

NEWS ITEMS, BIBLIOGRAPHIC INFORMATION, PERSONALIA

CREATIVE WORK REGARDLESS OF OBSTACLES: THE UKRAINIAN PHYSICIST OLEKSANDR GOLDMANN (1884—1971)

O. PROSKURA¹

The authority of an investigator and the efficiency of his/her work depend on many social and ideological factors that often acquire the determinative importance in undemocratic states. This fact is proved by the life and scientific activity of the Ukrainian physicist Oleksandr Goldmann.

A Doctor of Philosophy of the Leipzig University and Academician of the AS of UkrSSR Professor Oleksandr Genrikhovich Goldmann was a prominent physicist and an organizer of the Ukrainian science. He was the first one who started to investigate semiconductors in Ukraine. He found the path to discoveries himself and, creating the corresponding conditions for the education of his disciples — students, postgraduates, and young colleagues — paved the way for new discoveries.

Let me tell you about the life course of my teacher. The proposed lecture is based on the analysis of the documents taken from the archives of the Presidium of the NAS of Ukraine, Central State archives of Civil Associations of Ukraine, the archives of Leipzig University, and materials from the private archives of O.G. Goldmann kept by his daughter Z.O. Shyolina before they were transferred to the Kyiv archive.

Oleksandr Goldmann was born on February 3, 1884 in the family of the certified doctor Genrikh Goldmann and his wife Zinaida, Borukhina in girlhood, in Warsaw which was a part of the Russian Empire at that time.

O.G. Goldmann received his primary education at home. In 1891, his parents moved to Ukraine, and in the autumn of 1892, he entered the 1st Kyiv gymnasium, where he completed the education and training with a school-leaving certificate and rewards: a gold medal and

a book "Iliad" by Homer. In the autumn of 1901, O.G. Goldmann started his education in the Saint Volodymyr Imperial University in Kyiv in the mathematical faculty of the physico-mathematical department. Here, he listened to the lectures and attended studies of mathematicians Bukreev and Grave, physicists De-Metz, Kosonogov, Mykhailenko, and Suslov as well as psychologist Chelpanov.

In the spring of 1905, O.G. Goldmann got a temporary vacation in the Kyiv University for the education in Germany and was taken in as a student of the Leipzig University where he took a decision to devote himself to physics. His teachers in Leipzig were Beckman, Böfger, Dams, des Coudres, Fredenhaffen, Hausdorff, Hölder, Marx, Scholl, Wiener. In Leipzig, Goldmann took an interest in physical chemistry and also studied under the Nobel's Prize Laureate W. Ostwald.

After the successful completion of his education in Kyiv and Leipzig universities, O.G. Goldmann had no possibility to work by speciality in Russia because of his Jewish origin. In order to obtain a job, he turned from the Judaic confession to the Christian Protestantism, but this change had no meaning for tsarist officials as, according to the legislative acts of that time, people of the Jewish origin were unable to freely work in universities. Thus, in 1911, O.G. Goldmann had to leave Kyiv. By the invitation of Prof. Otto Wiener, he moved to Leipzig and took up a post of an assistant in the university, where his creative possibilities were already well known, because he had defended his thesis for a Doctor's degree "Photoelectric investigations of sells

¹Lecture "Schaffen trotz Hindernisse: Der ukrainische Physiker Aleksander Goldmann (1884—1971) at the 69-th Conference "Physics after Einstein" of the German Physical Society", Berlin, on March 8, 2005.

with dyes" [1] with a grade "egregia" here. This thesis and the further publications [2, 3] on the nature of the Becquerel phenomenon laid the foundation of the current physics of photovoltaic processes. It's worth noting that the Becquerel phenomenon is considered to be the earliest discovered photovoltaic effect and consists in the appearance of the photoelectromotive force between two metal electrodes immersed into an electrolyte under the lighting of one of the electrodes.

