts,

> Manuel Cardona is one of the few people who have substantially influenced my life. I first met Manuel in 1960 at the ICPS in Prague, when he approached me after my talk reporting our discovery of spin-orbit splittings in the reflection spectra of tetrahedral semiconductors.[7]

William Paul, who had been M.C.'s thesis adviser at Harvard, was very impressed by the progress made on this exciting topic in Prague under Jan's leadership. He invited Jan to work with him, and Jan managed to obtain a UNESCO fellowship to work at Harvard during the 1961-1962 academic year. Jan's wife, Vera, was not allowed to accompany him. Jan's friendship with one of the authors (R.Z.) began during Jan's sabbatical year in William Paul's lab. R.Z. was then a graduate student with Paul, working on the effect of pressure on semiconductor optical properties. In addition to shared scientific interests —for example, part of R.Z.'s Ph.D. thesis was to measure the effect of pressure on the reflectivity signature of spin-orbit splitting in germanium that was first discovered by Jan's group in Prague—the student and the visiting professor would often take dinners together where they would discuss physics and the state of the world.

One of Jan's duties as an eminent visitor was to serve on various doctoral committees. He took these responsibilities seriously. As a result of his diligence, he uncovered a case of serious plagiarism that led Harvard to tighten its policies for monitoring off-campus thesis work.

Jan's personality and soft-spoken humor made him popular with the young scientists in William Paul's group. At a 1962 dinner party someone remarked that Jan was (in American vernacular of the 1960s) a "perfect square." Jan objected, complaining that the term was more appropriately applied

to Paul, who on that occasion happened to be celebrating his 36th birthday.

In 1963 after returning from his sabbatical, Jan became a corresponding member of the ČSAV and, in 1964, professor of experimental physics at Charles University in Prague. These appointments would have been unthinkable a few years earlier. In the spring of 1965 Jan's group organized an international conference on amorphous and liquid semiconductors in Prague that turned out to be the first of a series, still going on today, that is held every two years in different countries. In 1965 the Italian Physical Society invited Jan to organize and direct a course on the optical properties of semiconductors at the International Enrico Fermi Summer School in Varenna. Again, the communist authorities refused to give Vera permission to accompany Jan. In the meantime Jan's scientific standing had become such that he could afford a confrontation with the system. He was so angry that he decided to write a letter to the president of the republic, Antonin Novotny, and delivered it directly to his residence at the historic and beautiful Hradčany palace. Novotny probably never saw it, but convincing his secretary was good enough to allow Vera's trip to Varenna, with the explicit proviso "without children." In spite of that "proviso," the permission granted Vera to accompany Jan reflected the fact that the liberal wing of the party, much friendlier to people like Jan, was gaining power. The cultural life was becoming exciting and, on the whole, it became easier to travel. In the spring of 1968 (the Prague Spring) Jan became director of the Institute of Physics of the Charles University. In July he attended the 10th International Conference on the Physics of Semiconductors in Moscow and realized the mounting political tensions between Dubček's Czechoslovakia (ČSSR) and Brezhnev's Russia.

During his stay in Italy in 1965 he met the chair of the Italian Physical Society, Professor Bernardini, who asked him to participate in his attempt to create a European Physical Society that would encompass the efforts of all European physicists, until then scattered throughout many small national societies. Bernardini considered it essential to include the East in his vision of one Europe. Jan obtained permission from the new (much more liberal) president of the ČSAV, F. Šorm, to attend the meeting of the committee in charge of founding the European Physical Society. He was the only participant from the Eastern Bloc, reflecting the fact that liberalization had not yet gone as far in the sister republics. But when the concrete efforts started, Jan was given an "assistant" (or "baby sitter"), party member F. Janouch.[8] In the spring of 1968 Jan invited the committee to Prague, where members from both East and West turned up.

