"There is the Scientific Council and the Wednesday seminar. That will do"

M P Ryutova

Foreword

At one of the meetings of the Scientific Council of the Institute of Physical Problems there was an item on the agenda 'Scientific information', which few were bothered with. The meeting was started, as always, by Petr Leonidovich. He fitted his remarks into the three minutes allotted to this topic and said that nobody was following the literature. Researchers were stewing in their own juices. They were concentrating on their own work and not following the general trends in science. "When a speaker has to be replaced suddenly at a seminar, nobody is capable of preparing a talk there and then", said Petr Leonidovich. "The following measures are therefore proposed. Every two months all the laboratory heads will list the major work in their field. From these lists it will be possible to select something for a presentation. Reviews on helium can be made by Peshkov, on superconductivity by Shal'nikov, theoretical ones by Landau, on antiferromagnetism and ferromagnetism by Borovik-Romanov, on galvanomagnetic effects by Alekseevskii, and on thermal effects by Strelkov. Are there are any objections or suggestions?" Strelkov proposed to restart the old tradition of a cryogenic seminar.

Kapitza objected: "There is the Scientific Council and the Wednesday seminar. That will do".

This was in the midfifties: Strelkov was still at the Institute and Landau was still responsible for the whole of theoretical physics.

All those who knew Kapitza's Wednesday seminar remembered that a presentation at this seminar brought instantaneous respect to the speaker. In addition to respect, for some this was salvation and for many it determined their fate. Back in 1944 the following report appeared in *Vestnik Ak ademii Nauk*: "From the day of foundation of the Institute of Physical Problems, a scientific seminar has been held there and it has been led by Academician P L Kapitza. Initially the seminar has been limited primarily to problems in low-temperature physics and galvanomagnetic effects. The seminar has been a forum mainly for the researchers at the Institute reporting planned

Received 15 April 1994 Uspekhi Fizicheskikh Nauk **164** (12) 1319–1340 (1994) Translated by A Tybulewicz, revised by the author or performed work, as well as reviews of the current foreign literature

"Gradually ... this seminar has begun to attract researchers from scientific establishments not only in Moscow, but also those in other cities of the Soviet Union Only in the last year, starting from July-August 1943 [at the time of the deadly war!], there have been 40 sessions of this seminar. The very wide range of the topics considered there makes it necessary to limit their account to a simple list and a brief precis of the most interesting of them.

"On 28 July 1943 the 176th session of the seminar was held. Prof. M O Kornfel'd spoke on the physical basis of rational design of automobile tyres." The *Vestnik* report then gives the promised "list and brief outline" of papers presented by I K Kikoin, L D Landau, L F Vereshchagin, K D Sinel'nikov, S A Vekshinskii (an engineer at the Moscow Electric Lamp Factory), E M Lifshitz, P P Kobeko, N N Semenov, once more L D Landau and again L D Landau, G I Pokrovskii (investigations of directed explosions), Yu B Khariton (several papers on detonation), O E Vlasov (applications of gas dynamics to explosions), V A Tsukerman, postgraduate student at the Institute of Physical Problems, V P Peshkov, and Academician O Y Shmidt (formation of the Earth and planets).

In this way the Wednesday seminar had long ceased to be the 'internal affair' of the Institute. The fact that Petr Leonidovich regarded the Scientific Council as equally important as the Wednesday seminar simply meant that the Scientific Council was an equally important place for 'the exchange of scientific information'.

This indeed was true.

No matter what the topic of a session of the Scientific Council, the last item on the agenda was constant: 'Papers for publication'. This item was there even if the Scientific Council was devoted to such a happy event as the fiftieth birthday of Landau.[†]

The whole Institute gathered at a session of the Scientific Council, in the same way as a good patriarchal family gathers on special days. All that occurred at the Council was the concern of everybody: the directorate, researchers, postgraduate students, undergraduate students, those on a practical course at the Institute, and those on a temporary posting.

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[†]This necessary item linked everybody's scientific interests and concerns—each success or failure had to be shared with all. And, of course, a paper approved for submission was never rejected.

Scientific journals usually paid a fee to the author and to the referee. (MR - this and all the other footnotes by the author were prepared specially for the English edition.)

As in a patriarchal family, the business was conducted by the head of the family: calmly, simply, and wisely. The simplicity and clarity with which Petr Leonidovich spoke on every subject, whether this was the scientific content or was about the cleanliness of the Dewars in the laboratories, established a benchmark at the Institute which was used to determine the scale of importance and ethics for all those present. I would like to describe these 'family' councils. I would not wish to conclude my story by simply recounting what I said at the Council but use these primary resources to show how things happened. Fortunately, the sessions of the Scientific Council (when theses were defended) were recorded by shorthand.[†] Moreover, the Secretary of the Scientific Council recorded the minutes of all the sessions. During the time that I shall deal with, the Secretary of the Council was Aleksei Alekseevich Abrikosov. He did not record the proceedings literally, but added some bright words to amuse those present: a session usually began with the reading of the minutes of the previous Council and voting on whether the minutes were correct. Aleksei Alekseevich brought artistry to his job. In this way the Councils usually began with merriment.

The suggestion that I should describe the Scientific Council sessions was unexpected and was actually put forward by Kapitza's widow. Anna Alekseevna Kapitza invited me to her home and asked to talk simply about Petr Leonidovich. In this way she met many people and recorded all these meetings. We talked for a long time, recalled the celebration of the seventieth birthday of Petr Leonidovich in 1964, and Anna Alekseevna asked me to write something for the birth centenary, in particular, to describe - if possible - the birthday meeting of the Council in 1964. The show which we arranged for this Council was liked so much by everybody that soon after we were asked to give another show at the Lebedev Physics Institute on the seventieth birthday of Igor Evgen'evich -Tamm. At the Lebedev Institute our show was a complete flop, but nevertheless everybody was merry.

The suggestion of Anna Alekseevna was too demanding for me. For several days I thought only about how to write about Petr Leonidovich and the Institute, how to put on paper my feelings and experiences of a young graduate student. As usually happens, each time all I would come up with were some hazy scraps. And, above all, just at that time I met Isaak Marovich Khalatnikov in Moscow. He saw me at the Institute and, as if we had parted only yesterday (and we had not seen each other for two years), he said: "Oh, hi, Ritka, you are writing already about Kapitza?"----and not even pausing for a reply, he ended with: "And what will you actually write? As for me, I know exactly what I shall write, and I shall write it well. Because I have a *concept* !" I then lost all courage. I had no concept. All that I had were my remarkable years at the Institute at Fizproblemy, an unbounded love for the place, a simple feeling that one was at the centre of creation, and that here at the centre of the Universe everything was the best: the best experimentalists, the best theoreticians, the best technicians working in glass and iron, the best librar-

[†]Only the defence of the theses was recorded by a professional stenographer. All the other sessions, including celebrations and discussions of scientific papers, were recorded by A A Abrikosov. He usually did it 'on his knee', but unbelievably accurately, although sometimes also with some malice. (*Note by P E Rubinin.*)

ians, the best tables and chairs in the library. And naturally the best Conference Hall, famed by those who lectured there. There was a cosy entrance hall in front of it. It was connected by a short corridor to another very bright hall, a place where everybody came with their needs and where calm and confidence reigned. This was the soul of the Institute; the hall had two doors: the door to the left led to the study of Petr Leonidovich and that to the right to the study of Malkov. In front of the door on the left, behind a large table, sat Petr Leonidovich's manager, Pavel Evgen'evich Rubinin. He inspired us with the simple feelings of safety and benevolence to this world. Lyuba Pogodina sat opposite the door to Malkov's study. Her function was that of a secretary, but Lyuba did everything. She typed our papers. She smoothed the rough language of the young to such an extent that she acquired the reputation that not only could she correct all our errors and improve our style, but she could correct even our scientific results if they were wrong. Pavel Evgen'evich regularly arranged exhibitions in our corridor and hall, as well as poets' evenings in our conference room. Those were events that people at the time [when Krushchev stamping his feet closed in blind fury the art exhibition in Manezh] did not even dare to dream about. The whole of Moscow came to these exhibitions because the entry to the Institute was free and was never guarded. Pavel Evgen'evich arranged exhibitions of Russian artists of worldwide renown [like Kandinsky and Serebryakova], whose pictures were immured in the storerooms of our museums or were carefully kept in private collections. He also found totally unknown artists and poets, whom we admired and who later became famous, usually after major ordeals. For example, we had an evening of poetry by Brodskii‡ at the time when he was sought by government agencies as a malicious parasite. But we read and knew by heart his poems, which Pavel Evgen'evich typed and placed among the new journals on a large table in the library. The head of the unavoidable First Division [concerned with state security], the always smiling Elena Vyacheslavovna, was our best friend, chief helper in all matters. We went to her to ask for translations of papers from German and French. We asked her to get us theatre tickets. We wanted to know how to get rid of a high temperature in one night, and we maintained a legend that she was a KGB colonel in retirement and a former famous spy, and that she would have been a general had it not been for the failure of some operation in an Eastern country.

The best scientific journal in the country, Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki (JETP in English translation), was a part of the Institute: it occupied the left wing of the main building, its editor was Petr Leonidovich and the journal was managed by Evgenii Mikhailovich Lifshitz who read and examined every paper submitted to the journal. It seemed natural when many years later one famous American physicist said in front of me "You have done a good job and you are very proud of it, and you have received a good grant of money for it. Now open up JETP of ten years ago and you can see that this work was done much better a long time ago by the Russians and what is more, it was done correctly."

My friend, Lyalya Chernikova, was in my eyes the most beautiful girl in Moscow. The place where the Institute was

‡Exiled from Russia—later Nobel Prize winner. (MR)

built was also the best in Moscow. Its position was selected by Petr Leonidovich himself and in a paper at a session of the Academy of Sciences in 1937 he explained in detail his choice: "To the left of the Institute there is the Neskuchnyi Orchard, to the right there is also a park;[†] on one side or the other the area will never be built up ... and the Institute will always remain isolated." In this respect Petr Leonidovich, unfortunately, was proved wrong; the Presidium of the Academy of Sciences, accustomed from time immemorial to hold its general meetings, sessions, and elections of the Division of General Physics and Astronomy in the modest conference hall of the Institute of Physical Problems, decided finally to chop off part of the land of the Institute and to construct there a new Presidium building. It took a long time to do this. And even a simple description of the outcome would be humiliating. An old Institute dog Vovka still sometimes runs along the fence and barks at the edifice.

Our brood of diploma and PhD students was very large, compared with the usual numbers at the Kapitza Institute. The vast majority of students and young reseach assistants were 'fiztekhi' (students who graduated from the famous Institute of Physics and Technology in Dolgoprudnyi, Moscow — Sasha Andreev, Sanya Parshin, Yura Anufriev, Igor' Fomin, Valera Edel'man, Gena Bogomolov, Zhenya Kosarev, Edik Tishchenko, Lev Luganskii, Mezhov-Deglin, Petya Kondratenko, and Yura Tsipenyuk. There were other youngsters there, but those listed above (with the exception of two people) are today working at the Institute. This is a unique case. Right from the beginning Petr Leonidovich instituted a simple rule: a youngster, admitted by the Institute for postgraduate studies, always completed them successfully and defended his doctoral thesis in time (sometimes ahead of time). He or she then had to leave the Institute. Petr Leonidovich himself helped with the arrangements. However, this was not the end of his care. If a youngster wanted to work longer at the Institute, the conditions were provided for this. Petr Leonidovich then talked to the director of the institute where the young man or woman was a member of staff, t so that only the salary would come from that institute and the scientific work will be continued at the Institute of Physical Problems. Directors of other institutes agreed to this. Thus a young person would join the staff of the Institute in exceptionally few cases. However, in our stream the majority remained at the Institute. Sasha Andreev, whom Petr Leonidovich left directly at the Institute, is now Director, Sanya Parshin and Lev Luganskii are his deputies. However, then, in the early sixties, when we filled the back rows in the Scientific Council room, we didn't feel the difference between us and those who were sitting in the front rows. Moreover, we had an advantage of the kind that spoiled and loved children have in a family. In contrast, members of the Council could be punished. For example, they could not be late for a session of the Scientific Council.

