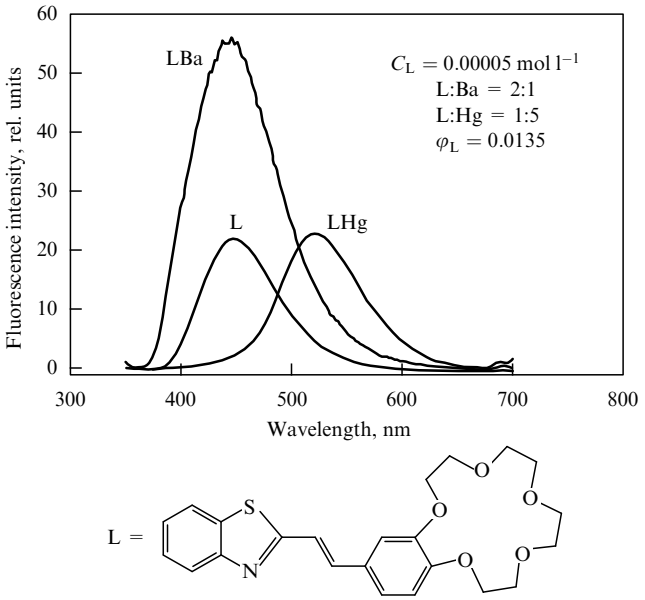

Figure 2. Fluorescence spectra of crown-containing styryl dye and its complexes with barium and mercury cations.

In the majority of dye solutions investigated, on addition of a metal salt to the solution a hypsochromic shift of absorption and fluorescence spectra occurs. In some cases, however, adding a metal salt to the solution results in the hypsochromic shift of the absorption spectrum, whereas the fluorescence spectra of the initial form of the dye and the complex coincide completely. The observed effect is attributed to the fact that the metal cation in these complexes moves, in the lifetime of excited electronic state, away from the heteroatom of the crown-ether fragment included in the conjugation chain (a recoordination occurs), and the dye fluorescence proceeds from the molecule structurally similar to the dye prior to the complex formation [12].

The dyes containing two similar complexing groups (crown-ether) or different complexing groups (crown-ether and a sulfoxyl, carboxyl group) form dye–cation complexes of composition 2:2 on addition of metal cations to the solution [13]. In this case, by varying the molecular structure and the cation dimension it is possible to finely control the complex stereostructure and change the mutual arrangement of the functional dye groups. For crown-containing styryl dyes, it has been possible to obtain stereostructures with both parallel and perpendicular arrangements of the double bonds of ethylene groups. In the complexes with a parallel arrangement of ethylene groups, during photolysis a photochemical reaction of cycloattachment proceeds with the formation of a cyclobutane ring out of two ethylene groups.

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Opening address

Yu S Osipov

Today we commemorate a remarkable date: the 110th anniversary of the birth of Academician Sergeĭ Ivanovich Vavilov — one of the outstanding physicists of the 20th century, a talented organizer of the science in our country, a public figure and a statesman, President of the USSR Academy of Sciences during the first post-war years.

S I Vavilov was born in Moscow on 24 March 1891. After graduating from the Moscow Commercial School in 1909, he entered the Physico-Mathematical Department of Moscow University. During his university years, Vavilov attended the seminars of and worked in the laboratory led by Professor P N Lebedev — the founder of the first major Russian school of physics. It was then that Sergeĭ Ivanovich took the general avenue of his investigations, and adopted the style and traditions of Lebedev's school. His attention was attracted by the fundamental questions of the nature of light and the light–matter interaction. That was the time when the first advances of quantum mechanics opened up the way for gaining a deeper insight into the nature of optical phenomena. S I Vavilov retained a prevailing interest in physical optics throughout his life in science.

After a brilliant graduation from Moscow University in 1914, he declined an invitation to stay at the university, which had been abandoned by the best professors. One month prior to the beginning of the First World War, Sergeĭ Ivanovich was called up for the army.

After his return from the front in 1918, S I Vavilov worked in the Physics and Biophysics Institute supervised by Academician P P Lazarev and lectured at Moscow University and other institutes of higher education in Moscow. He began with investigations into photochemistry and progressed to photoluminescence studies and physical optics in general.

