



Efim S. Kaplan, the author's father, in the fall of 1941. He was a junior officer-engineer on the Russian-German front.

Tribute to an Unknown Physicist

~ Alexander E. Kaplan ~

Ancient Greeks ran a temple for an Unknown God; it feels like a beautifully abstract and humble idea of the unknown in heaven. Closer to Earth, people from many cultures honor the memory of unknown soldiers; a dilapidated wooden post or a pile of stones on a grassy hill are silent reminders of those whose life and name has been lost in a small or big war.

Last year, we celebrated the World Year of Physics. It was a wonderful opportunity to highlight our field and remember the greats and well-known. But do we want to remember unknown physicists too? A countless number of them were part of classified projects; there were also those engaged in forced intellectual labor. And then there were those who worked hard on projects on their own and remained unknown even to small research communities.

In a 1901 short story by Russian author N.G. Garin-Mikhailovsky, an old Jewish man wearing a yarmulke showed up at the math department of Odessa University. He spoke only Yiddish, and brought a manuscript he had written in Hebrew. Unfortunately, nobody in the department spoke Yiddish or knew Hebrew. Finally, a student emerged who could translate the manuscript. It turned out that the old man had discovered calculus.

Filled with compassion, the student explained that this had already been done long ago by a famous scientist, Isaac Newton. “Where can I find his writings?” asked the old man. The student provided a reference for Newton’s original work. A few years before the old man passed away, he located a copy of the original work by Newton in one of Odessa’s libraries—in Latin. He spent his last years learning Latin and translating the work into Hebrew.

Can you imagine the loneliness and devotion of a great mind working all his life on a problem that, because of the linguistic and cultural gap, he could not share with another like-minded person, let alone a community? (The author’s note says that his story was based on a real person; his name was Pasternak.)

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People come into science in many different ways; some of them build their own temple of the Unknown to keep their mind and sanity away from the grim “knowns” of their life.

MY FATHER, EFIM (YEFIM) S. KAPLAN, was born in 1911 in a small shtetl in the Ukraine. His father was a teacher and his grandfather, a rabbi. In the early 1930s, he came to Kiev, speaking mostly Yiddish, and entered the Mining Institute, where he received his degree in electrical engineering with a focus on “electrical equipment of peat-mining machinery.” After that, he worked at a small power plant.

He was drafted as a junior officer into the Red Army in 1940, a year before the Nazis invaded Russia. He served at a new Ukrainian border. Like many in the Army, he saw the invasion coming. He was the only engineer who was responsible for the installation of defense electrical fences against a possible German attack. He got them installed, all right. But when the time came to use them, there was nobody to sign the order to throw the switch: After June 22, 1941, the Red Army was in chaotic retreat.

He served through the entire war, almost four years. As a military engineer, he became an expert in land mines and explosives. He planted them in when the Red Army retreated and pulled them out when the war—fed by millions of soldiers’ and civilians’ lives—rolled back to the West. While retreating, Wehrmacht was planting land mines of new, unfamiliar designs; many Russian sappers got killed trying to defuse them. A Russian commander of the advancing group of divisions ordered the formation of a special sapper unit to decipher these new mines, and my father was the unit’s commander. As one of the most experienced sappers, he was often the first person to enter mine fields where regular army sappers had failed to defuse the mines.

An explosives sapper’s job is one of the loneliest and deadliest in a war. Most of those soldiers never came back, while a few lucky survivors were heavily wounded. One was my father, who crawled his last mine field in 1945 in Rumania, and spent several months in the hospital recovering from his injuries.

At the time, in the very beginning of war, my mother was trying to escape Kiev, the first major Soviet city to fall to the invaders, along with her sister, their mother and three children—my cousins (one of them a baby) and me. Our train was bombed to smithereens by “stukas”—diving bombers, and many were killed. The survivors walked away from the city on the railroad tracks.

The three women walked all through the night, driven to protect the children. Their instincts saved our lives. Nobody knew that the German Army was surrounding the city. Very soon the ring was closed, and almost the entire population of Jews left in Kiev after that night ended up in Babii Yar. They comprised the majority of the 100,000 people who were exterminated there by firing squads.

My father’s mother and father, who had remained in their shtetl, met another end: A special unit of the German Army brought the entire Jewish population of a small town—elderly people, women and children—to a river bank, wrapped them tightly in bunches with barbed wire, and pushed them into the ice-cold river. Those who didn’t freeze to death or drown were shot.

Are these life stories relevant here? I think they are. People come into science in many different ways; some of them build their own temple of the Unknown to keep their mind and sanity away from the grim “knowns” of their life.