†Gorky Park; actually Neskuchnyi, Gorky Park, and the park where the Institute was built form a chain of an old Moscow forest along the Moscow river. (MR)

[‡]This is a clear exaggeration: P L did not object to anybody working at the Institute of Physical Problems, but the interested persons and their supervisors at the Institute (for example, M S Khaikin) had to take the initiative and arrange everything. In necessary cases, P L would telephone the director of an institute with his words of support. (*Note by P E Rubinin.*) If this happened, it was not left unnoticed. I recall how once Ivan Vasil'evich Obreimov, who from our point of view was an ancient oldster, appeared in the hall slightly late and, barely coping with shortness of breath, was trotting and shouting at the same time: "Petya, Petya, look, your clock is fast!" Petr Leonidovich answered: "Do not make up things, Vanya, the clock is in order. You are two minutes late and you will work today on the Accounts Committee."

The Scientific Councils were held at the Institute on Tuesdays, once every two weeks, and were rigorously organised. The session started exactly at ten o'clock in the morning and ended exactly at noon. By ten o'clock on these Tuesdays people had arrived at the Institute from other Moscow institutes and laboratories and also from other cities. Entry to the Institute was free. There was no security guard to the second floor of the main building, where the conference room was located, as well as to the Directorate, the First Division, the Personnel Division, and to the theoreticians. The only corridor on the second floor, turning immediately left from the stairs leading to the conference room, filled with people as ten o'clock approached. People were walking to and fro and talking quietly. In the entrance hall, in front of the conference room, they also walked and talked. Sometimes they collected in groups, but mostly they mingled. By ten o'clock this quiet walking and talking ended abruptly and all entered the conference room. At one minute to ten Petr Leonidovich came directly onto the stage, which was raised above the level of the conference room and which had a door to the left of those sitting in the hall. One minute precisely was sufficient for Petr Leonidovich to cross the whole stage, reach a chair which was on the right, to sit down, get settled, look over everybody in the room, and to open the session at ten o'clock exactly. This is how the Scientific Council of the Institute began.§

Scientific Councils

The session of the Scientific Council on 23 June 1955 was exceptional. It took place in a different location. This was the first Scientific Council after almost a decade of Petr Leonidovich's voluntary exile in Nikolina Gora.¶ By that time, over twenty years had passed when in the autumn of 1934 he found himself with a different life, filled with a continuous fight for science, people, and truth.

"... When over a year ago I was unexpectedly detained and harshly interrupted at a very interesting stage of my scientific work, my life was very difficult (wrote Petr Leonidovich to Stalin in 1935). Then they began to treat me very badly, and these months in the Soviet Union were the most difficult of my life. If I can see the sense in transporting my work here, I still cannot understand why it was necessary to treat me so badly." This complaint was included in the letter as a 'by the way', because the letter itself to Stalin, which was many pages long, was written since—on the one hand— Petr Leonidovich knew well about the positive decision of the House of Lords to sell the scientific equipment of Kapitza at the Mond Laboratory in Cambridge to the Soviet Union (his letter

[§]This is not quite correct. P L opened the session from 'the top table' and then settled down on a chair near the window. (*Not e by* $P \in Rubinin.$)

Moscow suburb where Petr Leonidovich had his dacha. (MR)

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to Stalin is dated 1 December 1935) and—on the other—because he was encountering difficulties in constructing the Institute. In this connection, Petr Leonidovich writes about the economic base, about the need for 'scientific economy', how important is enthusiasm in science, and how essential it is to infect the young with this enthusiasm. The end of the letter is simple and without courtesies:

"... In conclusion I would say that whatever happens, however difficult things may become for me, and no matter how I may be treated, I will always be working. I shall also try to ensure that my work is successful and I shall fight for this to the end. At the moment everything around me is gloomy. What I am afraid of is that my strength will be used up in various trials and trifles and none will be left for work.

P Kapitza''

However, we know that Petr Leonidovich had enough strength to construct the Institute he wanted, to assemble there remarkable people, and to make major discoveries. He had enough strength for many things. There were no trifles for Petr Leonidovich: any idleness was regarded as such and all matters were important. He also had the strength to win the fight, to release from prison and to save Vladimir Aleksandrovich Fock and Lev Landau, and to help the old Academician Bakh to obtain accommoda-tion ("my insides turn over", he wrote to Molotov, "when I see this swinish treatment of such a remarkable man as Aleksei Nikolaevich"). Kapitza defended N I Vavilov in the senseless dispute with Lysenko, he convinced Stalin (!) that the Commission on Stalin Scholarships (O Yu Schmidt, Chairof the Committee of Higher Educational man Establishments SF Kaftanov, and others) had absurdly and unjustly rejected Arkadii Migdal as the best candidate for a Stalin Scholarship.

Petr Leonidovich had enough strength not only to refuse to work on the atomic bomb (he would have refused in any case), but as a member of the Special Committee and of the Technical Council on the atomic bomb to analyse in detail the problem of *our* atomic bomb and with his usual simplicity and merciless bluntness to write to Stalin about the main technical and organisational problems, of possible ways of solving these problems, and, finally, of the disgraceful treatment of people and the whole project by Lavrentii Beria.

Petr Leonidovich had enough strength to raise the problem of the supply of oxygen in the country, to commission a factory at Balashikha (based on his own fundamentally new method of production of pure oxygen), become head of Glavkislorod (Main Administration of the Oxygen Industry) and, finally, to withstand the censure of the Resolution of the Council of Ministers of the Soviet Union, signed by Stalin, "for failure to carry out the decisions of the Government on the development of the oxygen industry in the Soviet Union, failure to use the existing new oxygen technology available abroad, and for ignoring the suggestions of Soviet specialists, to remove Academician Kapitza from his duties as the head of Glavkislorod of the Council of Ministers of the Soviet Union, Chairman of Technical Council of Glavkislorod, and Director of the Institute of Physical Problems of the USSR Academy of Sciences ... ". At the time major American firms, the British Oxygen Company, and other large Western concerns were trying to establish cooperation and to buy patents for the Kapitza turbine method. In a word, Petr Leonidovich had enough strength to remain himself throughout all this time.

How much it cost, that is a different matter.

On 23 June 1955 there were only three items on the agenda. The first was the confirmation of the composition of the Scientific Council of the Institute. Petr Leonidovich opened the session as if there had been no ten-year break:

"We can now begin our session. According to the Resolution of the Presidium of the Academy of Sciences of 3 June, the Scientific Council of the Institute of Physical Problems was established on the recommendation of the Bureau of the Division of Mathematical Sciences. The Council consists of: Chairman P L Kapitza, Deputy Chair-V P Peshkov, Secretary man of the Council A A Abrikosov, and members of the Council A I Alikha-L A Artsimovich. L D Landau. V A Fock. nov. I V Obreimov, A I Shal'nikov, I M Alekseevskii, E M Lifshitz, M P Malkov, P G Strelkov, I M Khalatnikov, and V T Khozyainov. A total of 15 people.

Today is the first session of the Scientific Council of the Institute. However, since an overhaul is taking place at the Institute and the conference room of the Institute is occupied, we decided to gather at the Presidium of the USSR Academy of Sciences, who kindly let us have their room.

Are there any comments or suggestions on the composition of the Council? None. Then the the Council can start functioning".

And so the Scientific Council of the Institute started functioning and there was one family again. Here the elders worked and taught youngsters how to work. They taught very simply: look and learn.

* * *

The Scientific Council is in session. The agenda includes "a general discussion on the subject of organisation of work at the Institute". As usual, Petr Leonidovich begins:

"The Institute is working well, many papers are published, but nevertheless the organisation of work can be improved. Scientific work is a creative process. Each creates separately in his own way. This is perfectly in order and let everybody work as he finds most convenient. However, there is also collective work. Nobody can carry out an experiment without helpers. Such work requires coordination. An example of appropriate organisation are the seminars and Councils at the Institute. They take place at very specific hours. Some discipline is needed to work as a team. We have three types of teamwork:

(a) sessions of the Scientific Council;

- (b) conferences;
- (c) publication of work.

All work intended for publication will be discussed. Everyone has the right to make critical comments.

"The scientific work at the Institute is divided in three ways:

- (1) laboratory work;
- (2) theoretical work;

(3) coordination of experimental and theoretical work. The last one is a weak link. However, it is necessary to say something about coordination and discipline in experimental work.

"Previously there has been a widely held view that discipline is necessary to make man work. This is wrong and

this belief must be rooted out. If it is true of somebody, then such a person should be driven hard. Discipline is necessary for people to work in a coordinated way. For example, during war there are partisans and the army. Discipline is needed in the army to ensure coordination of action, but the army will fight well only if it knows what it is fighting for.

'It is not possible to prescribe the manner of work. For example, Dirac or Poincare developed their theories when walking in a park. Lorentz frequently sat behind the table and worked for a definite time. Experimentalists use instruments, helium, electric current, and the services of the technical personnel. Therefore, they have to be in the laboratory. However, if somebody needs to read something or plan something and it is convenient to do it at home, this must not be forbidden. Like any other collaborator-a member of a team — such a person must be accessible. If it is more convenient for him to take a walk, let this be done at some definite time. In view of this, we have decided to change from keeping an attendance list of scientific workers and to leave the duty to maintain discipline to the heads of the laboratories. Moreover, we must ensure that people are not overworked. Otherwise they stay in the laboratory for a long time, greedy for work and try to do more than they can, and the productivity of their work then falls. In addition, there are still the service people, who do not carry out creative work and have fixed working hours, to consider. Therefore, a limit will be set on the working day for experimentalists at the Institute. This idea comes from Rutherford and, on reflection, it becomes clear how right he was.

"There should be a certain order in the laboratory. For example, helium cannot be supplied at any time and in any amount.

Everybody thinks that his work is the most important. This is how it should be. He is like a husband who always thinks that his wife is the most beautiful woman. Only then does he work best. However, one should not force others to think in the same way. We lost 180 cubic metres of helium. This is also evidence of the absence of order. Tubes slip off, Dewars break, and to a considerable degree this is the result of overwork. There have been suggestions to shift the beginning of work by one hour [later], but this takes place anyway.

"Another problem is the need for theoreticians and experimentalists to work closer together. This situation is unsatis-factory; as a matter of fact, one cannot say that the situation is bad, but it can be improved. The main shortcomings are:

(a) experimentalists frequently do not pay enough attention to the theoretical side of their work;

(b) all do not keep abreast of the literature;

(c) theoreticians are insufficiently interested in experiments.

'It is necessary to talk about all these shortcomings.

"The ideal case is when a scientific worker is a master of both theory and experiment. This is very rare. It has been true of Fermi, J J Thomson, Hertz, and others. However, there are also opposite examples. It is said that Landau cannot distinguish a domestic iron from a galvanometer.[†] Pauli was also like that. Einstein and Dirac were more interested in experiments. Debye and Langevin knew the experimental aspects well. Naturally, theoreticians know the experimental results, but for experimentalists the chief concern is to select a method so that the experiment can be carried out. The theory should be reduced to such a form that experimentalists could follow and repeat the calculations. If we cannot expect people to be simultaneously experimentalists and theoreticians, then cooperation is essential. We have such experience at the Institute. For example, Borovik-Romanov and Dzyaloshinskii have been able to discover and explain new phenomena. Evgenii Mikhailovich Lifshitz, Deryagin, and I I Abrikosova have also carried out excellent work, which was rewarded by prizes. Lev Davidovish and I cooperated successfully in the study of liquid helium. There was remarkable cooperation between Shal'nikov and Landau in the study of superconductors. The greatest results have been obtained when such cooperation has existed. Can't we make these cases more frequent? Must it be left to happen of its own accord?

"Naturally, a young man and a girl should choose one another according to their own taste, but life helps them. Dances and evenings are arranged, so that people meet. We must also think of ways of bringing people closer. If we do not have 'marriage partners' here, we can ask people from other laboratories, who are more interested in these matters, for example, Azbel'. If our theoreticians are interested in the work which is going on in K harkov, they can go there. Otherwise, it is love at a distance. But why should theoreticians not be interested in the work which is going on at the Institute. In a number of topics we are lagging. This applies, for example, to the experiment on the scattering of neutrons in liquid helium where their spectra were determined. This work was not even noticed at first."

