

“Physics is the Most Important” — Leonard Sosnowski

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I am probably one of the few who remember the first Jaszowiec Conferences that took place in the Teacher’s House. Memories of those old times are very blurred. However, I remember this period as full of enthusiasm and commitment to the study of new phenomena in the so-called “narrow energy gap” semiconductors. I also remember Professor Leonard Sosnowski, who was the highest authority for us, and who instilled in us the belief that “Physics is the Most Important” and should primarily regulate relations in our community. During these 50 years, since Professors Witold Giriat, Wiesław Wardzyński, and Józef Żmija took their first steps in the organization of “Jaszowiec”, a local Polish meeting turned into a prestigious international conference, building the coherence of the entire Polish semiconductor physics community. When I consider what enabled the systematic development and great success of “Jaszowiec”, what I see first is Sosnowski’s principle that Physics is our common good which we should preserve. The key role of this principle is in line with the hundred-year tradition of “Hoża 69”, born in II Rzeczpospolita. Despite turbulent times, this tradition has survived and is still alive among us.

topics: InSb, HgTe, high pressure, Dirac cone, effective mass

The Jaszowiec Conferences are among those important achievements that our entire community can be really proud of.

As I am probably one of a few who remember the first Conferences that were still held at the Teachers’ House in Jaszowiec, I was asked to try to present some memories from those old years. Of course, time has already blurred many of them, but I remember this period as full of enthusiasm and commitment to the study of new phenomena related to the so-called “Narrow energy gap” semiconductors, the main representatives of which were InSb and HgTe.

I also remember the extremely important role of Professor Leonard Sosnowski in the development of the entire Warsaw semiconductor physics community. He was the highest authority for us and instilled in us the belief that physics is the most important, and it was a general principle that regulated relations in our community. In this historically very difficult period, when politics was often extremely aggressive, it was for us of fundamental importance. That is why this is the title of my presentation — “Physics is the most important”.

The group of physicists at the Institute of Experimental Physics, Warsaw University (IEP UW) and Institute of Physics PAS (IP PAS) dealing with “narrow gap” semiconductors grew rapidly and almost immediately became an important team that was recognized around the world. For many

years, this subject was very strongly present at the Jaszowiec Conferences and attracted many physicists from other Polish and foreign research centers.

For me, this period was related to the development of semiconductor research under high-pressure conditions. After I finished my studies in 1960, Professor Sosnowski hired me at the IF PAS and asked me to organize a laboratory that would allow us to study the properties of semiconductors as a function of hydrostatic pressure. He was convinced that this would prove to be a very important method for the study of semiconductors, especially the “narrow gap” semiconductors.

The first fascinating results came very quickly. At that time, InSb and HgTe seemed very similar because both the shape of the conduction band and effective mass m^* , which controls dynamics of electrons defined as $m^* = \hbar^2 k (dE/dK)^{-1}$, were almost identical for them. At the same time, many of their properties differed significantly, which was difficult to understand.

Our first pressure experiments showed that this similarity is only coincidental and only occurs in normal conditions. Under pressure, the direction of change of the effective mass m^* in InSb and HgTe turned out to be opposite. These results indicated that the band structure of HgTe is significantly different from that of InSb.

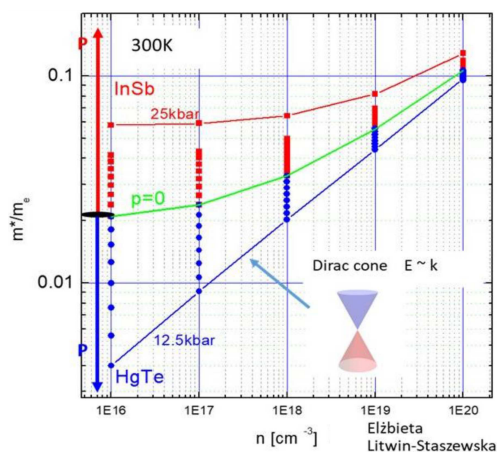


Fig. 1. Pressure changes of m^* at the Fermi level for strongly doped InSb and HgTe.

Figure 1 shows changes in m^* at the Fermi level for strongly doped InSb and HgTe. The green curve for $p = 0$ is common for both of them. The red points describe the increase in m^* with increasing pressure from 0 to 25 kbar for InSb, while the blue points show that for HgTe, the mass decreases with increasing pressure. For a pressure of 12.5 kbar, the conduction band takes the shape of a Dirac cone for which the energy depends linearly on the momentum $E \sim k$. This explained to us the previously incomprehensible differences between InSb and HgTe. It was the first experimental observation of the Dirac cone-like shape of the conduction band in semiconductors.