The Russians did not like the idea of a European society but all other members, with the exception of two countries (the German Democratic Republic being one of them), were enthusiastic about it. The Russians said they had to consult with headquarters at home, and no conclusions were reached. Jan reported an experience he had at the Moscow conference that showed how frustrated the Russians must have been with the difficulties in handling the liberal movement sprouting up in the ČSSR. One afternoon in July 1966 during a session of the ICPS, a uniformed chauffeur showed up and told Jan that his presence was requested at the Soviet Academy headquarters. A black limousine took him to a huge office where the powerful secretary of the Soviet Academy for Foreign Affairs was waiting behind a tremendous and intimidating desk. He expounded at length how bad the idea of a European Physical Society was for the socialist countries, obviously blaming him for the present situation. Jan thought that he was seriously in trouble, but

then the secretary changed tone and concluded that since the other socialist countries have accepted the idea, the Soviet Union would also join so as not to destroy the unity of the socialistic nations. Jan said later that this was the most surrealistic experience of his life.

One of the authors (R.Z.) fondly remembers how, at the Moscow semiconductor conference in July 1968, Jan used his knowledge of Russian to help R.Z. and his wife, Doris, arrange a quick trip to Leningrad (now St. Petersburg) to meet with their Russian relatives. After the conference, the Zallens and the Taucs took the same flight back to Prague, where Jan and Vera were fine hosts during that period of Dubček's Prague Spring. In Moscow, Vera had purchased a fur coat for her daughter. Apprehensive about the Czech and Russian airport bureaucrats, she asked Doris to wear the coat onto the plane. The idea was that to an Eastern Bloc bureaucrat, it might seem unsurprising for a rich conspicuous-consumption American woman to wear a fur coat in the July heat. It evidently worked. Doris was not challenged, and in Prague she returned the coat to Vera. Eight days after the end of the Prague visit, Jan and R.Z. met again, at a conference in New Hampshire on disordered solids. Jan was in typical good spirits. He opened his lecture with the well-appreciated remark that he was "impressed that the theorists could build such sophisticated theories on the basis of zero experimental evidence." Three days after Jan returned home Russian tanks appeared in Prague, eventually altering the trajectory of his career. American science was once again the beneficiary of dark events in Europe.

In the spring of 1969 Jan received his second National Prize from the hands of Dubček, who was still in office (until April 1969). But the situation in Prague was by then becoming too absurd to last. There were rumors about impending military action by "Big Brother," and the (obviously controlled)

newspapers were even beginning to propagate its necessity. Jan did not believe the Russians would do it because they would alienate the only socialist country that did not hate them as a nation; there had never been conflicts between them, and the Czechs regarded the Russians as their Slavic big brothers. Nevertheless, in the early hours of August 21 the Taucs got a call from a friend telling them that the Russians were invading. Soon the streets of Prague were full of armed vehicles with soldiers pointing machine guns at the population. Jan realized that an era of his life had ended.

The Russians and their Warsaw Pact allies were careful not to escalate the conflict into a widespread confrontation and proceeded slowly when taking control of the Czech institutions. They did not immediately seal the borders nor did they change the foreign-travel regulations; it remained relatively easy to get permission to work abroad. Jan felt that this interregnum would be his last chance to spend a sabbatical year abroad and started negotiations with Bell Laboratories in Murray Hill, New Jersey. Jan's standing had been greatly enhanced by his work, in collaboration with the Rumanian scientist Radu Grigorovici, on amorphous germanium. Jan was working at the time on amorphous semiconductors, which had become rather topical for possible use in photovoltaic cells and in electronic switches based on amorphous to crystalline conversion. Stanford Ovshinsky, a scientist and industrialist based in Michigan, was strongly pushing the possible applications of these materials. Although Bell Labs was somewhat skeptical about their widespread use, they wanted to keep an eye on developments. Since they had few experts in the field, B. Hannay and A. Chynoweth offered Jan a 12-month visiting position. Jan left Prague in the spring of 1969 (when Russian boots were already marching through Prague) and, after spending a few weeks with F. Abeles at the University of Paris, started work at Bell in June 1969 in

the department of J. H. Wernick. His entire family was able to join him in July.

