



## News &amp; Views

## The unfinished Nobel race of Eugene Zavoisky: to the 75th anniversary of EPR discovery

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On 21, January 2019 there will be 75 years when electron paramagnetic resonance (EPR) was discovered by Eugene (Yevgeny) Konstantinovich Zavoisky (Fig. 1) in 1944 in the USSR. This method has revolutionized the study of various physical, chemical and biological systems, and the importance of Zavoisky's discovery is acknowledged by the EPR scientific community all over the world. However, Zavoisky did not receive a Nobel Prize for this discovery he certainly deserved. This fact was (and is) often interpreted by his compatriots as a manifestation of the immanent bias of the Nobel Committee towards Russian scientists. The lack of profound scientific historical research related to Nobel Prizes in the USSR, particularly related to Zavoisky, largely and easily contributed to this attitude (widely shared belief).

This gap in knowledge was partially filled by the daughter of E. K. Zavoisky, N.E. Zavoiskaya [1], who gathered all the available information about the discovery of the EPR and its dissemination among the international scientific community, as well as the evidence for recognition of the discovery and priority of Zavoisky. That included both archive documents and personal memories of those taking part in those distant events (N. Bloembergen, R.V. Pound, J.S. Hyde, M. Packard, F. Bloch and others). Responses of American and European scientists show deep respect and admiration for his talent fully acknowledging the importance of the discovery. In the documents stored in Russia, reports of three nominations of Zavoisky to the Nobel Prize (in 1959, 1964, and 1976) by Soviet academicians were revealed. These unique historical materials, however, do not unveil the reasons for passing Zavoisky over with the Nobel Prize.

However, during 11 years since the book of Zavoiskaya was published, the Nobel Committee archive made the information about nominees and nominators till 1966 publically available. These data are impressive and obviously do not allow to suspect the Nobel Committee in any prejudice towards Russian scientists. On the contrary, they demonstrate deep respect for and attention to Zavoisky from the scientists outside the USSR.

The disclosed data show that Zavoisky was nominated every year since 1958 till at least 1966 (22 nominations in whole before 1966 including 2 in Chemistry and 20 in Physics; there are no

records on the latest period). Moreover, only 7 of them were made by Soviet scientists (in 1959, 1964 and 1966), and 15 belonged to scientists from Switzerland, Netherlands, Sweden, UK and DDR (for all 9 years since 1958 till 1966). Interestingly, European scientists mainly nominated Zavoisky alone, while the Soviet physicists mainly nominated him in tandem with somebody else (C. Gorter or B. Bleaney).

All the nominators are listed in Table S1 (online), as well as the co-nominees of Zavoisky, Nobel laureates and other famous nominees in the corresponding years. The most insistent nominators were L. Ružička and C. Gorter.

Cornelius Jacobus Gorter [2] (1907–1980), a Dutch physicist, was a pioneer in the experimental searching for magnetic resonance, and, to certain extent, a competitor to Zavoisky. However, he was always correct and generous, paying attention and interest to the efforts of Zavoisky working in the same field. When he learned about Zavoisky's works, he did not hesitate to insert a reference to his article in the proof-reading of his book [3], which had been already undergoing the publishing process. As it was already mentioned, later he repeatedly nominated Zavoisky to the Nobel Prize. From 1948–1966, he also nominated F. Bloch (with success), L. Néel and B.T. Matthias.

Leopold Ružička (1887–1976), a Swiss organic chemist of Croatian origin, was the Nobel laureate in Chemistry in 1939 (the main data concerning Nobel laureates given in the paper can be found on the website of the Nobel Committee, [www.nobelprize.org](http://www.nobelprize.org)). He was an active nominator with an exceptional perseverance and flair for the most essential works. He made at least 42 nominations till 1966 in Physics and Chemistry. Noteworthy, he proposed repeatedly almost all of his nominees until they (many of them) were finally awarded (e.g., R. Woodward, T. Reichstein, R. Robinson, W. Stanley, and others).

Here we will proceed to discussing the other nominators of Zavoisky.

Joseph Joshua Weiss (1905–1972) was a professor at the University of Newcastle-on-Tyne and specialized in radiation chemistry, including the interaction of free radicals with the biologically important molecules [4]. After his death in 1972, the Association for Radiation Research administered the Weiss Medal.