In studying the photoluminescence of solutions of complex organic dye molecules, Vavilov and his students elucidated the principal laws of absorption and emission of light by complex molecules. In particular, the dependence of fluorescence yield on the wavelength of exciting light was determined, which has come to be known as the Vavilov law. In a series of investigations into the fluorescence polarization effect, he and his co-workers discovered the dependence of the

degree of polarization on the wavelength of exciting light. The mechanisms of luminescence quenching were elucidated and the processes responsible for the glow duration were examined in the investigations pursued by Vavilov and his students.

In the experiments staged in 1923, S I Vavilov and V L Levshin discovered the first nonlinear optical effect: the dependence of light absorption in a medium on the light intensity. After the advent of lasers, since the 1960s, nonlinear optics would make rapid strides; the term 'nonlinear optics' itself was proposed by Vavilov.

In 1931, S I Vavilov was elected a Corresponding Member of the USSR Academy of Sciences, and in 1932 a Full Member and appointed the scientific supervisor of the State Optical Institute (GOI in Russ. abbr.), which now bears his name. In the institute, a start was made on investigations into a wide variety of optical problems ranging from producing optical glass and devising optical instruments to the basic problems of physical optics. As the scientific supervisor of the GOI, Vavilov fostered a rapid build-up of the home optical industry.

Also in 1932 S I Vavilov took charge of the Physics Institute of the USSR Academy of Sciences (FIAN in Russ. abbr.), which was established on the basis of the small Physics Department of the Physicomathematical Institute of the Academy of Sciences. On S I Vavilov's initiative, this institute was later named after P N Lebedev.

Continuing the research into the properties of elementary radiators, S I Vavilov and his collaborators performed in 1932–1941 a series of investigations into quantum fluctuations of light using visual techniques. He confirmed the intermittence of light emission by molecules, atoms, and electrons. What is more, he established the statistical character of fluctuations consistent with the notions of quantum theory and gave proof to the significance of the role of quantum fluctuations in the physiology of vision.

The visual technique of recording low light fluxes played a large role in the discovery of the Vavilov–Cherenkov effect. S I Vavilov set P A Cherenkov, his post-graduate student, the task of elucidating to what extent the luminescence properties of uranyl salt solution exposed to gamma rays coincide with the previously studied luminescence under light and X-ray irradiation. In the course of these investigations Cherenkov found that a glow is exhibited not only by the salt solution, but by pure water as well. Vavilov recognized a new phenomenon in the fact. It is well known that the theory of this phenomenon was constructed by I E Tamm and I M Frank. In 1946, S I Vavilov, P A Cherenkov, I E Tamm, and I M Frank were awarded a State Prize of First Class; in 1958, after the decease of Sergeĭ Ivanovich, the remaining participants of this work were awarded the Nobel Prize for Physics.

The results of the nearly 30-year long investigations of S I Vavilov in the field of quantum fluctuations and interference effects were summarized in his last monograph entitled *Microstructure of Light* (1950).

S I Vavilov's scientific activity was characterized by exceptional purposefulness. The themes of his work were never accidental; in one way or another all of them were related to the common line of research – cognition of the nature of light.

At the same time, along with treating purely scientific problems Sergeĭ Ivanovich always sought for a practical outcome of the results he obtained. There is no escape from mentioning the applications of luminescence. As early as the 1920s, S I Vavilov pioneered the work on the development of basically new and economical light sources — luminescent lamps. In May 1941, a decision was made to organize their mass production. Because of the beginning of the war, the production of luminescent light sources in our country did not commence until the first post-war years. Vavilov and his collaborators made a large contribution to the development of techniques of luminescent analysis.

S I Vavilov would not have been able to do everything he achieved in science were it not for his amazing capacity for work and, most importantly, were he not always surrounded by students. The most significant result of Sergeĭ Ivanovich's activity is the foundation of the biggest school of science in physical optics.

The influence of Vavilov and his scientific school is traced in the accomplishments of his disciples and companions-in-research — primarily in the origination and brilliant advancement of quantum electronics in FIAN. It is by no means a mere coincidence that Raman scattering in crystals was discovered by scientists related to S I Vavilov.