The Taucs were not planning to emigrate and took only a few things with them. Jan naïvely thought that the Czech nation would unite against the invaders and the Russians would allow some kind of regime, possibly more liberal than the one that had previously existed. On the contrary, the Russians and their allies introduced a regime not only harsher but also dominated by cynical opportunists. The new regime had little interest in supporting scientific and cultural institutions; after all, the intelligentsia had been the main troublemakers. In October of 1969, when his work at Bell was beginning to blossom, Jan received a letter from the Czech Academy revoking his permission to stay abroad and demanded his immediate return to Czechoslovakia with his family. He replied telling them that a return at this point was not possible since he was under contract with Bell Labs and that his work was beginning to yield results. He never received an answer. At that point he started looking for a job in the United States. He was well aware that his behavior was making him liable to prosecution at home. In fact, a few years later he was tried in absentia and sentenced to about five years in jail.[9]

Jan had heard of Bell Labs as a difficult place to work, where colleagues were extremely competitive. His experience, as he told us, was that they were very competent and hard driving at work but also very helpful and friendly. He was offered a permanent job at Bell and was close to accepting it. In November 1969, however, the Taucs had a long talk with one of the authors (M.C.) and his wife, with whom they had become close friends. M.C. was a professor of physics at Brown University and mentioned to Jan that Brown had received a large amount of money from Thomas J. Watson to strengthen the physics and engineering departments.

The physics contribution had already been allocated, but J. Loferski, head of engineering, told Jan that there was a Watson chair still available in engineering. Jan was offered it, and he promptly accepted. In the summer of 1970 the Taucs moved to Rhode Island. Jan thus started his 22-year career at Brown, a move he claimed he never regretted: a small, friendly elite university, with easy access to the magnificent Narragansett Bay. In 1971, when M.C. moved to Stuttgart to found a new Max Planck institute, Jan inherited most of his equipment and some laboratories plus a close association with the Physics Department. From 1983 until 1988 Jan was in charge of Brown's materials science laboratory supported by the National Science Foundation. He spent sabbatical years at Stanford (1977) and at the Max Planck Institute in Stuttgart (1982) and at various other places in Europe. He became a U.S. citizen in 1978.

In late 1970 not long after settling in Rhode Island, Jan's parents tragically died in their Prague apartment from the fumes of a space heater. Jan could not risk returning to Czechoslovakia at that time. He thus could not attend his parents' funeral.

The move to Brown was, in a real sense, the beginning of the second half of Jan's scientific career. During his time at Brown, Jan extended his studies of disordered materials to the chalcogenide glasses and went on to use photomodulation spectroscopy to determine the electronic energy levels and carrier dynamics in tetrahedrally bonded amorphous semiconductors. He was constantly searching for new materials or phenomena that could lead to interesting physics. He was courageous in seeking out new research directions that others might have dismissed as not being in the mainstream. Having shown that optical properties of amorphous semiconductors had clean and reproducible behavior, Jan

studied the electronic properties of metallic glasses using both optical techniques and photoelectric spectroscopy.

Starting in the 1980s Jan turned his attention to picosecond spectroscopy of transport in amorphous semiconductors and observed the propagation of coherent phonons. This discovery led to a patent, with colleagues H. J. Maris and C. Thomsen, for a powerful nondestructive diagnostic method that is used for determining the structure and interface properties of complex multilayers used in microelectronics technology.

It is hard to think of Jan without remembering his warmth and humor. He was completely serious while inside the laboratory but as soon as he left the building there was a twinkle in his eyes. He advised his students and postdocs that there should always be one good joke in every talk and once told one of his postdocs who wanted to repeat one of his jokes in a talk, that this was okay because his jokes, once spoken, were forever after the property of the National Science Foundation. He often spoke of wanting to write a grant to the funding agencies that simply said that he proposed to be lucky for the next three years.

At an American Physical Society meeting in March in the early seventies, Jan and R.Z. were listening to a talk by J. C. Phillips of Bell Labs when Phillips coined the term "Tauc edge" in connection with optical absorption in amorphous semiconductors. Though he recognized immediately what was meant, R.Z. couldn't resist leaning over to ask Jan, "What the heck is that?" In a typical example of Taucian humanity, accompanied by a thumb jabbed in mock pride at his chest, back came the sly (though none too informative) response: "MY edge!"[10]

Jan cared about the members of his group and often invited them to his home, where they would get a wonderful Czech meal cooked by Vera. Later, when he bought a boat,

he tried to coax his friends to accompany him on his navigations around Narragansett Bay. Not only did he help his students and postdocs succeed in their careers but he also wanted them to be happy and satisfied. Years after leaving his group, members would return to visit him to get professional and personal advice. They would get guidance, but more importantly they would get real friendship. Jan's group loved him in return.