When my father was released from the hospital, he was assigned his first research job at the newly established Army Institute for Engineering near Moscow. In the beginning, he continued to work on land mines. Soon, however, he switched to electrical engineering, with a focus on electrical fences. It was the first independent project of his youth; the topic that became the basis of his Ph.D. was also on “electrical currents in the ground.”

The subject was not forgotten; when my father later read Mark Twain’s *A Yankee at King Arthur’s Court*, he was thrilled by the description of how the Yankee installed an electrical fence around King Arthur’s camp. Except for a few technical comments, the Yankee and Mark Twain got high marks from him.

Electrical fences made him curious about more advanced electrodynamics. He studied classical books and began making inroads. He developed his own classification of EM-fields and modified Maxwell equations. My childhood memories are filled with images of

The Kaplan family in 1973, including (clockwise from top left) Alex, his brother Semyon, his mother Anna and father Efim.



my dad hunched over his writing in the dead of night, with books by Stratton, Watson, Sommerfeld and others piled on his desk. My first notion of beauty came from three-dimensional plots of special functions in Janke and Emde.

I developed my own interest in physics, and, in my early teens, I took up endeavors accessible to me: simple explosives, electrical arcs and discharges, radio-receivers and homemade electrical ovens to melt metals using a mixture of regular and wooden coals, etc. I was appropriately reprimanded for my riskier exploits, but not too much discouraged. Two years before I completed high school, my dad was not too surprised to discover in my notes that I was using Navier-Stokes equations, trying to solve the problem of peculiar, well-separated waves in a thin-layer water flow on flat-tilted surfaces. (I realized many years later that the waves must've been a train of KDV solitons.)

Later on, when I was an undergraduate in Moscow, my father asked me to look in the top Soviet library for the original Maxwell papers on his equations in the *Proceedings of the Royal Philosophical Society*. I was awed to find all three, as I recalled, of them—each more than 100 pages long—and his mechanistic interpretations. I was astounded by the complexity of what I saw: Nothing looked like the Maxwell equations that were familiar to me.

According to my dad, the beautiful, streamlined Maxwell equations known to any physicist were actually written by Oliver Heaviside, who not only cleaned up the whole math mess (vectorial calculus didn't exist in Maxwell's time), but also eliminated redundancies and greatly simplified the entire thing. In addition, Heaviside introduced an operational calculus, used now by any engineer and physicist, and was the first to discover an ionospheric layer. So, I had another name to admire.

My dad wrote his Doctor of Science (advanced degree similar to German habilitation) dissertation on his new research, but never submitted it. It was the beginning of the 1950s and times were getting tough. Under Stalin's paranoid orders, the KGB was preparing to deport the entire Jewish population of the Soviet Union to the concentration camps in the Russian Far-East, Birobidjan area. They began by arresting a large group of Jewish medical doctors under ramped-up charges of conspiracy to eliminate the Communist elite, including Stalin. Jews were fired from their professional positions. Those who were employed in military and defense were the first to be let go.

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For a long time, I thought my propensity to do things my own way and follow my instincts was a self-earned trait. But now I know better: It came from the person who taught me by his life—my dad.

Mass arrests and family deportations were expected to follow, but the threat slowly dissolved after Stalin died in 1953. Meanwhile, since the top military commanders remembered my dad's work in the war minefields, my father was promptly transferred from Moscow to work in several obscure locations; this provided some safety. Obviously, it was not a time to be much concerned about an academic degree.

In the beginning of the 1960s, my father was an electrical engineering professor at a provincial institute (technical university). There, he shifted his attention to the special relativity theory (SRT), which, at that time, he fully rejected. But then he made steady progress in developing his own, alternative SRT, in which he was engaged until his death in 1994. His approach and techniques grew more and more sophisticated over the years; group and curved space theories eventually became part of it. His later research had evolved into a more general theory, part of which was the conventional SRT.

My father was an entirely self-taught physicist who knew of the field only through books, most of which were rather old. He had no access to the current literature, and, having had no formal schooling in contemporary physics, he was unfamiliar with commonly used jargon and paradigms. As such, it was difficult for him to communicate his results to the high-ranking professional physicists with whom he would sometimes manage to gain access. In the Soviet-era scientific hierarchy, very few would be willing to waste their time on him, anyway. Most of his submissions were rejected as irrelevant, although I don't believe that anyone ever read them carefully.

One possible way for him to deal with that situation was by engaging me, his son, a burgeoning professional physicist. I had entered the Moscow Institute of Physics & Technology in 1955, and graduated with the equivalent of an MS degree in 1961.

I began publishing almost right away, and I was the sole author on my first 10 journal papers (nonlinear oscillations, lasers and nonlinear optics). With pride, I showed them and my first book to my dad, but he was not too impressed. In his view, a "real man" should focus on the fundamentals, beginning with the SRT.