A discussion then began. The first to object was Peshkov. Vasilii Petrovich Peshkov always objected first and he said that the work in question was known even before its publication. Then Petr Leonidovich recalled the absorption of sound by vortices and Cooper's ideas.

Landau then objected to what Kapitza said: "This is incorrect. We cannot pretend that we can do all. Other scientists can also do something."

Kapitza explained Landau's reaction by suggesting that theoreticians have not yet learned to praise themselves as much as mathematicians.

"Theoreticians do their best", said Landau, "Einstein would undoubtedly work better, but everybody works as well as they can. I agree in some respects with Petr Leonidovich, but in other respects I cannot agree. True, the cooperation with experimentalists is not the best possible. Anything, even if it is very good, can be made better.

'If we recall what was happening 30 years ago, we can see that the scope of theoretical physics has widened considerably. Three decades ago, all theoreticians were universalists. Nowadays there are practically no such theoreticians and the narrowing of interests continues. At the Kiev Conference it has been said that soon there will be specialists who are interested only in the maximum at 300 MeV in the scattering of π mesons by nucleons. This is the field in which Azbel' is working. It is a very difficult subject and Azbel' is the world's best specialist. Parallelism in this field is irrational, because Azbel' is working well. The distance between Kharkov and Moscow is small, and one

[†]It is true that Landau would hardly ever apply a hammer to a nail, but he knew experiments very well and could discuss them in detail. But Kapitza, who was gifted with most skilful hands (for example, he was an excellent watchmaker) and worked with tools until his last days, used to recount the joke about the galvanometer. (MR)

can only welcome the cooperation between the institutes. As far as the measures to be taken in our Institute are concerned, the idea of additional contacts regarded as a means of bringing young men and girls closer is perfectly right. But if they are forced to listen instead to a church sermon, it will be a waste of time. If the experimentalists will describe method, this is no better than presentation of mathematical details of a theory. If seminars are organised on the method, theoreticians at such seminars are unnecessary. Otherwise, aversion will be generated, which in no way helps love. The combined seminars are those at which the physical aspect of the matter in hand is discussed." The discussion heated up and concentrated on the work of postgraduate students. Khaikin, a great advocate of students, suggested that action should be taken immediately.

"When postgraduate students are given a subject", continued Landau, "it is necessary to think whether the work on this subject is realistic. Therefore, much that was said by Khaikin is utopian and the method he proposes for courting the girls does not promote love."

Alekseevskii said that he is categorically against limiting experimental work to just theoretical predictions: "Many effects seem at first to be unexpected from the theoretical point of view. This was true of the MoSssbauer effect. And such things are the most interesting."

The dispute continued and Petr Leonidovich was forced to intervene:

"We have moved away from our subject. An experimentalist who thinks that a theoretician will run to him is as wrong as a theoretician assuming that experimentalists should run after him. True, at the moment experimentalists court theoreticians as if they were girls. Landau thinks that there is no point in theoreticians learning about experimental methods. But Freud, who is at present taboo, said that for creative activity a man needs an irritant. If a writer is placed in a magnificent House of Creativity, he will stop working. The American advertising policy is based on this. For example, at the most critical point in a detective film, a frame with an announcement is shown very briefly. This is not noticed by the viewer but it enters his consciousness and he is irritated. If somebody hears a boring lecture, it helps his creative work. Every member of the Institute should spend 20% of his time in organisational work. It is wrong to allow a man to do only what he wants. For example, Evgenii Mikhailovich Lifshitz takes care of the library, Gorkov of inventions." Then Petr Leonidovich proposed a committee to put forward proposals on improving the coordination of work between members of the Institute, composed of Malkov (who could organise anything) as Chairman, Landau (always responsible for theory), Borovik-Romanov (responsible for experiments), and Filimonov (always given various responsibilities).

A very important topic for the Scientific Council was that of postgraduate students: how their work should be organised, how examinations should be taken, and what these examinations should consist of. Although the system developed at the Institute has more than justified itself, Petr Leonidovich returned from time to time to this subject: "The question can be divided into two: what is wrong in our Institute and what is wrong throughout the country? The main difficulty is the selection of people. Landau proceeds in a simple manner: a postgraduate passes nine examinations and in the process Landau becomes acquainted with him. In the case of experimentalists, the situation is more complex. People should take their diploma at the Institute, work for two years and then an assessment should be taken. Attempts to bring people from outside have not been successful. For the time being, the Institute is overloaded with tasks and cannot take in many postgraduate students... As far as the program of examinations is concerned, it is not of any importance. It is necessary to find out what a man knows. If he does not know the subject, he should be driven hard. Rutherford said that if after two years somebody asks what he should do, then he should not be in science." Some suggested that the basis of an examination on low-temperature physics should be a written thesis and that the other examinations should be taken in the two years preceding the postgraduate studies.

Kapitza suggested that a postgraduate student should himself suggest to a supervisor a programme on a special subject to be approved (!). Sharvin asked what to do with postgraduate students from abroad, in particular from Democratic Republics, and from other cities. Kapitza said that allowances should be made for them. Shal'nikov said that in such a system three years of postgraduate studies should be sufficient.

"The success of the work depends primarily on the correct selection of the direction, because otherwise efforts will be wasted for nothing", said Petr Leonidovich. "In a well-known story, a hero also has to choose where to go. If he goes to the left, he will be killed. If he goes to the right, he finds a beautiful woman, but in this case something even worse may happen. The choice of direction is made by the scientific worker himself because he risks his time. A supervisor will find it difficult to suggest what has to be done, although sometimes it is of major importance. For example, Rutherford suggested to Moseley to study characteristic x-ray spectra. The results of this study are well known."

Landau stressed that the main thing is the selection of people, which is done poorly in the case of experimentalists. Kapitza responded that all the students tend to join theoreticians because life is easy with the latter. The requirements set for theoreticians must be increased.

Landau accepted the criticism calmly and said: "At our Institute the level of work is sufficiently high. As far as theoretical work in general is concerned, there is indeed much poor work done, but this is true also of experimental work."

Kapitza advised Landau that he should go around and say that theoreticians work poorly. Landau declined this mission, saying that nobody liked him anyway on account of his abusive speeches. Kapitza said that much depended on how things were said and ended the discussion on the organisation of postgraduate studies.

It is difficult to resist even a short quotation from a speech by Vitalii Lazarevich Ginzburg when Lev Pitaevskii was defending his doctorate thesis:

"... Since the defence of a thesis is not just an Institute event, I would like to make one comment related to the fact that one chapter of the thesis is based on a collaboration between Lev Petrovich and me.

"Since I am his senior in rank, title, and age (Lev Petrovich is 25), I must stress that in this part Lev Petrovich was absolutely my equal. We simply did the same thing in parallel. At the last meeting on lowtemperature physics we discussed the subject and when we met in the autumn, we had both done everything independently of one another. Naturally, we published together, but if I had not done this, he would have published alone.

"In general, one should say that the Institute of Physical Problems relies on good postgraduates. Since the Institute is spoilt in this respect, it undoubtedly has not noticed what an outstanding person is Lev Petrovich. Knowing our Lebedev Institute, where we have few people of the same calibre, and knowing other institutes, I think that not more than one person per year of this calibre appears in theoretical physics in the Soviet Union ..."

As everybody similarly praised Lev Pitaevskii, Petr Leonidovich decided to introduce a different note: "However, I think that to praise young people in this way is also wrong. I am always afraid when a man is praised ..." However, Petr Leonidovich did not continue for long and very soon after he himself starting praising Pitaevskii.

What Petr Leonidovich said at the end of the defence of a thesis was remarkable. Every time that someone defended a thesis, there were special words intended only for that person and his work.

Let us consider now the defence of the doctorate thesis by Lev Gor'kov in March 1956. The subject of the thesis is far from the prime interest of the Institute. "... Unfortunately, we are distant from this subject," said Petr Leonidovich. "We do not go through the laws of collisions between particles and we do not carry out experiments needed in the field in which Lev Petrovich is personally interested.... Therefore, it is difficult for us to judge his work, because we are not following the subject, we are *not living it*....

"However, a general judgement can still be made about such a thesis....

"I agree with those who say that it is essential that there should be a practical yield, although such a yield is not always obtained immediately.

"The geometry of Lobachevski and Riemann preceded the theory of relativity and the fact that it was necessary to consider the theory of space was not known. However, on the other hand, if we can say that this theoretical work has explained some phenomenon, then just for us experimentalists [this is what the shorthand report says MR] a sufficiently good criterion is to say immediately that yes, up to the appearance of this theory the phenomenon could not have been explained, but after this work it can be explained. This criterion is very strong for somebody who does not understand the subject, but if one understands it, it may not be so strong...

"We thus have to take these questions slightly on faith ... It may be that an Institute of Theoretical Physics should be established in the Soviet Union where degrees would be awarded for such work."[†]

I Ya Pomeranchuk immediately responded: "Theoreticians will then move far away from experiments."

"They will not move away from experiments", replied

Petr Leonidovich. "An experimental verification will always remain a criterion for any theoretical work ..."

Another example is the brilliant defence of a thesis by Borovik-Romanov. At the end of the official procedure, when everybody could speak, those wishing to speak were very many. All promised to say a few words and quickly forgot the promise.

Landau was the first, beginning with: "I find it difficult to say much...", and then with surprising ease he gave a long lecture on antiferromagnetism, on elegant experiments, and on the theory.

A short comment promised by Ginzburg became a discussion of new ideas and threatened to have no end. Then perhaps Obreimov would say a word, pointing out only the surprising modesty with which the thesis was presented. Petr Leonidovich did not pretend that he was trying to say something briefly, not only because the subject in hand was remarkable science, but also because many others had spoken. In each speech, and this was *true always*, Petr Leonidovich found something important and shared it with everybody. On this occasion he began with comments on Ginzburg's speech: "... Particularly interesting was Ginzburg's speech. True, Vitalii Lazarevich spoke more of his ideas than of the ideas of the defender of the thesis, but these ideas have been stimulated by the work in this thesis and demonstrate its value. I, among others, share the view of Vitalii Lazarevich and for a long time I have tried to convince our colleagues that it is time to look at antiferromagnetism in polymers. Therefore, I have not interrupted Vitalii Lazarevich, because his speech has helped me in promoting these ideas.

"It has been said here that Borovik-Romanov is a civilised experimentalist because he understands the theory and can analyse it. Now I have a question: what is a civilised theoretician?" This was followed by a general discussion of the qualities theoreticians and experimentalists should have, on the need to eliminate the boundary between experimental and theoretical physicists. But at the very end Petr Leonidovich naturally returned to the results of the thesis and to how remarkable it was that theory and experiment were engaged in at our Institute and also, the main point, what should be the topics for the future.

Equally thorough were the Scientific Council and its Chairman when dealing with theses done outside the Institute. When Roal'd Sagdeev defended his doctoral thesis at the Institute, Petr Leonidovich even changed the official order of things: immediately after the presentation by Sagdeev, he began to ask questions and only when he received answers to all his questions he said: "And now we can start a general discussion". The questions asked by Petr Leonidovich of this quite young man were not easy. For example, here is the first question: "Was a quantitative check of all your results made experimentally?" The subject was 'Problems in dynamics of low-intensity plasma', which was a new science. Sagdeev answered proficiently. Other questions of Petr Leonidovich either dealt with details of the subject or were not questions, but suggestions ("However, could not the loss of plasma be explained by leakage after a pulse?"). In a word, having satisfied his curiosity, Petr Leonidovich suggested that others participate. And others did participate with great gusto. The most remarkable was the speech by Landau. It represented a detailed and clear exposition of the brief and bright history of plasma physics.