Jan was constantly amused (and angry) at the state of the world and was able to accept many of the minor foibles of his colleagues as part of the surreal comedy of life. For Jan many of the petty squabbles seemed to pale in comparison with the assault on human dignity he had suffered while trying to do physics research under Communist Party rule in his native Czechoslovakia. An example of what Jan surely felt was a surreal world occurred when he was sent from Czechoslovakia a crossword puzzle from the daily paper with the clue: A great Czech scientist. The answer was "Tauc." He was of course flattered but even more amused because he was still not allowed to return to his home country.

Jan's legacy lies not only in his science—where he showed the scientific community that new worlds await those who are curious enough about nature to explore topics that defy the common wisdom about what is "interesting"—but also in those lucky enough to have been mentored by him. Those individuals cannot help but try to carry on his spirit of generosity and warmth to those who will be Jan's scientific grandchildren.

Jan was honored for his science, in the East and in the West, during both halves of his career. In the United States he received, in 1980, the U.S. Senior Scientist Award from the Alexander von Humboldt Foundation, the Frank Isakson Prize in 1982, and the David Adler Lectureship Award in 1988 from the American Physical Society. On the occasion

of his 70th birthday a collection of papers in Jan's honor under the title "Optical Properties of Disordered Solids" was published in the *Journal of Non-Crystalline Solids*.[11] He became a member of the National Academy of Sciences in 1992. In his native country after its return to democracy, Jan was honored in 1992 with the Hlavka Medal of the Union of Czechoslovak Mathematicians and Physicists. Particularly gratifying to Jan was when he was honored in 2003 with the highly prestigious *De Scientia et Humanitate Optime Meritis* Medal from the Academy of Sciences of the Czech Republic (AVČR). This was the highest award his native country could bestow on a scientist.

Jan is survived by a daughter, Elena, and a son, Jan. After retiring from Brown, Jan and Vera moved to Washington State to be close to their children and their grandchildren. They missed, however, many of the friends they had made on the East Cost, in particular Bill and Babs Paul at Harvard, and at Brown, Maurice and Yetta Glicksman. Vera passed away in 2008, less than two years before Jan, who died in December 2010.

NOTES

1. J. Tauc. *Krystalové Diody a Triody* (Crystal Diodes and Triodes). Praha: Technicko-Vědecké Vydavatelství, 1952.
2. Ladislav Tauc was a famous neuroscientist, a pioneer in neuroethology and neuronal physiology.
3. This was a kind of second doctorate, similar to the German *Habilitation*, common in the Eastern European countries at the time. During a recent trip to Prague, one of the authors of this memoir (M.C.) was told that this doctorate had been abolished so as to equalize the degrees to those common throughout most of the world.
4. The shock in the West produced by the launching of the Soviet *Sputnik* resulted, especially in the United States, in a large increase in the support of research in the technical and natural sciences. One of us (M.C.) was at the time a graduate student at Harvard and strongly profited from the *Sputnik* effect.

5. M.C. met Ioffe at the International Conference of the Physics of Semiconductors in Rochester, New York, in 1958. He was a very friendly (even to a 24-year-old student), elderly gentleman, obviously very powerful in the Soviet Union as judged by his entourage and scientific production. Apparently Jan had the same experience.
6. J. Tauc. Conquest of the band structure of semiconductors. *Philos. Mag. B* 70(1994):409-415.
7. M.C.: Thank you, Jan. If you were with us I would say similar words to you, emphasizing the fact that you were a senior, famous scientist and I a young student.
8. This did not work as planned by the party hierarchy. Janouch turned out to be a militant liberal who was expelled from the Communist Party and even from the country after the Russian invasion.
9. Jan told M.C. that the sentence amounted to eight years. A Czech lawyer told us, however, that the maximum sentence for leaving the republic illegally those days was five years. It does not much matter since neither he nor his family served the sentence.
10. Jan and another of the authors of this memoir (R.Z.) coauthored only one paper, a 1970 report of the infrared absorption of amorphous germanium, in which they observed disorder-induced one-phonon far-infrared absorption. They also observed a strong mid-infrared band but guessed incorrectly its origin. In 1974 as the role of hydrogen in amorphous Ge and Si was beginning to unfold, W. Paul and his coworkers showed this band to be caused by Ge-H bond-stretching vibrations. Tauc-Zallen correspondence is archived in Ms2008-069, Zallen papers, Library Special Collections, Virginia Tech.
11. P. C. Taylor and Z. Vardeny, eds. Optical properties of disordered solids. *J. Non-Cryst. Solids* 141(1992): Special Issue.