Investigating the eosin dye, O.G. Goldmann established that the magnitude of a photocurrent, which is defined by the number of electrons released under the action of light, and the quantity of eosin decomposed under the action of light are proportional to the value of light energy absorbed by the dye. O.G. Goldmann also formulated an assumption that the action of light was concentrated on dye molecules. Thus, in 1908, O.G. Goldmann approached the current quantum formulation of the photochemical equivalence law proposed in 1908 by I. Stark and substantiated by A. Einstein in 1912 from the positions of thermodynamics. O.G. Goldmann demonstrated that the Becquerel phenomenon can be considered as an analog of the external photoelectric effect and explained it in accordance to the theory of light quanta by Einstein, who, in the "miracle-year" ("annus mirabilis") 1905 historical for physics, had substantiated the hypothesis of quanta in order to clarify the nature of photoemission.

After the beginning of the 1st World War in 1914, O.G. Goldmann had to leave Germany as a citizen of the hostile country and departed for Russia via Scandinavia. For some time, he worked in Petrograd at the Board of Weights and Measures, where he worked out a Russian standard of the unit of electric current intensity, and in the Polytechnic Institute.

In 1918, O.G. Goldmann returned to Kyiv. The situation in Ukraine and Russia after the October Revolution was chaotic. The civil war began. The father of O.G. Goldmann, a doctor, was killed by bandits in the settlement of Lebedyn directly in his consulting room. O.G. Goldmann intended to leave Kyiv where he had work for Petrograd but he was not able to do it because of the civil war and transport problems. That's why he stayed in Kyiv, where he initiated an active scientific and organizational activity.

In Kyiv, O.G. Goldmann proceeded with his investigations of photopolarization of solid dielectrics and semiconductors and reported the obtained results at the Kyiv Second Conference of the Association of Russian physicists in 1921. The investigations of

photopolarization performed by O.G. Goldmann laid the physical foundation of xerography.

In 1921, O.G. Goldmann got the Chair of Physics in the Kyiv Polytechnic Institute and organized a Physical research laboratory. The first post-graduates of O.G. Goldmann who started their scientific activity in this laboratory were L. Shtrum, P. Tartakovs'kyi, V. Lashkarev, V. Lynnyk, S. Gertsryken, and Yu. Yunyts'kyi. There also functioned a city scientific seminar on physics attached to the laboratory. Passing through various stages of evolution, the Physical laboratory developed into the Institute of Physics in 1929 (now — the Institute of Physics of the NASU). O.G. Goldmann was the founder of the Institute of Physics and its first director. With his direct assistance, original photoelectric investigations were performed in the Institute of Physics. On their basis, the semiconductor receivers of light, photocells being best in the USSR, were developed. For various needs, more than 250,000 photocells were produced in the Institute of Physics by 1970.

In 1929, O.G. Goldmann was elected to the AS UkrSSR. He was also elected a member of the Presidium of AS UkrSSR and became the Academician-Secretary of the Division of Mathematics and Natural Science. On the occasion of this election, Academician D.O. Grave published his considerations and conclusions on the research, educational, and organizational activity of O.G. Goldmann and emphasized that the whole community of young scientists and physics lecturers in Kyiv is a result of the intense work of O.G. Goldmann. To this estimation, one can add that, in the search of more favorable conditions for work, a significant part of disciples of O.G. Goldmann's scientific school left for Russian Federation, where new powerful research institutes were established after the revolution and the status of universities was preserved. Later on in Moscow, one of Goldmann's disciples Academician B.M. Vul told the author of this lecture about the respect that he and his colleagues had for their Kyiv teacher.

Under the conditions of totalitarianism, O.G. Goldmann remained a scientist with the honest civil position and courageous behavior. For example, at the Session of the AS USSR in Moscow in March of 1936, he was the first one in the history of the Soviet science who criticized the state's pseudopatriotic doctrine about a leading role of the soviet physics in the world science [4]. The official representative of this doctrine was the prominent physicist and an organizer of science A.F. Ioffe who headed the Physical group in the AS USSR. Under the tragic situation that was created in the

country and certainly concerned physicists as well, O.G. Goldmann dared to insist on the fact that the scientific results obtained in investigations should be so reliable and trustworthy that none would have possibility to object to them. In this connection, he criticized some scientific results of the activity of the Leningrad Physicotechnical Institute headed by A.F. Ioffe. O.G. Goldmann and A.F. Ioffe started a sharp discussion. The prominent Soviet physicists L.D. Landau, I.E. Tamm et al. maintained the courageous Ukrainian colleague. But soon afterwards O.G. Goldmann was arrested and accused of terrorism and antistate activity. The arrest of O.G. Goldmann took place in Kyiv on January 22, 1938 immediately after receiving the telegram with the corresponding sanction from the KGB Central Directorate. A week later, the resolution of the Presidium of the AS UkrSSR of 29.01.1938 deprived him of the academic status and all his posts on the ground of the arrest. During examinations, KGB officers cruelly tortured O.G. Goldmann, but he didn't acknowledge his guilt. This firmness possibly saved his life. Without a legal resolution, he was exiled to Kazakhstan for five years. The family of O.G. Goldmann had to leave the apartment in winter. Under these conditions, his son caught cold and died.