 $[\]dagger$ Less than a decade later I M Khalatnikov set up the Institute of Theoretical Physics in Chernogolovka. The Institute has become a power centre of theoretical physics. Ironically, Chernogolovka turned out to be a 'closed' place because of the surrounding military objects, and this wonderful establishment, with the best theoreticians in the country, beautiful cottages, rich forest and a lake, was reduced to a single room on the upper floor in Fizproblemy as far as the official mailing address and visits of foreign colleagues were concerned. (*MR*)

Petr Leonidovich frequently commented on the results of a thesis or the work intended for publication by thinking aloud. This had an immediate response from those sitting in the hall. Nobody ever thought of an ordered procedure. For example, a discussion could deal with the question of how to write papers:

"As Editor of *ZhETF* and Director of the Institute I have to review the papers of those working at the Institute (!!). The papers, particularly those of young people, are badly written. The principle of writing a paper begins with the recognition that nobody reads the paper from beginning to end, but just the beginning and the end. If to understand a paper it is essential to read the middle part, then nobody will get the gist of it. For this reason, the main ideas and results should be at the beginning and the end. The middle part should be written in such a way that in the case of an experimental paper any experimentalist could repeat the experiment, and in a theoretical paper it should be possible to reproduce all the calculations. Moreover, the whole paper should be written in a readable style."

On the subject of how, in principle, one should work, Petr Leonidovich said: "Each scientific worker should work in a field for not more than seven years and then should change subjects." This comment was made in connection with the work of Sharvin under the same heading 'Papers for publication'. The discussion began with the remark of Kapitza that Landau should have said something about Sharvin's work: it was his child. Landau objected that the child had grown and he no longer expects to pay alimony. However, Petr Leonidovich was in a serious mood:

"The question of layers in the intermediate state arose in 1935-1936. Landau was the first to put forward the hypothesis of the existence of a surface energy, but he could not calculate it. The Institute established a prize for describing this phenomenon. Shal'nikov carried out a brilliant experiment, detected the layers, and received the prize. More detailed experiments were then carried out by him in collaboration with Meshkovskii, and then Sharvin took up the subject, applying the new method of ferromagnetic powders. He not only found the surface tension itself, but discovered its anisotropy. The work was done exceptionally thoroughly and can be always regarded as an example to follow in experimental work. However, one can ask whether it was worth spending so much time in solving this problem. Could not the genius and energy of Sharvin have been addressed to other projects: the Institute has been working on surface tension for 20 years. It was a major discovery and now it is more like a scientific conclusion." And here Petr Leonidovich said that it was necessary to change direction every seven years and added: "The work of Sharvin is excellent. Here, as in the other work on ferromagnetism at the Institute, the important feature was the cooperation of experimentalists and theoreticians. However, all work is gradually becoming dated."

Borovik-Romanov asked for three more years for antiferromagnetism, but Petr Leonidovich was still serious: 'I did not have this in mind. Antiferromagnetism should be continued, but one should say goodbye to the balance.[†] The work of Sharvin is thus finished. He will soon receive a Doctorate of Science[‡] and it is necessary to switch to something else. Landau or Abrikosov will think of something. Maybe on the subject of dry friction?"

"That subject is very boring", said Landau.

The exploding Dewar problem was discussed equally seriously. "This was not a nice thing with the Dewar: the cleaning woman was frightened", said Petr Leonidovich. "Naturally, one cannot think of everything, but one should try. If something like this occurs, it means that the scientific worker is not sufficiently alert. It is a pity that Mina is absent. It applies particularly to him. There is insufficient order at the Institute Shal'nikov always has exemplary order, but in many other cases this is not true. Lev Davidovich, how about you: do you call the nation to order?"

Landau answered that his rule was only over theoreticians and that experimentalists did not belong to his realm. Shal'nikov suggested that theoreticians should clean the laboratories. Kapitza defended the theoreticians: "Extreme order creates an impression that no work is done. However, it is also difficult to work in a mess."

The question of discipline was sometimes taken up deliberately at the Scientific Council. The main evil was the 'excessive' time spent in the laboratory. Kapitza thought that it only harmed the work.

"There is continuous relaxation of discipline among the scientists (said Petr Leonidovich). They systematically stay behind in the laboratories and they do not ask permission. They gradually forget civilised behaviour. Koz'ma Prutkov said that three things started at the same time are difficult to finish: eating tasty food, talking to a friend who has just returned, and scratching oneself where it's usual to do so. Undoubtedly, there is a fourth activity: experimental work. However, all excess is harmful. Gluttony can disturb digestion, chatter with a friend can result in taking a dislike to him, and scratching can produce a hole. Failure to observe hygiene requirements can also sometimes produce serious consequences. Moreover, one should not forget one more thing. Scientific work is a form of Communist labour. People work because of their interest and not for the money. However, service personnel cannot be expected to work with the same attitude. Scientific workers must be taken in hand ... " Then Petr Leonidovich asked everybody to be aware of the problem and particularly Borovik-Romanov in whose division the situation was particularly bad.

Petr Leonidovich taught us not to be afraid of mistakes: even if the work is obviously wrong, there could be a germ of a new idea in it.

"I would like to draw attention to the interesting work of Landau on the absorption of electric waves in a plasma", said Petr Leonidovich, turning to this subject during one of the meetings on defence of a thesis. "This work, which played a major role, was done a fairly long time ago—in 1946, over 16 years ago. Landau predicted a new type of absorption of waves in a plasma.§

"Vlasov began to work earlier on a theory of plasmas, but the work of Vlasov produced a strong reaction from theoretical physicists, who studied it for latent errors. However, the result of all this was the work of Landau, which now plays such an important role.

^{*}K apitza speaks here of continuation of experiments with the magnetic balance, which was used in the first experimental work, leading to the discovery of weak ferromagnetism. (*Note by P E Rubinin*.)

 $[\]ddagger$ Equivalent to DSc. (*MR*)

[§]Landau resonance in rarefied plasma. (MR)

"This is one more case which shows that it is necessary to publish also papers with mistakes, so as to stimulate correct work. The worst in work is triviality. The most important is not the correctness at all, but a new idea. One should never fail to publish new ideas. Vlasov came with ideas new to the plasma theory, which might have been partly incorrect, but he still made a major step forward, because without him the work of Landau would not have seen the light of day."

As in any normal family, there were occasions when there was a dissension at the Scientific Council.

In one case a purely experimental work prepared for publication and done at the Institute was being discussed. The subject was the refractive index and the absorption coefficient of bismuth in the infrared spectral ranges at low temperatures. Landau instantaneously found a flaw. The author tried to defend himself and said that this was an experimental observation. Landau pointed out: "The experimental error here is 40%". Other questions were invoked. All were trying to see how the situation could have been improved. At the end Petr Leonidovich summarised thus:

"The results do not justify the work done. After all, the work was started four years ago. The work was done well. An original idea underlies the work However, there is no convincing result. This is because there is no suitable radiation source. The method should be published, but the paper should not include any speculation based on the results obtained. And this work should not be continued."

The situation reached the level of a domestic scandal. The whole fury of the presenter was concentrated on Peshkov who asked some quite innocent question:

"The work was done a year ago and was checked repeatedly", said the presenter and explained in detail the source of the errors and the fine points of the experiments, "and Peshkov with the lightness of a ballerina blunders into somebody else's work and makes an unintelligent judgement about it. Only Peshkov is clever and everybody else is stupid."

Nobody paid any attention to these offensive remarks and all were absorbed in discussing the results. The discussion occupied the rest of the time at the Council. Shal'nikov then found the optimal form of the paper in which it could be published. The author did not want to change the paper and asked whether it could be published as a description of the method in Pribory i Tek hnika Eksperimenta or as a letter to ZhE TF. Kapitza answered that this should not be done because we are not speaking here of a note about the method. The work took four years and a detailed paper should be written, but not about the method. Evgenii Mikhailovich Lifshitz said the paper is in no way suitable as a letter to ZhETF. Then the author, completely unsettled, said that he would not publish the paper at all and that he had lost interest in this work. Kapitza objected and said that the method developed would help others and should be published. The author remained inflexible. Then Landau intervened with: "If all say that you are drunk, then go and sleep it off.'

Petr Leonidovich ended the session simply:

"The whole difficulty is in the absence of a source. As far as the discussion is concerned, everything was in order. If we were afraid to offend one another, that would be a bad situation. It is accepted at the Academy of Sciences that people are nice to one another, but behind each others' backs say all sorts of nasty things. We should not do things in this way."

With the same simplicity Petr Leonidovich noted the International Woman's Day:

"On this day all women have reached 50 years"—said Petr Leonidovich and, paying no attention to Lifshitz's remark that hardly all the women would agree with this treatment of their Day, he continued greeting the female staff at the Institute.

Another question was to find a simple solution to the participation of the Institute in a New York exhibition. The secretary of the Council reported: "In June 1959 there will be an exhibition of scientific and technical achievements of the Soviet Union in New York. The Institute can participate in this exhibition. The instruments to be exhibited can be ordered at factories." Petr Leonidovich suggested that the *Course of Theoretical Physics* [by Landau and Lifshitz] should be exhibited and that the books should be ordered in a leather binding.

Consider the situation where there is no volunteer whatsoever to speak on "40 years from the day of appearance of Lenin's book *Materialism and Empiriocriticism*". The secretary of the Council stressed the need to celebrate this date. Evgenii Mikhailovich Lifshitz made an innocent observation that in the journal *Voprosy Filosofii* he saw a paper by Omel'yanovskii in which it was said that the work of Landau on parity nonconservation is a brilliant example of dialectical materialism. Petr Leonidovich reacted instantaneously: "Every reasonable work is of such an example. As far as the talk on this occasion is concerned, *now* it is obvious that it should be written by Landau." Then Petr Leonidovich changed the subject calmly to the papers for publication.

Here we are at another session of the Scientific Council: Zavaritskii is reporting his work. It represents a new method for measuring the specific heat at low temperatures. The results were obtained for tin at a few tenths of a kelvin. The main question is the type of spectrum of excitations corresponding to the superconductive state. (The work was presented in April 1956, but the results were obtained earlier. There was a tradition at the Institute that a work should mature like a good wine. And that there should be no fear that the work will be stolen. Good work cannot be stolen. Yurii Borisovich Rumer told me that Ehrenfest liked to repeat: "What does it mean to steal somebody's work? Can the work of Einstein be stolen, or that of Bohr, or of Pauli?").

Zavaritskii said: "In these experiments I measured simultaneously the thermal conductivity and I was thus able to determine the temperature dependence of the number of normal electrons."

Landau pointed out that these experiments have made it possible to determine the region of strong absorption of short-wavelength radiation.

Zavaritskii then mentioned that after the measurements on superconductors he was planning to study ferromagnets at low temperatures. Unfortunately, magnetic measurements are quite difficult to carry out, because the transportation of an instrument to a magnet results in undesirable vibrations.

Kapitza asked whether it would not be better for Zavaritskii to work in the basement.

Zavaritskii answered that he could go to the basement, but only together with the Big Magnet.

Kapitza immediately turned the discussion away from the Big Magnet and asked whether there was any interest in the behaviour of semiconductors at low temperatures? However, this diversion was not successful and the discussion soon returned to ferromagnets: which ferromagnets should be studied? Landau said: "It should not be tin. Tin is particularly inconvenient: because of its anisotropy, the T^3 law begins to apply at low temperatures. It is therefore better to study other objects." Zavaritskii said that he proposed to study pure metals, particularly nickel. Borovik-Romanov confirmed that indeed at low temperatures the main contribution to the specific heat of ferromagnetic metals comes from conduction electrons. Zavaritskii stressed that he was going to determine the temperature dependence of the magnetic moment and that his main task would be a study of the energy spectra.

Kapitza proposed that the method employed by Zavaritskii be used to study also other topics, for example, he could deform the lattice and measure the difference effect. In such measurements the method of Zavaritskii would have decisive advantages over others.

Lifshitz added that the difference method should make it possible to study the behaviour of the specific heat near the point of a second-order phase transition, where a high precision would be specially required.

Zavaritskii agreed with this, but he saw the main advantage of the method in the ability to carry out measurements at very low temperatures when the specific heat is low and the static methods are unsuitable because of strong fluctuations.