Sergeĭ Ivanovich combined thorough experimental investigations of physical phenomena with broad theoretical generalizations. He was also interested in general physical problems; he placed strong emphasis on the experimental substantiation of the principles of new physics. To exemplify, in 1928 Vavilov published a book entitled *Experimental Foundations of the Theory of Relativity*, which provided the systematic presentation and analysis of experimental facts underlying Einstein's relativity theory. And that was at the time when not all scientists, including the scientists of our country, had adopted this theory.

He displayed a great interest in the history and philosophy of science. Numerous articles and books written by S I Vavilov were concerned with the history of physics in the Russian Academy of Sciences, the activity of M V Lomonosov, the papers in optics by Newton, Galileo, and Euler, and the physics of Lucretius. In 1943, he wrote I Newton's scientific biography in commemoration of his 300-year anniversary. During his last years, Vavilov wrote a series of articles and brochures on the history of national science during the Soviet period. From 1935 through 1950, S I Vavilov wrote several papers on the philosophical problems of contemporary physics. He initiated the establishment of the journal *Voprosy Filosofii* (Philosophical Problems) (1947) and became the member of its Editorial Board.

It was typical of S I Vavilov to endeavor to make the accomplishments of science widely known to the public. He gave much attention to the popularization of the findings of scientific investigations. To him belong such examples of popular-scientific literature as *The Action of Light* (1922), *The Eye and the Sun* (1927), *On 'Warm' Light and 'Cold' Light* (1949), and the papers on the history of physics mentioned above. S I Vavilov wrote, translated, and edited a great deal of articles and books intended not only for experts, but for the mass reader as well. With a knowledge of Latin and several European languages, he translated into Russian Newton's *Optics* and *Lectures on Optics* and also Lucretius's poem *On the Nature of Things*.

Soon after the end of the war, Sergeĭ Ivanovich came to be one of those who pioneered the establishment of the All-Union Society for the Dissemination of Political and Scientific Knowledge [presently the 'Znanie' (Knowledge) Society] and the first Chairman of the Society.

In 1949, S I Vavilov was appointed Chief Editor of the 2nd edition of the Big Soviet Encyclopedia. He appraised the responsibility resting on the Chief Editor and set the task to broadly cover the achievements of the USSR in the realms of industry, culture, science, and arts. He used to personally edit articles and read proofs.

A few words follow about Vavilov's influence on the publishing activity of the Academy of Sciences. Upon taking charge of the Editorial-Publishing Council of the USSR Academy of Sciences, Sergeĭ Ivanovich extended the publishing activity of the Academy and brought it up to a higher standard. On his initiative the series of the editions "Classics of Science", "Literary Monuments", "Scientific Heritage", etc. were launched. Sergeĭ Ivanovich was the Chief Editor of the edition *Materials for the Bibliography of Scientists*, the Editor-in-Chief of several journals, including *Doklady Akademii Nauk SSSR*, *Priroda* (Nature) and *Zhurnal Experimental'noĭ i Teoreticheskoĭ Fiziki* (*JETP*).

S I Vavilov attached much importance to the education of his scientific successors. He combined work in research institutions with educational activity in Moscow State University and the Moscow Higher Technical School (presently the Bauman State Technical University). He believed it absolutely indispensable for university students to perform their degree work at academic institutions.

Vavilov always showed concern for improving the standards of higher education. An example of the practical realization of the idea to unite academic science with the higher school is the joint Colloquium of FIAN and the Physics Department of Moscow State University, which was organized on his initiative in late 1945.

Sergeĭ Ivanovich placed special emphasis on drawing in young people to scientific institutions, on enlarging and refining the training of scientific personnel of highest qualification via post-graduate study not only for the USSR Academy of Sciences, but for the National Republics of the Union as well.

The many-sided activity of S I Vavilov was successful largely because he was exceptionally gifted as a science administrator. His work of organization expanded widely after election to the Academy of Sciences, beginning with work in the GOI and FIAN, and especially after he was elected a member of the Presidium of the USSR Academy of Sciences in 1935.