After the arrest of O.G. Goldmann, there took place a session of the Presidium of AS UkrSSR. At this session on June 4, 1938, A.F. Ioffe accused his Kyiv opponent O.G. Goldmann of the anti-Soviet activity. At that time, O.G. Goldmann, being already arrested, was under examination. O.G. Goldmann later noted that he owed his exile to A.F. Ioffe who lacked for civil courage.

Probably, it's worth describing, at least briefly, the historical situation formed in Ukraine at that time. Numerous accusations of people of antistate plots were nonrandom and characterized with a system approach. The regime in the republics of the Soviet Union and particularly in UkrSSR was based on terror. Executors of the orders made by the leader of the country Stalin had to respond obediently to his personal telegram of directive character of 2.01.1930, in which he demanded to accuse the Ukrainian literary critic Academician S.O. Efremov of terrorism. Local functionaries demonstrated their counteractivity in the realization of the organized fight against the national intellect. The arrest of O.G. Goldmann corresponded to the tragic statistics: in 1936–1938, 15 Ukrainian Academicians were arrested. A short time previously, the national church was crushed. The peasants who were the carriers and the source of Ukrainian culture suffered heavy losses: due to the hunger artificially organized in Ukraine, 6–8 million

peasants died in 1932–1933. The free world kept silence about this state terrorism. Concerning the concealment of the tragic situation in Ukraine by the West, the Doctor of Philosophy E.O. Sverstyuk expressed an opinion that such a relation of the world community to the famine in the Eastern Europe served as a peculiar permission for the Jewish holocaust in the Western Europe.

During his exile to Kazakhstan, O.G. Goldmann was allowed to teach at a secondary school of the town of Akmolinsk. In the exile, he seriously fell ill with pneumonia and recovered due to the nursing of his wife Elizaveta Pavlovna who urgently arrived to him.

All the documents of O.G. Goldmann were eliminated by the security service. In Akmolinsk, he attested his identity and status with the help of the book he kept by him, which included a group photograph of scientists, among whom there also was his picture. He managed to receive copies of the certificates of education and Doctor's degree from the archives of Leipzig University only after he had served his exile. Regardless of his repeated applications, O.G. Goldmann didn't obtain the manuscript of his paper (which is now unfortunately interesting only in historical respect) from the KGB archives on the depletion layer in semiconductors, which had been arrested along with his documents and working papers. Its timely publication in the thirties could leave behind the fundamentally important publications of W. Schottky.

O.G. Goldmann repeatedly petitioned the government for the revision of the groundless accusations against him. In his letter to the Attorney General of the USSR in 1945, he argued his request with the following words: "I know about myself that, under trying conditions, I voluntarily and readily gave all my knowledge and energy to the education of the scientific youth of our country, showed them the ways of science, and helped them to proceed to its tops. I know that, in spite of obstacles, I left behind a large research institute of physics, a new scientific manpower, and new scientific ideas that are developed further already without me". The applications of O.G. Goldmann remained unanswered.

O.G. Goldmann had no possibility to resume work in Ukraine after he had served his exile. In the summer of 1944, he and his family settled in the Russian town of Vologda situated not far from such large scientific centers as Moscow and Leningrad, which somehow could be conductive to his scientific activity. O.G. Goldmann began the first physical scientific investigations in Vologda and, heading the Chair of Physics of the

Vologda Pedagogical Institute, trained nine candidates of science among his graduates.