Peshkov objected: "If fluctuations occur in static measurements, will they not interfere also in this method." However, Zavaritskii pointed out that this was not so because these measurements were carried out at a fixed frequency and he used a resonance circuit. Therefore, the noise was not as dangerous as in the static method.

The reaction of Petr Leonidovich to Zavaritskii's answer was characteristic: Petr Leonidovich 'caught' the word 'noise' and the discussion veered in a different direction:

"It is necessary to take on seriously the struggle with electric noise and vibrations", said Petr Leonidovich. "Vetchinkin, familiar with the necessary apparatus, should investigate the rooms from the point of view of noise and identify the better rooms. One can then share out the accommodation accordingly."

Khaikin recalled that approximately a year ago a start was made in dealing with such a source of noise in the form of fans. Up to now we have not been able to do anything.

Petr Leonidovich promised to join the struggle: "We have just succeeded in stopping the noise from the aviation factory and I am sure we shall be able to deal with fans. By the way, we have to move somewhere the circulation pump which produces terrible vibrations", he added and asked all the staff to identify problems of this kind.

Abrikosov then mentioned that a motor drawing the blinds in the conference room produced a strong and sudden noise in the room occupied by the theoreticians, which badly affected those who were in the room.

Kapitza said that this could also be eliminated and returned to fans. The struggle with noise, external and internal, was a serious problem and like any other problem required a solution. This session of the Scientific Council took place in April 1956 and the victory over the noise from the aviation factory did not come easily or quickly to Petr Leonidovich. The factory was across the river, less than half a kilometre from the Institute. Petr Leonidovich convinced the director of the factory about the obvious absurdity of carrying out tests in the centre of Moscow. The tests went on day and night. The factory director agreed, but apparently could not do anything about it, referring such an important matter to the Minister of the Aviation Industry, Dement'ev. Dement'ev was deaf to Kapitza's appeals. Petr Leonidovich then wrote a letter to the prime minister Bulganin presenting the problem in detail and in the simplest and clearest manner explaining how he himself suffered from the factory noise, how his Institute was suffering, how obviously tens of thousand of Muscovites were also suffering and could not escape anywhere from the noise, and also how patients in the clinics were suffering, as Bakuley, President of the Medical Academy told Petr Leonidovich. Petr Leonidovich referred to inhabitants of the city of Glupov[†] ("even Shchedrin's bunglers could not think up the testing of turbojet engines in the middle of our most populous city") and finally, by the way of a post script, Petr Leonidovich tried a desperate, almost childish, ploy:

"P.S. I have also pointed out to the workers in the aviation industry that there is one further argument for taking these tests out of Moscow and it is as follows. I think that if we record on magnetic tape the noise of the engines and then carry out a harmonic analysis of the recorded sound of the engines, we should be able to determine a number of important technical parameters of our aviation turbines, such as the rate of rotation, the critical velocity, the number of blades, the occurrence of vibrations, and possibly even the power. If one of the 'foreign powers' has the intelligence to make such recordings, which is naturally not difficult, it can get much information which we undoubtedly regard as highly classified. It is thus quite likely that the noise from the tests of our aviation engines broadcasts to the whole world the information which should not be made public." This letter was dated 25 March 1956. Quite soon, a bit before the Scientific Council described above, a letter arrived with the assurance that such tests would cease. However, the final victory came only after a year.

Having considered the problem with fans, Petr Leonidovich asked the next person on the list in 'Papers for publication' to speak. It was Yurii Vasil'evich Sharvin, who reported that "at the time when he was occupied with the depth of penetration, Shal'nikov and Meshkovskii were working on the intermediate state and obtained interesting results, namely the existence of two phases ... ".

This was how, the papers for publication were presented. These short papers describing the results of hard and thoughtful work soon reached the pages of handbooks.

The list of 'Papers for publication' sometimes included contributions from scientists working outside the Institute. This could be due to a variety of circumstances, such as the importance of the work to the Institute, the importance of the work in general, or the desire of the author of the paper even to present a short report, such as a five-minute presentation in front of the audience at the Institute (in

†In A History of One City, a nineteenth-century Russian writer M E Saltikov-Shchedrin satirised despots governing a city called Glupov ('Sillytown'). (Note from the translator.) these cases, Petr Leonidovich would have to find the work really interesting), etc.

For example, at the September 1957 Scientific Council Petr Leonidovich announced a paper by A M Prokhorov "Paramagnetic resonance of free radicals". In the five minutes available to him Prokhorov reported on the use of the method of paramagnetic resonance to detect radicals generated either in a glow electric discharge in H_2O and H_2O_2 vapour or by irradiation of frozen water and hydrogen peroxide. This made it possible to identify the radicals as OH and HO_2 , and also the atoms of hydrogen formed in the course of chemical reactions.

Petr Leonidovich asked why it was important to get the radical HO_2 .

Prokhorov answered that in chemistry these radicals are important for the understanding of the kinetics of chemical reactions.

Landau explained that the existence of the radical HO_2 did not require confirmation. A really important question would be the number of such radicals.

Shal'nikov added that there were two questions here: (1) a study of physical methods of the interaction with water, which was not interesting; (2) the reaction kinetics, when it is necessary to know the number of radicals produced by a process.

Alekseevskii pointed out that a whole series of radicals is obtained in the form of ions, and this makes it possible to apply mass-spectrometric methods. Kondrat'ev and Semenov were working on this.

K apitza suggested the use of molecular beams produced by the Rabi method.

Prokhorov answered that the Rabi method would not work. It is not possible to form a molecular beam by irradiation with gamma rays. The purpose of the work was to reveal resonance lines characterising different radicals, which would allow to identify them in specific cases.

Kapitza asked whether Prokhorov required low temperatures to reduce the linewidth and increase the resolution.

Prokhorov answered that this was his aim because the linewidth is proportional to T^4 .

Peshkov said that liquid hydrogen temperatures would be sufficiently low for obtaining narrow lines.

Petr Leonidovich concluded the discussion by saying that although the subject of the paper was not of great interest for the Institute, it was nevertheless necessary to help in this work, but with the condition that Prokhorov would work himself and not send assistants in his place. Prokhorov agreed. And he immediately volunteered to present next time the results of another experiment which is then in progress and which was devoted to the construction of a low-noise amplifier based on parametric resonance.[†] Petr Leonidovich took to this immediately and said that the subject was more interesting and proposed that Aleksander Mikhailovich Prokhorov should present a paper about it at the next session.

At this next session there was a very characteristic discussion after a paper by I M Khalatnikov and R G Arkhipov on "Propagation of sound across a boundary between two superfluid liquids". Three minutes were sufficient for Khalatnikov to present the results of his

[†]The subject that brought Prokhorov and Basov the Nobel Prize for masers and lasers in 1964. (MR)

work. The first question was put forward to Peshkov: "What would be the temperature jump at the boundary?"

Khalatnikov answered that it could be estimated to an order of magnitude from an expression for the thermomechanical effect. This was the only question that Khalatnikov was allowed to answer himself. The authors of the paper did not get a chance to participate in the subsequent discussion.

Landau: "In reality there is not a jump, but rather a temperature drop in a layer whose thickness is determined by the viscosity, by analogy with the boundary layer in hydrodynamics."

Kapitza: "What amount of 3 He is needed to carry out such an experiment?" Peshkov answered that it was approximately two litres.

Kapitza: "The experiment is realistic. Which is the aspect of interest?"

Landau: "It would be interesting to test the hypothesis that at any concentration or temperature the impurities penetrate the normal part. Moreover, it would be interesting to know how the effects change on crossing the λ line and near the critical point itself."

Kapitza: "Vasilii Petrovich, are you going to carry out this experiment? The problem is not quite clear from the theoretical point of view and it would be interesting to study it experimentally."

Peshkov: "Such an experiment will be carried out when the technique of working with solutions is mastered. Could not a theory be developed without assuming that impurities enter the normal part?"

Landau: "The theory is then no longer uniquely determined. In the theory developed in the paper [we heard] there are no arbitrary constants."

Kapitza: 'How does the thermodynamic potential of a solution vary with the density of impurities?''

Landau: "The curve representing the thermodynamic potential as a function of the density has two minima."

K apitza: "Is it possible to determine the form of this curve?"

Landau: "It can be done, but not in the region of absolute instability, which is in principle unobservable."

Kapitza: "Can we find out something about the interaction of atoms in a solution?"

Landau: "The problem can be considered if a solution is weak. Then the solute forms a gas. At high solute concentrations, which are important in this case, we cannot say anything definite."

Thus, Kapitza would ask a question and Landau would give an answer. Kapitza would ask another question and again Landau would answer. When somebody else asked a question, Landau answered. This did not occur because the authors could not answer (naturally they could), but Landau reacted instantaneously. Just as a jeweller picks up a precious stone, looks at it, and without failure identifies its best faces, so Landau shed light on results under discussion. On the occasion of the fiftieth birthday of Landau, A I Alikhanov said: "Since I come from the Caucasus, I like to raise birthday toasts. However, since Dau[‡] normally drinks only lemonade, the hand dries and

 \ddagger Landau's nickname. Almost everybody there had a nickname; Landau was the best in inventing them as well as calling those whom he disliked by various names. He even explained his own nickname, saying that it was obvious that it had a French origin and came from L'Ane Dau. (*MR*) the toast fades. I cannot properly priase the highly theoretical work of Landau, but I will simply mention the role which Dau plays in the case of all physicists, both theoreticians and experimentalists. When Dau is present at a seminar, every problem becomes transparent, just like a glass of good vodka."

This bright celebration of Landau's birthday has been recalled so frequently and in such detail that those (and that includes myself) who had not been at the Institute at the time have come to know the celebration and all its details: they could clearly see a poster which met the guests: "NO WAY, Mr Khalatnikov!" They also examined repeatedly the gifts which Landau received and which were carefully guarded by Evgenii Mikhailovich Lifshitz.

The minutes of session No. 32 of the Scientific Council of the Institute of Physical Problems on 21 January 1958 had as the first item on the agenda the celebration of the 50th birthday of Academician L D Landau. 21 January was the 'Council Tuesday': the jubilees could be moved in time, whereas the sessions of the Council—never. Landau's birthday was 22 January, so that he was quite lucky with the Council. The first 'celebration' speech was made naturally by Petr Leonidovich. In his usual manner, simple and clear, of the kind that only children are capable of, Petr Leonidovich said:

"... There are various relationships between people. Each day we do something pleasant and unpleasant to one another. The birthday is a day when everybody agrees to be pleasant to somebody and to express their good wishes. We, who like Dau so much, wish to do something pleasant for him. However, we cannot do the same for all, because people are different. Therefore, we shall organise an unofficial celebration. It is usual to give an oral review of the work of the person whose birthday is celebrated. But this would be hardly a pleasure for him. However, if could invite Niels Bohr today, this would be a great pleasure to Dau. But we cannot invite anybody else because there are no greater theoreticians among us than Dau..."

Approximately a year before this celebratory Council, Landau was the main speaker at the Scientific Council on the occasion of the 40th anniversary of the Great October Revolution. Naturally, as usual, an introductory word came from Petr Leonidovich:

"The whole country is marking the 40th anniversary and we are also celebrating this occasion. What is the meaning of such anniversaries? Take a wayfarer walking along a road. He stops, looks back and thinks about the path that he has travelled ...

"For us, the most interesting thing is the development of physics in the last 40 years. I have been the witness of this development right from the beginning, because I started together with the Revolution. My first paper was published in 1917 ... "And then Petr Leonidovich described how our science was growing, and how great are the services that A F loffe had rendered to our science laying the foundations of the successes achieved so far; how the beginnings were small, how difficult were the conditions during the Civil War, and the ordeal we went through during the Patriotic War. "And now we have the hydrogen bomb, the synchrophasotron, the sputnik, and the thermonuclear project. Summarising the path we travelled, we have to decide what we should develop in future and what we must drop. Any obsolete directions will introduce bureaucracy into science and will hinder its social applications. Therefore, it would not be out of place to be self-critical. This will only help us." Petr Leonidovich then asked Landau to speak.