SELECTED BIBLIOGRAPHY

1955

Theory of the bulk photovoltaic effect in semiconductors. *Czech J. Phys.* 5:178.

1957

The generation of an EMF in semiconductors with nonequilibrium current carrier concentrations. *Rev. Mod. Phys.* 29:308-324.

1959

Electron impact ionization in semiconductors. *J. Phys. Chem. Solids* 8:219-223.

1960

With E. Antoncik. Optical observation of spin-orbit interaction in germanium. *Phys. Rev. Lett.* 5:253-254.

1961

With A. Abraham. Reflection spectra of semiconductors with diamond and sphalerite structures. In *Proceedings of the International Conference on Semiconductor Physics, Prague, 1960*, p. 375. Prague: Publishing House of the Czechoslovak Academy of Sciences.

1962

Photo and Thermoelectric Effects in Semiconductors. London: Pergamon Press.

1966

With R. Grigorovici and A. Vancu. Optical properties and electronic structure of amorphous germanium. *Phys. Stat. Solidi B* 15:627.

1970

With A. Abraham, R. Zallen, and M. Slade. Infrared absorption in amorphous germanium. *J. Non-Cryst. Solids* 4:279-288.

Absorption edge and internal electric fields in amorphous semiconductors. *Mat. Res. Bull.* 5:721.

1972

With D. L. Wood. Weak absorption tails in amorphous semiconductors. *Phys. Rev. B* 5:3144.

With A. Menth. States in the gap. *J. Non-Cryst. Solids* 8-10:569-585.

1974

Optical properties of amorphous semiconductors. Chapter 4 in *Amorphous and Liquid Semiconductors*, ed. J. Tauc, p. 159. London: Plenum Press.

1975

With S. R. Nagel. Nearly-free-electron approach to the theory of metallic glass alloys. *Phys. Rev. Lett.* 35:380-383.

With E. Finkman, R. Kershaw, and A. Wold. Lattice dynamics of tetrahedrally-bonded semiconductors containing ordered vacant sites. *Phys. Rev. B* 11:3785-3794.

1979

With D. E. Ackley and W. Paul. Picosecond relaxation of optically induced absorption in amorphous semiconductors. *Phys. Rev. Lett.* 43:715-718.

1981

With Z. Vardeny. Picosecond coherence coupling in the pump and probe technique. *Opt. Commun.* 39:396-400.

1982

With P. O'Connor. Photoinduced midgap absorption in tetrahedrally bonded amorphous semiconductors. *Phys. Rev. B* 25:2748-2766.

1984

With C. Thomsen, J. Strait, Z. Vardeny, H. J. Maris, and J. J. Hauser. Coherent phonon generation and detection by picosecond light pulses. *Phys. Rev. Lett.* 53:989-992.

1986

With C. Thomsen, H. T. Grahn, and H. J. Maris. Surface generation and detection of phonons by picosecond light pulses. *Phys. Rev. B* 34:4129-4138.

1987

With H. J. Maris and C. Thomsen. Optical generator and detector of stress pulses. U.S. Patent number 4,710,030.

1988

With H. T. Grahn, H. J. Maris, and B. Abeles. Time-resolved study of vibrations of a-Ge:H/a-Si:H multilayers. *Phys. Rev. B* 38:6066-6074.

1989

With H. T. Grahn and H. J. Maris. Picosecond ultrasonics. *IEEE J. Quantum Elect.* 25:2562-2569.

With H.-N. Lin, R. J. Stoner, and H. J. Maris. Phonon attenuation and velocity measurements in transparent materials by picosecond acoustic interferometry. *J. Appl. Phys.* 69:3816-3822.