Rudolf Ritschl (1902–1982) was a director of the Institute of Optics and Spectroscopy of the German Academy of Sciences in

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**Fig. 1.** Eugene Konstantinovich Zavoisky (1907–1976). Source: Personal archive of N.E. Zavoiskaya.

Berlin in 1959–1967, and specialized in spectroscopy, particularly in Zeeman effect [5].

Erik Rudberg (1902–1980) was a chairman of the Nobel Committee for Physics in 1963–1972, later (in 1970–1972) he was the president of the European Physical Society [6].

The first Soviet nominator of Zavoisky was Ilya Mikhailovich Frank (1908–1990) in 1959. He was a 1959 Nobel laureate in Physics “for the discovery and the interpretation of the Cherenkov effect”. It is interesting that his uncle was the famous philosopher Semyon Lyudvigovich Frank [7].

Igor Yevgenyevich Tamm (1895–1971), Soviet theoretical physicist, shared the award with Frank in 1958. He was a teacher of S.A. Altshuler — a colleague and a friend of Zavoisky, who participated in the early works on searching EPR, and founded a scientific school in EPR spectroscopy in USSR in 1950s–1970s [8].

Nikolay Nikolayevich Semenov (1896–1986), a Nobel laureate in 1956 in Chemistry (together with C.N. Hinshelwood “for their researches into the mechanism of chemical reactions”). At the Institute of Chemical Physics in Moscow, which was headed by Semenov, the first studies on chemical radiospectroscopy in the USSR began and were developed further [8].

Alexander Mikhailovich Prokhorov (1916–2002), a Nobel laureate in 1964 “for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser principle”. He was one of the first in the USSR who, apart from the colleagues and disciples of Zavoisky, began to study the crystals with EPR spectroscopy and constructed the EPR-maser [9].

Anatoly Petrovich Alexandrov (1903–1994), Lev Andreevich Artsimovic (1909–1973), and Boris Pavlovich Konstantinov (1910–1969) were among the leaders of the Soviet science, specializing presumably in atomic energetics, controlled thermonuclear fusion, and plasma physics.

Data in Table S1 (online) may lead to certain conclusions.

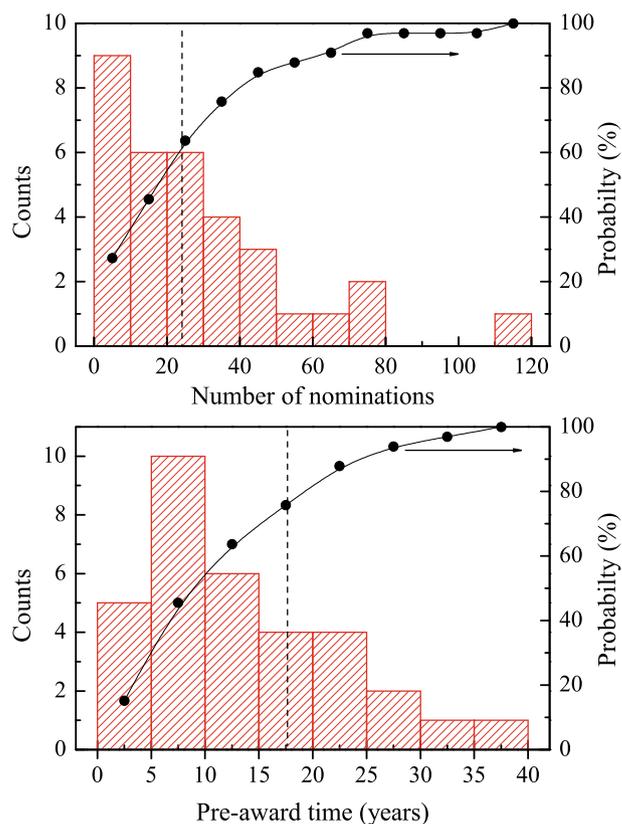
First, European scientists began to nominate Zavoisky earlier, and also did it more regularly than his compatriots did. This indicates their attention and respect for Russian science. Moreover, it seems that they revealed even greater respect and attention to the Soviet scientist than he received in the country.