"The chairman of the Scientific Council has chosen a wrong speaker. I suffer from brevity", said Landau and set out on a long speech:

"Petr Leonidovich spoke on the development of physics as a whole. I would like to talk about the growth of theoretical physics. My reminiscences will start later. In 1917 I was nine years old. Therefore, I shall begin with 1925, when I came to Leningrad. At the time that city was the chief scientific centre. Theoretical physics in our country was in a special position. Even before the Revolution, our experimental physics was not bad. Take, for example, Lebedev. However, there was no theoretical physics at all. A very major role in the development of theoretical physics was played by Ehrenfest, who spent five years in Russia and engendered a kernel of theoretical physics. At my time in Leningrad there were two physics higher educational establishments and two groups of physics research institutes associated with them.

"The first was the Lesnoe group, † which included the Physicotechnical and Polytechnic Institutes. The second group was the University and the Optical Institute of Rozhdestvenskii. In the Lesnoe group the main theoretician was Yakov Il'ich Frenkel, whom many of those present here have known. There has been much criticism of his theoretical work, but he played a very major role in the development of theoretical physics, since he had been able to gather around him a large group of young people. The University group worked independently. The main role there was played by Krutov, Bursian, and Fredericksz. A very talented physicist was Friedmann [Fridman], but he died earlier and I did not meet him. Although university professors did little research at my time (they were too old), they taught us well. All the theoretical physics at Leningrad University developed along the directions in which the professors pointed us. And the directions were correct. For example, at the end of 1925 Bursian drew my attention to the work of Heisenberg. After all, a young man beginning his science work needs to be directed. How would one know that quantum mechanics is the correct direction, and Thomson's bagels were nonsense?

"Theoretical physics was developing also in Moscow. Here, the praise is primarily due to Mandel'shtam. He played a conspicuous role in science and gathered around himself a group of theoreticians. Academicians Tamm and Leontovich are his pupils. Right from the beginning this group went in the correct direction. The level of Soviet theoretical physics at the time was not inferior to that elsewhere, for example, to Germany which was then a leading country in physics. The USA played no significant role. The Americans developed their theoretical physics even later than we did — in the thirties. However, quantitatively we were behind.

"The present picture cannot be compared with what I described. In thirty years, to which I am a witness, our theoretical physics has developed very greatly and occupies now one of the first places in the world. Not only in the qualitative sense, but also quantitatively it is comparable with American physics. There are now theoreticians in all physics research institutes.

[†]Lesnoe is a suburb of Leningrad.

"Theoretical physics has developed even faster than experimental physics, which seems somewhat strange. Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki [JETP] receives two or three times more theoretical than experimental papers. This perhaps is not true of *Physics Review*. Although theoreticians naturally suffer to some extent from graphomania, this is their general feature worldwide. The situation in our country is evidence of insufficient development of experimental work. For example, in nuclear physics we are doing much less than we ought to. The lag of experimental physics should be eliminated, naturally by enhancing experimental work. An insufficient theoretical knowledge of our experimentalists should be noted. The mastery of theory in the case of the best foreign experimentalists is considerably better. Nowadays it is difficult to do experimental work without deep knowledge of the theory.

"I shall now concentrate in detail on our theoretical schools. There are at present many theoretical groups. These groups are working along different directions, but they do not lose contact. In Moscow it is the group of our Institute, and then the group of I Ya Pomeranchuk at the Technical Heat Laboratory, † which is preoccupied with general problems in theoretical physics and has done much in this field. There is also the group of I E Tamm and V L Ginzburg at the Lebedev Physics Institute. One of the achievements of this group is an intensive training programme. One should mention here also the group of Bogolyubov. Bogolyubov himself is a very talented man. He is dealing successfully with the theory of the Bose gas, the Fermi gas, and general problems of statistics. One should mention also other groups, for example that of M A Leontovich, which represents the school of Mandel'shtam, and the group of Migdal at the Institute of Nuclear Physics. In Leningrad the theory has become very sick compared with the earlier times. Moscow has sucked up everything and Leningrad, the former centre of theoretical thought, is now in the position of a squeezed lemon. V A Fock is himself a very major theoretician, but he is not interested in teaching (Petr Leonidovich once recalled what Ehrenfest said about Fock: "Fock can do everything. If necessary, he can integrate a boot".) The situation is much better in Kharkov, where advanced theoretical physics is done by a large number of people working well. One can mention the groups of A I Akhiezer and I M Lifshitz. The work of the group of I M Lifshitz on the electron theory of metals is in its field among the most important in world literature. S I Pekar, a pupil of I E Tamm, and Pekar's group are working in Kiev. Pekar deserves much scientific credit. He proposed a new concept of semiconductors. Finally, the work of Ya B Zel'dovich should be mentioned. True, he is now in a somewhat Indeterminate Place,[‡] but he has done very major work. He has earlier developed foundations of the theory of chemical reactions. And one can say he was the first who built a bridge between theoretical physics and hydrodynamics."

This is how Landau ended his 'celebratory' speech. The anniversary session of the Scientific Council continued. Petr Leonidovich began to think aloud:

"I have given much thought to the gap between theory and experiment. It is largely due to the fact that, whereas theoretical physics is taught by our best scientists, the teaching of general physics is in the hands of second-grade physicists. Compare this with Cambridge, where general physics was taught by Rutherford, Thomson, and Bren§. Obviously, this situation has to be improved. More attention should be given to teaching of the young. This is the most important task. After all, our future is in the hands of the young. Our physics should not be just equal to that abroad, it should be accepted without doubt."

Ivan Vasil'evich Obreimov added that he heard from everybody that we suffer from hypertrophy of theoretical physics. He himself always smoothed the path for theoreticians. For example, at the Physicotechnical Institute in Leningrad they could not find a place for V A Fock, but because of Obreimov's insistence he was taken on as a collaborator of this Institute. "The weakness of Russian physics is in the gap between the scientists", said Ivan Vasil'evich. "Theoreticians should be the link between physicists. Ehrenfest was such a link. He was a very good and accessible man. In particular, he organised Sunday seminars. Then such seminars were started by physicists in other countries, and for a long time they have been regarded as a Russian tradition. Friedmann played a very major role in bringing physicists together. A theoretician is not a calculator. He should know the whole of physics. The heads of experimentalists are full of masses of technical details. The role of theoreticians is to stimulate and bring together all the physicists. Therefore, I would rather say that we have an insufficient number of theoreticians."

Pomeranchuk followed by pointing out the credit due to A D Sakharov in the development of Soviet physics.

Landau returned to the comments of Obreimov and agreed with him: "One should speak here not of overproduction of theoreticians, but of a shortage of experimentalists."

Kapitza pointed out the gap between mathematicians and theoreticians.

Lev Petrovich Pitaevskii drew attention to the low level of physics teaching at higher educational establishments. He said: "This applies not only to the provinces where the situation is simply very bad, but also to Moscow University, where the majority of lecture courses are presented by scientists who are below the first rank. A major shortcoming is the gap between the Academy of Sciences and the University."

Kapitza said that attempts were being made to tackle this problem at the Moscow Physicotechnical Institute: "The Minister of Higher Education, Elyutin, said that this experience will now be used in Siberia [the building of Akademgorodok in Novosibirsk began in that year]. The teaching establishments should be based on research institutes. This was true of the Polytechnic Institute in Leningrad, associated with the Physicotechnical Institute,

[†]This Laboratory is now the Institute of Theoretical and Experimental Physics.

 $[\]sharp$ 'Indeterminate Place' for those who were involved was known as 'Ob'ekt'—the place where the H-bomb was made. Three names, in particular, were associated with it: Ya B Zel'dovich, A D Sakharov, and Yu B Khariton. (*MR*)

[§]This is how this name appears in the minutes of this Scientific Council, which were not corrected by P L Kapitza. Obviously, he meant W L Bragg. (*Note by P E Rubinin.*)

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and also of the University where the proximity to the Optical Institute has led to the growth of an excellent school of optics specialists."

Khalatnikov described how he studied at a place in the provinces, Dnepropetrovsk. At the time, major physicists such as Kurdyumov and Finkel'shtein were working at the University there. They followed the Leningrad traditions. Students from the first day learnt what Landau's School was. They came to Moscow to pass the 'theoretical minimum' examination.† That style of work has now been dropped completely. The whole of science is concentrated in several major cities and Dnepropetrovsk is not even a scientific centre.

Kapitza added: "... We are all gradually reaching the conclusion that physics develops in groups associated with major scientists. In our country up to the recent War, it was very widely held that the role of major scientists is small. They were treated badly and were easily removed. This attitude is a consequence of the general socialist concepts on the role of personality. It was an interesting view on the development of science in society, but it was incorrect, as practice has shown. I had a dispute on this subject with Bukharin, who was of the opinion that for science to move forward it is sufficient to collect many people in a large Institute. I gave him, by way of example, the problem of how many monkeys have to be placed in front of typewriters in order that at least one of them should write Hamlet. It can be shown that more monkeys than atoms in the Universe are needed to write the first two lines of the play. The attitude to scientists has now changed. However, the problem is not yet fully solved."

Obreimov returned to the short comments by Kapitza on the gap between mathematicians and physicists: "At the beginning of the Revolution there were great mathematicians in Leningrad: Markov, Steklov, Lyapunov. However, physicists were being taught bits and pieces from the eighteenth century. In particular, physicists had never heard of the Fourier series. Although some idea of the theory of numbers was given to physicists, other branches of modern mathematics were not discussed. At the time Steklov had three pupils. They were Smirnov, Friedmann, and Tamarkin. Young physicists turned to Steklov's pupils to tell them what mathematicians were doing at the time. Mathematicians presented a suitable course and this was the origin of Smirnov's well-known course.

Shal'nilov returned to the problem of experimentalists and this was followed, up to the moment when the clock hands came together at twelve and the Scientific Council had to end, by a discussion of matters as if in a family. All then wanted to continue the Council, but the rules were kept very strictly.

Here is some more about anniversary celebrations. The Institute put on years together with its members.

It is 6 October 1959, the fiftieth birthday of A I Pavlov. Petr Leonidovich declares: "Deputy Director of the Institute of Physical Problems, Andrei Ivanovich Pavlov, is now fifty years old. Pavlov is one of the oldest members of the Institute. 25 years back he took part in building the Institute. The quality of building work was even poorer than it is now. To improve this quality I recommended that Pavlov should acquire an axe and cut down what was badly built. For this Pavlov was nearly axed himself. In the last 25 years Pavlov grew as a famous builder: he is now the head of several serious objects. Moreover, he is an outstanding administrator. He maintains a very high order here. In this respect the Institute has a deserved fame and even foreigners admire us. To a large extent we owe this to Pavlov. His were the main ideas on a new plan of the Institute. However, I am afraid to praise Pavlov further because after praise people usually work less well. And Pavlov has at least another 25 years of work at the Institute ... " Petr Leonidovich then asked Malkov to speak. Landau was impatiently waiting for his turn and although everybody was expecting him to gloat, he said that even theoreticians could not imagine the Institute without Pavlov.

At this Scientific Council, under the permanent item 'Papers for publication' the first to be considered was a paper by Dzyaloshinskii 'On the problem of the magnetoelectric effect in antiferromagnets''. Igor' Dzyaloshinskii described very briefly his results. Landau *asked* how big was the effect. Igor' answered that ''the effect can be estimated only roughly''.

Landau *explained the essence of the effect*: "If in the bulk there is no set of magnetic angular momenta, then a total angular momentum of the body cannot be created by an electric field under any conditions. This is because a nonmagnetic crystal has time reversal symmetry. The sign of the electric field is not affected by such reversal, but the magnetic angular momentum changes its sign. However, an antiferromagnet may not have such symmetry. The electric field can then deform a crystal to such an extent that an antiferromagnet becomes a weak ferromagnet exhibiting nonzero momentum."

Kaptiza added: "After Dzyaloshinskii has linked the magnetic properties of antiferromagnets to their symmetry, all their properties follow from this connection self consistently. However, the magnitude of the effect cannot be predicted. Borovik was lucky: he observed piezomagnetism. If the magnetoelectric effect is large, this would be very interesting, but it is hardly true. The main difficulty in the task of discovering this effect is the availability of a good material."