Though the security service in Vologda stopped keeping O.G. Goldmann under secret supervision as a “Ukrainian nationalist” and he was invited to Moscow to attend the Victory Parade in 1945, the National Academy of Sciences of the UkrSSR was not able to solve the problem of the renewal of his work in Kyiv. The corresponding application of the President of the AS USSR Academician S.I. Vavilov submitted in 1946 also gave no positive results. A real possibility to return to the Kyiv Institute of Physics appeared only in 1959, that is, three years after the rehabilitation resolution, according to which O.G. Goldmann was found not guilty of the incriminated crimes.

After his return to Kyiv, O.G. Goldmann aged 76 organized an electroluminescence laboratory, where he performed interesting experimental investigations with the assistance of the third generation of his disciples and obtained important results. He shared his first scientific results after his return to the Institute of Physics with Academician P.L. Kapitza, who visited O.G. Goldmann at the laboratory together with his son and had a many-hour conversation.

In his last laboratory, O.G. Goldmann first repeated the classical investigations by O. Losev with silicon carbide and those by G. Destriau with zinc sulfide. After that, he started experimental investigations with various luminescent and semiconductor materials prepared at the same laboratory.

In 1963, O.G. Goldmann began investigations of the Gudden-Pohl effect that manifested itself as a flash of light against the background of phosphorescence under the imposition of the electric field on an excited phosphor material. O.G. Goldmann established [5,6] that, in zinc-sulfide phosphor materials, this effect represented an optical indicator of the state of their photopolarization discovered as a physical phenomenon [7] in the investigation which he had performed in 1911 together with the Professor of Kyiv University S. Kalandyk. In the last years of his life, O.G. Goldmann discovered and fully investigated the phenomenon of commutation of the electric current in semiconductors, which was associated with the memorization of the electric and optical information and appeared to be conditioned with macrodistortions of the structure of crystals [8]. In his last laboratory, O.G. Goldmann had time to train eight candidates of science.

However, even many years after the arrest of O.G. Goldmann, the Soviet power didn't want to forget that

he had been punished according to the PCIA resolution and had insisted on his innocence of the incriminated crimes. That's why the proposition of the Institute of Physics to mark the labor activity of O.G. Goldmann with the State Order of the USSR on the occasion of his 80-th birthday was rejected.

In spite of the declining years and the overlived difficulties, O.G. Goldmann remained active and full of creative plans. But their realization was suddenly broken: after O.G. Goldmann had been knocked over by a militia car, he died on December 30, 1971 at a Kyiv hospital. The resolution of the staff meeting of the Institute of Physics about the perpetuation of the memory of O.G. Goldmann with a memorial tablet on the wall of the Institute he had founded was artificially hampered for a long time.

Since Ukraine has taken the path of the democratic development, the life of O.G. Goldmann as a prominent scientist and an organizer of science is investigated with the adequate estimation of his activity [9–11]. It is obvious that O.G. Goldmann worked regardless of the obstacles and, due to the tragic socio-political circumstances under conditions of the totalitarianism, was not able to completely realize his huge potential of an investigator, organizer, and teacher in science. However, the personality of O.G. Goldmann and his heritage remain an example of the devotion to the creative scientific work.

Oleksandr Goldmann was true to the precept of the King David: “Be strong and work!”

Thank you sincerely for the given opportunity to tell you about the prominent Ukrainian physicist.

1. A. Goldmann, Ann. Phys. **27**, 449 (1908).
2. A. Goldmann, J. Brodsky, Ann. Phys. **44**, 849 (1914).
3. A. Goldmann, Ann. Phys. **44**, 901 (1914).
4. A.G. Goldmann, Izv. AN SSSR, Ser. Fiz. 1, 63 (1936); 2, 224 (1936).
5. A.G. Goldmann, A.I. Proskura, Dokl. AN SSSR **150**, 519 (1963).
6. A.G. Goldmann, A.I. Proskura, S.F. Lysenko, Opt. Spektr. **19**, 943 (1965).
7. A.G. Goldmann, S. Kalandyk, Ann. Phys. **36**, 589 (1911).
8. A.G. Goldmann, G.A. Zhokhevich, *Stimulated Currents and Electroluminescence* (Naukova Dumka, Kyiv, 1972) (in Russian).
9. O. Proskura, Ukr. Fiz. Zh. **44**, 1536 (1999).
10. A.N. Glebova, Yu.A. Khramov, Science and Science of Science. 1–2, 104 (2000).
11. O. Proskura, Journ. Univers. Leipzig **6**, 31 (2002).