Second, the data raise an interesting question: why the nomination of Zavoisky began in 1958? Though there is no reliable answer, it seems plausible that the impetus was made by the Lenin Prize in 1957 Zavoisky was awarded with. Probably it made the name of Zavoisky public, after ten years since his overt work on EPR. The main Soviet newspaper “Pravda” published the article by E.K. Zavoisky along with his portrait, showing to the European scien-

tific world that Zavoisky is a “real person”. Note that Gorter could not meet Zavoisky during his visit to USSR in 1956 due to security reasons [1]. In any case, the recognition of a scientist at homeland is necessary for world recognition, and the example of Zavoisky demonstrates it. This imposes a great responsibility on the compatriots for recognizing national scientists and their achievements as a prerequisite sometimes to further recognition by the international scientific community.

Third, the data in Table S1 (online) demonstrate how tough the competition for Nobel medals was at that time. It was a tough task indeed for Nobel Committee to choose among the candidates. Some of them (A. Abragam, N. Bloembergen, A. Kastler, A.W. Overhauser, J.H. van Vleck) had achievements in studying magnetic resonance. Note that W.F. Libby was awarded “for his method to use carbon-14 for age determination in archaeology, geology, geophysics, and other branches of science”, D.A. Glaser — for the invention of the bubble chamber, R.L. Mössbauer — “for his ... discovery ... of the effect which bears his name”. These methods shaped the development of science in the 20th century. The same can be said about other laureates. Besides, it is clearly seen that Zavoisky very often competed with his Soviet colleagues — they received Nobel Prizes regularly during this decade. This also excludes any political reasons behind passing him over.

Perhaps, the most real chance “to catch the train” for Zavoisky would have been in 1952 together with E.M. Purcell and F. Bloch. But it was the moment of the most severe “Iron Curtain” with complete isolation of the Soviet science from the world community. Probably, even if the Nobel Prize had been awarded to a Soviet scientist in 1952, it could have cost him a career, if not a life or freedom. The fate of Soviet poet B.L. Pasternak awarded with the Nobel



**Fig. 2.** (Color online) The distribution of pre-award time (i.e., the time from the first nomination of a person till the award) of the Nobel laureates nominated to the Nobel Prize in Physics or in Chemistry in 1958 together with Zavoisky. The number of nominations is underestimated due to the absence of disclosed data on nominations after 1966. The dashed vertical lines indicate the “position” of Zavoisky by the 1966 (number of nominations) or by 1976 (pre-award time).

Prize in a much more mild period of 1958, as well as prosecution of the biologists G.I. Roskin and N.G. Kliueva since 1947 for their scientific contacts with foreign colleagues, clearly demonstrate that this was a highly possible outcome.

The data from the Nomination Archive of the Nobel Committee show that receiving the Nobel Prize was possible for Zavoisky nevertheless. Lists of the Nobel nominees, only briefly mentioned in Table S1 (online), as well as in Fig. 2, show how long (up to decades!) the period of repeated nominations could be before they finally received (or did not receive) a well-deserved award.

Thus, H. Bethe, who competed with Zavoisky almost in all the years, waited the award for 24 years, being nominated 48 times; L. Onsager waited for 16 years after no less than 47 nominations, and L. Néel needed no less than 77 nominations during the forthcoming 18 years. Fig. 2 represents the pre-award times and the typical number of nominations for successful nominees for Nobel Prize in Physics and in Chemistry in 1958, when Zavoisky started his Nobel race. We may say that Zavoisky passed about two thirds or three quarters of the way. The respect of colleagues throughout the world which would be ready to nominate a scientist, as well as the long life of the latter should have greatly increased his chances of receiving a Nobel Prize. As it can be seen from the data presented, the first condition (the international acknowledgment) was met, while the second was not: Eugene Zavoisky unfortunately died in 1976.

#### Conflict of interest

The author declares that he has no conflict of interest.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.scib.2018.12.012>.

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Vasily Ptushenko obtained his Ph.D. degree in biophysics and ecology from the Lomonosov Moscow State University (Russia) in 2006. He developed the spin label method for studying photosynthesis. His present research focuses on bioenergetics of photosynthesis and stress tolerance of the photosynthetic apparatus. His interests include also the history of science, especially of magnetic resonance researches.