The next session of the Scientific Council on 20 October 1959 also began with anniversary greetings. Petr Leonidovich informed those present that Petr Georgievich Strelkov had reached 60 years and that he was trying very hard to conceal this. Strelkov said that he could not see why one should be proud of this. Kapitza continued: "Strelkov is very closely associated with the Institute and we still regard him as a member of our family, although his interests have moved to the East [Akademgorodok in Novosibirsk] and he will himself move there soon. Strelkov is one of the first members of the Institute and he began his work at the same time as Shal'nikov."

Strelkov corrected that "Shal'nikov began earlier, but I coauthored the first paper published by the Institute."

[†]This examination, known as 'Teorminimum' could be taken by anybody who wanted to do research in Landau's group. There were nine tests: two dealt with mathematics and mathematical physics, and the remaining seven extended over all nine volumes of *Theoretical Physics* by Landau and Lifshitz. To start with, Landau alone examined all entrants. Then he distributed some tests among E M Lifshitz, I M Khalatnikov, A A Abrikosov, L P Gor'kov, and I E Dzyaloshinskii (in the 60s), but retained for himself mathematics and analytical mechanics. He kept an old notebook, 'tetrad'', where the results of the tests were recorded. In the long list of names in the 'tetrad'' only a few were marked with nine '+' signs. (*MR*)

Kapitza continued: "I came to know Strelkov when he was still a laboratory instructor for undergraduate students at the Physicotechnical Institute. Strelkov himself was an undergraduate student and a very meticulous young man. He never cheated to adjust the results to the correct answer, but got this answer himself. Later at the Physicotechnical Institute, Strelkov carried out zone purification of a metal.... Then, he worked with Obreimov. He worked on growth of crystals. Then he carried out a number of investigations in ballistics. This was followed by biological work apparently with the aim of exterminating rats. Strelkov then began to work at the Institute of Physical Problems.... He has always worked very precisely and reliably. He was the one who extended the temperature scale to low values and developed special thermometers. Now temperatures are measured with high precision and nobody even remembers Strelkov. However, before that nobody was sure of their measurements. Now he is being sent to Novosibirsk. The Institute gives him blessings in his new job, because it is good when our people travel to other places and spread the influence of the Institute."

Landau was the next to congratulate Strelkov and he said that although those present were gloating, they will hardly look like Strelkov at the age of 60. The next question at this session was that of the Lenin Prizes. Petr Leonidovich suggested to put forward only the work in which the Institute was specialising and said that the most important work carried out recently was that of I M Lifshitz and M Ya Azbel' on the theory of metals, which was a great step forward in the understanding of the physics of conduction, and also of the experiments of N E Alekseevskii and Yu P Gaidukov. "Next are the experiments of A S Borovik-Romanov, I E Dzyaloshinskii, and R A Alikhanov on antiferromagnetism. Outside the Institute we should note the investigations of B N Samoilov, but they are not yet sufficiently mature. Then there is the work of B G Lazarev on polymorphism of metals. This is a major direction. The Council should resolve whether these investigations are worth the Lenin Prize. Perhaps it would be best not to put forward candidates this year. Poor wine is drunk immediately and good wine improves with time. Do you have any suggestions?"

Borovik-Romanov said that, in his opinion, the most interesting were the theoretical investigations of I M Lifshitz and that they had been confirmed strikingly by the experiments of Alekseevskii and Gaidukov. Therefore, he suggested that these investigations should be put forward for the Lenin Prize.

Landau added that the work of II'ya Mikhailovich Lifshitz and his school had been discussed on many occasions and therefore there was no need to deal with them in detail: "It is sufficient to say that these investigations have been the best that have been done in the theory of metals."

Another anniversary was celebrated at the session of the Scientific Council on 17 November 1959. The items on the agenda were:

(1) defence of the thesis by R A Alikhanov;

(2) the fiftieth birthday of the Deputy Director of the Institute of Physical Problems, Prof. M P Malkov.

Petr Leonidovich said that a happy event fell on this very day: "Mikhail Petrovich Malkov had reached fifty. Many people have gathered to congratulate him or gloat over his age, as Landau says. Malkov came to the Institute

16 years ago to deal with techniques for the production of liquid oxygen. This was one of the directions of research at the Institute and it is still being pursued here. Malkov began to work at the Institute at the time of a major change in the development of this subject. Before coming to the Institute, Malkov did not know what physics was. Now not only has he learnt, but also he is Deputy Director and organises scientific workers. This is a very difficult task. After ballerinas, scientists are the most capricious and undisciplined people. Everyone thinks that his work is the most important. If the Director does not understand this, then he does not understand anything. This is a natural view. We should not dissuade people from this because they will stop working. On the other hand, we cannot do everything that scientists demand. Malkov is a technician who can reconcile this contradiction. He was even born exactly on the day of the Scientific Council. Nobody else can boast of this!

'Malkov is responsible for management, orders for instruments, supplies, payment of salaries; he answers to the Academy for plans, accounts, discipline, etc. All those bits of papers presented at the Scientific Council are just a small fraction of the total amount that is pouring into the Institute. All have to be answered, although not all instructions have to be carried out. Friction occurs sometimes between members of the Institute and they sometimes behave not as they should. It is necessary to lubricate the machine so that it continues to roll. Malkov can do this superbly. He has become very popular in the last ten years as Deputy Director. In all this time I did not even have once cause to complain." Petr Leonidovich followed with warm congratulations and wished that Malkov would keep his character "which will be pleasant not only for members of the Institute, but also for many ladies."

Everybody who could catch the eye of Kapitza wanted to say something on the occasion of this birthday. And the number was always large.

Then, naturally, Mikhail Petrovich spoke and he gave the following advice to all those aged fifty: "When your fiftieth birthday comes, think about how this should be treated. At General Electric, in the US, there is the following rule: if you have made a mistake, then admit this and forget it. This applies also in the case of this birthday."

Kapitza noted how fast time flows: "Malkov is now fifty and I am sixty five. There was a time when I examined A I Alikhanov and now his son defends his thesis."

So, as the time passed, the Institute was celebrating more and more anniversaries. In those days, these were mainly the fiftieth birthdays, but there were also some who reached sixty. The session of the Scientific Council on 5 April 1960 was opened by Petr Leonidovich with the words: "We discovered one more person celebrating his birthday at our Institute. He tried to cover this up, but can't hide from the Directorate. Nikolai Nikolaevich Mikhailov is the head of the Physicochemical Division. This Division helps other divisions. Various sciences are now interacting more and more with one another. If any science tries to develop in isolation from the others, it will fade. Mikhailov is the link with metallurgy. In particular, very pure tin was produced in his Division. Much work at the Institute has been possible only because of Mikhailov's Division. Purification and analysis of materials require high-level techniques and can be carried out only with a good understanding of the physics of phenomena ...

'Fifty years is a sad event. Landau admitted this with tears in his eyes. However, it has also its advantages. A human being passes three stages in his development. The first 25 years is the animal state. Man thinks mainly about his passions and much less of science. The next 25 years represent a mixed state because a man then thinks of satisfying his animal passions but also of useful activity. Only the next 25 years can be regarded as the human state. There are no more passions and one can devote oneself to useful activity. As far as the 25 years beyond 75 are concerned, this is a godly state. Man becomes an icon. He does nothing, but one can pray to him. Nikolai Nikolaevich has entered the human period of 25 years. All of us congratulate him and wish him success in his work ... "And all naturally congratulated Mikhailov who, as Lazurkin said, had a strong influence on his relatives: 75% of the Lazurkin family have become physicists and the others are not yet physicists simply because they are too young.

And now the sixtieth birthday of the 'oldest and most important' member of the Institute, Aleksandr Vasil'evich Petushkov, one of the remarkable Petushkov brothers who had no equals in the world of glassblowers. The celebrations were regal.

The fiftieth birthday of Nikolai Evgen'evich Alekseevskii was something else. In this case everybody unburdened his heart. As usual, the Chairman began. However, even with all his benevolence, Petr Leonidovich had to start not from announcing the happy anniversary, but by suggesting that Alekseevskii should release Karstens from the laboratory where he was locked. "Keeping Karstens under lock and key is a characteristic of the man whose birthday we are celebrating, who is ready to sacrifice his strength and health and that of his staff for the sake of work. True, there have been no fatalities as yet, and the results are good, so that we shall forgive him. Alekseevskii has worked at the Institute for almost 25 years. Many events have taken place in this time. Now he is fully occupied with low temperatures. However, if we relate those temperatures not to the room temperature, but to the temperature of Nikolai Evgen'evich, then we will understand that he is working at much lower temperatures than the rest. He has broken instruments, has been severely wounded, and yet has lived to reach fifty. His temperament is somewhat subdued, but it is still sufficient to keep the Directorate suffering. After I had left the post of head of the Low-Temperature Division of the Academy of Sciences, this post was taken up by Alekseevskii whose knowledge and talent made him the best for the job. The totally unsuspecting Presidium confirmed this position and now they will suffer too." Petr Leonidovich was followed by Malkov. By this time the temporarily liberated Karstens appeared in the hall. Malkov beamed with pleasure and expressed his satisfaction, adding that somehow or other ultimately he always found language in common with Alekseevskii. Filimonov said the same: "I have been working at the Institute from the day of its foundation, for a longer time with Petr Leonidovich and somewhat less with Alekseevskii. They say that Alekseevskiiÿ is a hard man. This is not true. He is hard only on those who deserve it. I have never felt this myself." Abrikosov also decided to be kind to Alekseevskii and said that he himself and the whole theoretical department fully joined in all good wishes to Alekseevskii and decisively dissociated themselves from all the bad things they had heard about him from previous speakers.

Zavaritskii said that he had never worked with Alekseevskiiÿ, but nevertheless the latter always made a strong impression on him and this had begun at their very first meeting. When the very young Zavaritskii together with the other sophomore students first came to the Institute, Yakovlev took them around the Institute and showed them the laboratories. All the doors were hospitably open. However, when the procession approached the Big Magnet hall, a terrible man came out in a green overall and with a stool in his hand. Yakovlev, covering the retreat, whispered: "He is carrying out an experiment".

The sixtieth birthday of Sergei Aleksandrovich Yakovlev, who was working at the Institute, came in January 1964. He was treated as badly as Alekseevskii. Everybody told how the best helium specialist in the country drank their blood. Shal'nikov even said that Yakovlev reached his sixtieth birthday by reducing the life of other workers at the Institute by a total of more than 60 years. However, they could then work with helium and enjoy their shorter life. Finally, it transpired that only Filimonov had survived without conflict with Yakovlev in all these years (both of them have been working at the Institute right from its foundation). However, it was sufficient to look at the face of Filimonov to understand why, in principle, this man could not have any conflict with anybody.

In 1964 there were many birthday-celebrating Scientific Councils. Filimonov reached the age of 50. Sergei Ivanovich was one of the first people to work at the Institute and Petr Leonidovich recalled how he saw him first: 'Filimonov came with a team of fitters. They all remained at the Institute and reached leading positions. Three generations of Filimonovs are working at the Institute: the father of Sergei Ivanovich, he himself, and his son. Sergei Ivanovich has now been working at the Institute for 28 years. He was 22 when he came here. I saw him first when I came into the Big Magnet hall. He was sitting on a pipe and had a sensible expression on his face. Today, we are celebrating his fiftieth birthday. In such cases we always seek weak points. However, this time the task is difficult: there are no such points...

"This year Filimonov became a double grandfather, but he does not look like a solid middle-aged man. We wish that he should not look like a grandfather for as long as possible. We would like also the fourth generation of Filimonovs to be associated with the Institute." This indeed happened. A girl Rika, born in the same year (1964) for Tanya Filimonova, daughter of Sergei Ivanovich, later married Garik Landau. Tanya herself worked for over 30 years in the library of the Institute[†] and was responsible, together with Elena Grigor'evna, who had continuously held the post of head of the library, for the famous order established there a long time ago.