Having been trained by "mainstream" physicists, I did not share his main ideas about SRT, which of course did not make them wrong. However, I tried hard to help him to bring his writing, references, math and argumentation to more contemporary terms so that it could pass beyond the first negative reaction by editors.

My attempts failed miserably. Our discussions on how to simplify or streamline the logic and math of his manuscripts would quickly become heated and emotional. He was stubborn, and demanded that his "in-house editor" be his absolute follower. Apparently, there was fault on my side too: Patience and the willingness to be anyone's disciple were not my greatest skills.

Around this time, my own life and career were getting interesting. I received my Ph.D. in physics and math in 1967. Even before that I had a collision with the KGB related to a political trial against two Russian writers in 1965. This marked the start of my dissident activity in the Russian human rights movement.

In August 1968, when Warsaw block armies invaded Czechoslovakia, I publicly protested the invasion. I paid for that, but the price was not high compared with what my father had endured in his life. I was thrown out of my research lab and placed in an obscure, marginal institute that had nothing to do with my work. The implicit understanding was that, research-wise, I could do whatever I wanted and publish it, as long as the work remained in the theoretical realm and I did it alone. I stayed there for 10 years.

Thanks to strong efforts by a few people at the Academy of Sciences, I remained sheltered but not forgotten. They were not indifferent to the fate of one small but independent and original researcher. Among them were Vladimir Sandomirsky, Lev Gudzenko, Sergei Rytov, Mikhail Levin, Boris Katsenelenbaum, Andrey Gaponov-Grekhov, Mikhail Leontovich, Pyotr Kapitsa, and a few others. I was also effectively protected by Rem Khokhlov, the top Russian physicist in the field of nonlinear optics and also the President of Moscow State University. He was familiar with my research beginning from my student projects.

Yet none of these men had been my formal advisor, research supervisor or mentor. They did what they did out of compassion to a younger colleague and, perhaps more important, a love for science. I have learned a simple truth: If you put your soul and passion into what you do, there will always be people of the same mold who will help you. I've also learned to pass it on.

My quiet source of pride was that I had never worked for or under anybody, and that no problem I had solved had been posed to me by anyone but myself. You can build a thing, a mental shelter if you wish, from within. You can do it alone, and you have to be able to carry it under your hat. Nobody then can take it away, and it protects you. You can take it—or it can take you—through bad times and across the borders. For a long time, I thought my propensity to do things my own way and follow my instincts was a self-earned trait. But now I know better: It came from the person who taught me by his life—my dad.

I immigrated to the United States in 1979. I had very little hope of continuing my career as a physicist. But, as luck had it (and the luck's name was Paul Kelley), very soon I got my first job from Ben Lax of Francis Bitter Magnet National Lab at MIT and my first grant from the Air Force Office of Scientific Research. (Howie Schlossberg was—and still is—my program manager).

I've discovered for myself a wonderfully supportive and friendly research community, something that I would never have previously dreamed possible. Aside from those three, I am also grateful to Nico Bloembergen, Peter Smith, Jack Tomlinson, Pierre Meystre, Erich Ippen, Hermann Haus, Steve Brueck, Bob Terhune, Herbert Walther, and the many others who helped me to get established in that community. Soon, I knew people in my field from coast-to-coast and around the globe, and I was able to move fast into new subjects. (My current research interests are mainly in “extreme”—in particular relativistic—nonlinear optics).

After I left MIT, I was honored to become a faculty member at Purdue and then Johns Hopkins. I have published more than 100 journal papers in this country alone. Although I remain somewhat of a “lone scout,” I have benefited tremendously by becoming part of a large, active, vibrant and supportive community.

Last year, the Optical Society of America bestowed on me its Max Born Award, a great honor. After I learned of this, I went to my bookshelves and pulled out a volume by Max Born, *Physics in the Life of My Generation* (a title of a Russian translation); I wanted to hear the voice of that great man.

I hadn't used the book in many years and had almost forgotten that it had belonged to my father. When I opened it, my dad's handwriting jumped off the pages. He had covered the margins with his marks and comments. Two physicists talked to me across a time gap: Born—a major contributor to contemporary physics—and my father, a self-made researcher unknown to almost anyone except his family.

Has my dad contributed to physics as we know it? My answer is yes. His insatiable curiosity, his drive toward unreachable horizons and his fearless, lone-scout spirit live on. In the work of me, my students, post-docs and associates, there is his hidden contribution. The unknown physicist, you have not been forgotten.

Epilogue

Efim S. Kaplan immigrated to the United States in 1992. He was 81 years old. At that time, he submitted a proposal to the Office of the U.S. President requesting funding to construct a magnetic monopole based on a complicated system of rotating electrical charges. He never received funding, but continued his theoretical work until the very last days of his life. He died in Baltimore in 1994.



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