He was engaged in organizational activities when working continuously as the Director of FIAN which in a short period turned into the largest, leading physics institute of our country. The FIAN subdivisions underlay the establishment of over ten independent scientific institutions. I believe we will hear more about this in the speeches with recollections of Sergeĭ Ivanovich. I will emphasize only one point. Almost since the establishment of FIAN when the scientific profile of the institute was being formed, Vavilov sought to set up research on fundamental physical problems — first and foremost on nuclear and elementary particle physics. The scientific foundation was thereby laid for the solution of the atomic problem during the post-war years. This was yet another manifestation of the amazing foresight and intuition of the scientist.

During the Great Patriotic War (1941 – 1945), S I Vavilov continued to supervise FIAN and the GOI, aiming them at the solution of defense-oriented scientific problems. Since 1943 to the end of the war, he was a commissioner of the State Defense Committee.

Academician S I Vavilov's election to the President of the Academy of Sciences on 17 July 1945 became the summit of his fruitful organizational activity. His immense scientific prestige, the trust of the country's leaders, and the deep respect of the leading scientists allowed him to organize the work of the Academy of Sciences in such a way that the Academy managed to fulfil the primary tasks set and to afford the rapid development of academic science in the country.

A better candidature for this post was hard to imagine, for it called for excellent personal qualities, a deep comprehension of the problems facing science and the specific features of the scientific work, an administrative talent and high capacity for work, adherence to hallowed traditions of a native science and an unfailing concern for the future of science. Sergeĭ Ivanovich possessed all these qualities in full measure.

S I Vavilov took charge of the Academy in the period of high spirits in the country, following the victory in the war. A rehabilitation of the national economy on the basis of accomplishments of science and technology lay ahead. A deep imprint on the post-war decades was made by the 'cold' war that had commenced. The country was facing complex scientific and engineering problems — first and foremost the problem of harnessing the energy of the atomic nucleus. All this called for launching basic and applied research along several new avenues of investigation, including the pursuance of the research in the Academy of Sciences.

Out of the diversity of scientific administrative issues of academy activity, S I Vavilov placed special emphasis on the planning of research work, the organization of scientific research in the union republics, the rehabilitation of academic institutions ravaged by the war, the structural transformations in the system of the USSR Academy of Sciences, and scientific instrument making. He also emphasized the necessity of assisting the industry in its renewal on the basis of new technology.

S I Vavilov recognized clearly that the Academy of Sciences should not be opposed to the higher school or branch association of institutions as competitors of a sort. He stressed that "the Academy of Sciences is the necessary complement of the higher school and special institutes. Only with concerted, coordinated, and combined efforts of these three links of the scientific research network can we hope to accomplish the great and exciting tasks we are facing".

An outstanding scientist and organizer, Vavilov contributed to the solution of the then most significant scientific and engineering problems related to the harnessing of nuclear energy and the development of rocket technology. It was in these years that our country put into operation the first nuclear reactor in our country and in Europe (1946) and conducted a nuclear weapon test (1949). A special Scientific Council was established by the Presidium of the Academy, whose task was the dissemination of the methods of nuclear physics in different branches of science and engineering; Sergeĭ Ivanovich took charge of the council. Also established was a special Space Commission attached to the Presidium of the Academy.

Work was continued to establish academies of science in the union republics and branches in different regions of the country. In 1945, on S I Vavilov's initiative the Government established the Council on the Coordination of the Scientific Activities of the Academies of Sciences of Union Republics, attached to the USSR Academy of Sciences.

The years of S I Vavilov's presidency (1945 – 1950) saw the structural transformation of several academic institutions, the rehabilitation of observatories and laboratories ravaged during the war, and the establishment of new institutes, including the Institute for History of the Natural Sciences and Technology, which now bears the name of S I Vavilov.

All aspects of S I Vavilov's activity as an Academy President are hard to cover in the context of this presentation.

I cannot help mentioning the following, probably little known, fact. In 1946, on the initiative of S I Vavilov, the traditional annual meetings of the Academy of Sciences (on the 2nd of February) were resumed in the form which still persists now. Since then, the annual sessions of the General Meeting have commenced with the opening speech of the Academy President which gives a brief review of the scientific accomplishments over the year elapsed.

During the post-war period, S I Vavilov devoted considerable effort to the resumption and development of the international scientific relations of the Academy of Sciences. This was vital to emerge from the international isolation in which the Academy had found itself during the pre-war and war-time years.

S I Vavilov was well known abroad. He was elected an honorary member of several foreign academies of sciences.