This result was obviously a great satisfaction for us. It was later a reference point for numerous works presented at the “Jaszowiec”, including many of ours from the Laboratory of Pressure Studies of Semiconductors of the IP PAS.

In 1972, the Laboratory was transformed into an independent Laboratory of High Pressure Physics and Technology UNIPRESS. This year, together with “Jaszowiec”, UNIPRESS is also celebrating its 50th anniversary. Participation in the Jaszowiec Conferences has always been very inspiring for us. Since 1985, at the special request of Professor Sosnowski, UNIPRESS has also had the honor to co-organize these conferences. In 1985, Professor Sosnowski was the Chairman of the Conference, and I was the Chairman of the Program Committee. In the following years, many UNIPRESS professors managed “Jaszowiec”, taking turns with representatives of other research centers.

The organization of the Conference in 1985 remains a vivid memory for me. “Jaszowiec” was already a serious international meeting, but my experience in this field was very small. Fortunately, Jacek Kossut, currently an important professor, Chairman of the Scientific Council of the IP PAS, was assigned to me as the Secretary of the Conference. He really saved me from stumbling

TABLE I

“Jaszowiec” School & Conference — spectacular development

“Jaszowiec” School & Conference	1985	2018
number of papers	87	177
number of Polish participating institutions	15	25
— including ones with 8 or more papers	2	7
number of foreign countries contributed to the Conference	8	23
— including ones with 5 or more papers	2	9

and embarrassment. When I spoke to him recently, he couldn’t remember it. But he told me a story that showed how complete the care of Professor Sosnowski was. Jacek, after a while, recalled that despite the fact that he was the Secretary, he did not participate in the Conference — at the last moment, he left for a one-year postdoctoral fellowship in the USA. He achieved a number of successes there, due to which he was invited to deliver a prestigious lecture at the 1986 Autumn Conference of the MRS. Unfortunately, the date of the Conference fell several months after the return date set by our Academy. Despite his best efforts, he was unable to postpone the deadline for his return. So he wrote a letter to Professor Sosnowski, asking for help and addressing him a bit like his father. In a week, everything was taken care of, and in a letter to Jacek, Professor Sosnowski wrote that he should come back immediately after MRS, because it was already necessary to start organizing the ICPS Conference, which was to be held in Warsaw in a year and a half.

This event took place shortly before the death of Professor Sosnowski, who passed away in November 1986. The solid foundations that the Conference already had then allowed it to continue to develop and play its important role in the Polish and international community of solid state physicists.

During these 50 years, since the professors: Witold Girit, Wiesław Wardzyński, and Józef Żmija took their first steps in the organization of “Jaszowiec”, the local Polish meeting turned into a prestigious international conference.

Table I shows the spectacular development of the Jaszowiec Conferences, as can be seen from the comparison of some numbers relating to the one from 1985 and the one that took place 33 years later, in 2018.

The number of publications presented doubled during that period, and at the same time, the number of Polish research centers participating in the Conference increased from 15 to 25. In 1985, the presented papers came mainly from IFD UW and IF PAS. The rest of the centers presented single works.



Fig. 2. Teacher's House – place of the first Jaszowiec Conferences.

In 2018, 5 new centers appeared that already have significant importance, and they were: Wrocław University of Science and Technology, University of Wrocław, University of Rzeszów, Warsaw University of Technology, and Institute of High Pressure Physics UNIPRESS.

The number of foreign countries from which works were presented increased from 8 to 23. In 1985, France and Germany were the main participants. In 2018, another 7 countries with a very significant contribution joined the Conference: USA, Japan, UK, Ukraine, Russia, Sweden, and Switzerland.

Observing the development of “Jaszowiec” during these several decades, you can see the great development of semiconductor physics in Poland and our role in the international semiconductor physics community.



Fig. 3. Jaszowiec 1973, in front of the Teachers House. From the right, Professors: Leonard Sosnowski, Wiesław Wardzyński, Józef Żmija, and Witold Giriat.

When I consider what enabled this systematic development and great success of “Jaszowiec”, what I see first is Sosnowski’s principle that “Physics is the most important” and that it is our common good, which we should preserve. A key role of this principle is in line with the great hundred-year tradition of “Hoża 69”, born in II Rzeczpospolita. Fortunately, despite turbulent times, this tradition has survived and is still alive among us.

Figure 2 shows the Teacher’s House in Jaszowiec — the site of the first Jaszowiec Conferences. Figure 3 shows a group of Conference participants in 1973.

This is where I finish my part. But UNIPRESS has also grown a lot during these 50 years. Professor Izabella Grzegory, who has been its director for the last 12 years, describes in the next paper of this issue what is the most important contribution UNIPRESS brought to the Physics of Semiconductors.