All these facts demonstrate how much larger and stronger the Academy became under the supervision of Sergeĭ Ivanovich. And he was its President for only five and a half years!

His many-sided scientific and administrative work in the Academy of Sciences was combined with active participation in the public life of our country.

However, it is invalid to say that the advancement of science in the country and the Academy life were void of conflicts and contradictions during S I Vavilov's presidency. The aggravation of ideological war after the onset of the cold war had an extremely negative effect on the development of several branches of science, first and foremost biology. Before long, the ideological campaign embraced other branches, too: physiology, cybernetics, and economics. There followed administrative measures. Several scientific institutions and scientific journals were either closed or reorganized. Similar events were about to occur in physics.

In view of the circumstances, S I Vavilov had to withstand the intrusion of ideological dictate into the realm of scientific activity and to display enormous self-restraint to eliminate the destructive consequences of this intrusion. An amazing willpower, his prestige, and of course a deep knowledge of philosophy and specific sciences allowed him to avert, with support from other leading scientists, a terrible disaster, and thereby save the physical sciences from a pogrom similar to that which biology had been subjected to. And not only the physical sciences.

All that S I Vavilov did for science, the Academy of Sciences, the country, and all his enormous scientific, enlightening, administrative, public, and state activities can be termed in no other way than a heroic feat. This feat could only be accomplished by an encyclopedist, a personality of high cultural and moral standards, a person to whom the interests of his native land came first.

Those who knew Sergeĭ Ivanovich would speak of the fascination of this man, of his tactfulness, responsiveness, and diligence.

The great labor, the arrest and decease of his brother, and the death of his nephew had a grave effect on his health. He suffered from several heart attacks and died of myocardium infarct on the night of 25 January 1951, precisely half a century ago. Sergeĭ Ivanovich was buried in the Novodevich'e cemetery in Moscow.

I never had the honor to personally witness Vavilov's activity, so to say, 'in real time'. In the preparation for this meeting, I looked through many articles and collected memoirs of Sergeĭ Ivanovich's disciples and comrades, and several of his articles and books. Most striking is the great scale of this man's personality, who did so much for our country and our Academy.

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About Sergeĭ Ivanovich Vavilov

V L Ginzburg

My speech is nothing more than several remarks, and rather odd ones at that. I only hope that these remarks will be not without interest and to some extent complement the in-depth analysis inherent in E L Feĭnberg's articles [1] and his speech to this audience.

Sergeĭ Ivanovich Vavilov was the Director of FIAN from its inception in 1932 up to his decease in 1951. As for me, I have been working at this institute since 1940, but in actuality I have been related to FIAN for a longer time (approximately since 1938). The institute was small at that time (about 200 staff members), and the Director's activity was generally transparent to all staff members. Furthermore, some issues I was concerned with interested Sergeĭ Ivanovich, though I recall only one scientific discussion with him. One day, which was before the war, Sergeĭ Ivanovich asked me to what extent the acceleration of a Vavilov – Cherenkov radiation source could be neglected — for such an acceleration was seemingly inevitable due to the radiation loss. I gave the correct answer: the acceleration is generally insignificant, which follows from calculations neglecting the acceleration. However, later I gave some more thought to the issue and grasped the heart of the matter without any computations. First, it is possible to compensate for the source (then, as well as today, an electron was usually referred to) acceleration, say, by an external electric field. Second, if the source mass is large enough, the effect of radiation, which is responsible for the variation of the source velocity, can always be treated as being arbitrarily small. In other words, the source velocity can be quite legitimately considered to be given and, in particular, constant. I also note that Sergeĭ Ivanovich was to some extent familiar with my work in other fields as well, for he communicated about ten of my papers to *Dokl. Akad. Nauk SSSR* from 1940 to 1946.

I noted this incidentally, for I am not going to discuss physics today. I would like to touch upon other aspects and appraisals of Sergeĭ Ivanovich's activity.

Among these there are found some distinctly negative appraisals concerning both Sergeĭ Ivanovich's scientific level and accomplishments in physics and the political attitude he assumed. There exists an opinion that we may either speak highly of those gone or not speak at all (de mortuis aut bene aut nihil). This viewpoint is acceptable when we are dealing with an epitaph or even with an obituary. But after a long