At the end of September 1964 Elena Vyacheslavovna Smolyanitskaya celebrated her fiftieth birthday. As always, the first to speak was Petr Leonidovich: 'Birthdays of the opposite sex always cause difficulties. We cannot be indelicate. And in this case there is a special reason. Elena Vyacheslavovna is the guardian of the state secrets. And if she had been unable to keep her age secret, can she keep other secrets? One way or another,

[†]Tat'yana retired over a year ago. However, the grandson of Sergei Ivanovich, Dima, son of Leonid, is working at the Institute. (*Note by P E Rubinin.*)



Session (7 July 1964) celebrating the seventieth birthday of P L Kapitza, the main target of the celebration. (Photograph by Yu G Za enchik).

this birthday did happen. Smolyanitskaya has been working at the Institute since 1946. We have no right to give an opinion on her work. Undoubtedly, she is working well. No other activity has been monitored by the authorities so thoroughly as the security service and all is well. But let us discuss other things. If somebody falls ill or if something happens and help is needed, the first to help is Elena Vyacheslavovna. Nobody else responds this well.... She has unique abilities: she can take shorthand in Russian, German, and in English; she also knows French. One can dictate her a letter in any language..."

Khalatnikov said that theoreticians frequently have to turn to Smolyanitskaya and they regard her as a marvel. "Everybody is called by their nicknames behind their back. Smolyanitskaya is called Lenochka and I hope that for many years she will remain Lenochka to theoreticians".

Alekseevskii congratulated Smolyanitskaya on 18 years ... of work at the Institute. He said that her activities had ensured that foreigners did not have the pleasure of reading messages in clumsy English.

1964 was a special year for birthdays. For the first time the bell chimed 70. It did it first in March and then in July.

At the session of the Scientific Council on 24 March Petr Leonidovich informed us: "At long last we are able to catch Ivan Vasil'evich Obreimov, who has reached seventy. Beyond this age a man begins to grow younger. Obreimov has been connected with the Institute right from its foundation. He is a member of the Council and an active participant of all its meetings. The main rule is to ask stupid questions. Then the young ones are no longer afraid to come out with their questions. Obreimov has always enlivened our meetings. There is no need to state how I see him as a scientist because his activities are well known to all. He is distinguished by the ability to look at a problem from an unexpected side, which stimulates greatly the others ... "

In spite of the tradition, Alekseevskii could not resist the subject of science and said that he met Obreimov 30 years ago at the Ukrainian Physicotechnical Institute, where he organised-then the first in the Soviet Union-investigations of low temperature physics and commissioned the first machine producing liquid hydrogen. Alekseevskii also gave two examples of the exceptional insight of Obreimov. He was the first to propose zone recrystallisation as a metal purification method. This work was done by him together with Brilliantov. Then the single crystals grown by this method were used to detect the Shubnikov-de Haas and de Haas-van Alphven effects. The second example of Obreimov's insight happened at the Institute for Physical Problems. There was a discussion at a session of the Scientific Council on which substance should be mixed with helium to detect flow. Nobody could think of anything, but Ivan Vasil'evich suggested ³He. At the time it might as well have been some substance from the Moon. And now it is being used. At this stage Alekseevskii gave Obreimov two presents: an ampoule of ³He and a walking stick with a light.

Continuing the subject of unusual ways of looking at things, Khaikin—a pupil of Obreimov—recalled how in 1945 Obreimov inspected him and said: "You are a young man, I am middle-aged, and there is a clear difference between us: you have patches on the knees and I have them on my backside."

Shal'nikov recalled the saying: "Not a man but a brace. Everything is the wrong way round in Vanya's case." Everybody with satisfaction joked about the 'Old



'Pioneers' greeting Kapitza on his birthday. From left to right: M P Kemoklidze (Ryutova), A Ya Parshin, L F Chernikova, I A Fomin, P S Kondratenko, V A Tsarev, V S Edel'man, A I Rusinov, P L Mezhov-Deglin, V S Tsoi, Yu S Karimov, A F Andreev. July 1964. (*Photograph by Yu G Za enchik*)



The garland and the medal from the 'Moldavian Academy of Pioneers' (?!). From left to right: L P Mezhov-Deglin, V S Tsoi, Yu S Karimov, M P Kemoklidze, L F Chernikova, P L Kapitza. (*Photograph by Yu G Za enchik*)

Vanya', founder and first Director of the Kharkov Physicotechnical Institute. Ivan Vasil'evich sat there and smiled happily. And then he spoke with gratitude for a long time in a very serious manner. His speech was a remarkable history of our science, beginning from Ehrenfest and Rozhdestvenskii. And because we heard it from the eyewitness, it would have seemed normal and we would not have been surprised if Ehrenfest had entered the conference room and began to nod with approval when Ivan Vasil'evich quoted him: "Why are you silent?" asked Ehrenfest of his audience. "If you do not understand something, say: I do not understand."

Petr Leonidovich himself reached seventy on 9 July 1964. However, Tuesday was on 7 July. And since Tuesday was immovable, the celebratory session took place on the 7th. We were preparing for this day for a long time. It was decided to have a show. Although everybody knew that the best show could be put up by students from the Physicotechnical Institute ('Phystech'), famed by their shattering victories in the television programme 'Club of the Merry and Quick-Witted' and organising outstanding skits, it was decided that at the Institute we would rely on ourselves. The Phystech students should have their main show at Nikolina Gora. There, at Nikolina Gora on the birthday of Petr Leonidovich, the plan was to bring together all the relatives, friends, and workers of Petr Leonidovich at a festive dinner, which would require preparing long tables in the open under the trees. Since the number of guests was very large, there was a chief toastmaster-tamada (probably Iraklii Andronikov[†]) and several local deputytamadas. All, however, could see the shining eyes of Anna Alekseevna and the permanent tuft of hair of Kapitza, to which everybody had become accustomed. I do not remember very well the show of the Phystech students at Nikolina Gora, but I do remember an enormous, two or three metres long, choc-ice on a stick which they lugged across the courtyard and presented to Petr Leonidovich.

Our artistic producer, main director, and scriptwriter was Aleksei Alekseevich Abrikosov. The idea for a scenario came from the news that an Academy of Sciences of the Pioneers [pioneers were the Communist boy scouts and girl guides] was established in Moldavia and it had elected Petr Leonidovich as their first honorary member. This was a true event. And we had to represent Moldavian pioneers, who came to the famous birthday celebrations in Moscow to greet the honorary member of their Academy. All the young people at our Institute acted as pioneers. As I mentioned earlier, there were many of us: together with the older generation of Volodya Tkachenko and Rinat -Mina, there were sixteen boys and two girls: Lyalya Chernikova and myself. Although the majority of boys were from the Phystech Institute, they were not those from the television show and as artists and especially as singers one could consider seriously only two: Sanya Parshin and Yura Anufriev. However, there were no equals to these two. They were singing everything and, as Mila Prozorova said, they performed each song in accordance with the Stanislavsky method which demands living the role. True, there was by then at our Institute an experienced member of the Phystech Television Club, Slava Kamenskii. However, he knew he was too good for us and decided to remain with the other students at Nikolina Gora.

I had the additional duties of designing a medal which we intended to present to Petr Leonidovich as the newly elected member of the Academy of Pioneers. On one side of the medal I drew a queue of children, approximately five-years old, who had clearly played too long and suddenly remembered the toilet. Their final target a chamberpot already occupied by one happy child showing without inhibition fat buttocks and looking through a telescope. The other side of the medal described the event. I do not remember whose idea this medal was. However, Isaak Markovich Khalatnikov suggested hanging the medal from a heavy and long string of garlic. He said: "Let us make it of garlic; it will prove useful at home." The wooden medal was made at our workshop. It was very thick and heavy, of the size of a large pie dish. The funniest and most unexpected act in our show was ours. We appeared before this distinguished audience in the conference room, filled to capacity, in pioneers' dress: the boys were in satin shorts, either dark blue or striped, and Lyalya and I had very short skirts. The fashion for miniskirts was still some years away and nobody wore satin shorts at the Institute, of course. We were thus not sure who was more embarrassed by our appearance, ourselves or those sitting in the room. However, the audience rapidly recovered from the shock and burst out laughing. We began with the usual pioneer greeting. Lyalya and I then stepped forward and carried on our extended hands an enormous string of garlic which under the weight of the absurd wooden medal was likely to break if we made a single wrong move. We carried this lot across the whole audience and hung it on the neck of the stunned Petr Leonidovich. He accepted the medal with respect, adjusted the garlic on his chest, and kissed both of us. We returned to our prerehearsed places and burst into a chorus:

In wild fires Bluebirds do take wing, We are pioneers, Kapitza's offspring.

This was followed by a long and well-rhymed, sometimes very indecent, history of the Institute. The following song, much more modest, was based on a nice thieves song: "Here we are two thief-gorillas, ring, ring, ring; I am one and the other is Gavrila, ring, ring, ring". It went as follows:

Here we are two science cronies, ring, ring, ring. I am one and the other is Semenov, ring, ring, ring. If it pleases you, 'drela phugh, drela ya, Come to us as dear guests, yes, yes, yes.

We shall show you tricks and hocks, ring, ring, ring. We shall undo all padlocks, ring, ring, ring. If you see Neskuchnyi ever, drela phugh, drela ya, You shall stay with us forever, yes, yes, yes, yes.

We could split atomic moment, ring, ring, ring, In a moment, in a moment, ring, ring, ring. Stern and Gerlach recognised, drela phugh, drela ya, They took away the Nobel Prize, yes, yes, yes, yes....

And so on. This song was performed, in the Stanislavsky method, by Sanya Parshin and Yura Anufriev, and the

chorus joined them only in "ring, ring, ring" and "drela phugh, drela ya".

And then there was this remarkable day at Nikolina Gora, festive and shiny.

Concluding remarks

Science at the Institute of Physical Problems has always been a male preserve. Throughout the whole history of the Institute there were no more than four women at one time on the staff. Klava Zinov'eva, Mila Prozorova, Natasha Kreines (all three experimentalists) and I, a theoretician, were there earlier. Now there are four again: Klava Zinov'eva, Mila Prozorova, Natasha Kreines, and Ol'ga Andreeva, all four experimentalists. I still remember the doubtful expression on the face of our janitor Auntie Tasya, who told me: "Ritochka, you are so young and already a theoretician". For Auntie Tasya, who worked all her life at the Institute, the word 'theoretician' did not mean a profession but a title which she associated with Landau, Lifshitz, Pomeranchuk, Khalatnikov, Ginzburg, Gor'kov, and Abrikosov. And I soon became accustomed to the question: "How did you get into the Institute of Physical Problems?"

In contrast to practically everybody else, I came to the Institute without even suspecting its existence. I came there because of sheets of paper with the 'Landau minimum'. I was studying in the Physics Department of Tbilisi University where one of the main subjects was 'theoretical physics'. Specialisation began from the second year of undergraduate study and from that time we were taught 'hard-core' theoretical physics. Sheets with the Landau minimum reached me in the spring of 1961, when I was in the fourth year. These sheets included telephones labelled '(s)' and '(d)' ['office' and 'home' in Russian]. This was followed by programmes of Mathematics 1, Mathematics 2, and seven sections of the Course of Theoretical Physics, which at that time consisted of nine volumes. There were no addresses on these sheets. But we had no doubts about the address: for us at Tbilisi, at least among students, the embodiment of the nation's science in the capital was the high-rise building of the Moscow State University. All those who decided to take the Landau examination were intending to go just to that place. There were strong mathematical traditions in Georgia and they taught mathematics well in Tbilisi. The two mathematics programmes, compiled (according to those who brought these sheets) by Landau himself, seemed to me attractive. I concluded that there should be no problem about it. As far as the other examinations were concerned, to a student all of them were okay. Nine divides exactly into three and I quickly decided that if I took three examinations at one time, this would make three short sessions-a trifle compared with our sessions of five to six examinations. Thus I would take both mathematics and mechanics in one group. I had sufficient time: almost three months. I myself scheduled these examinations for June, but in a very childish way I had not thought of even ringing the telephone numbers on the sheets and arranging matters, if only to ask whether students were still being accepted for these examinations or not. I simply finished my examination session ahead of time and departed for Moscow with the warm parting words from our Dean, Vagan Mamasakhlisov: "Mind you do not disgrace our University".

The train reached the Kursk Station in the morning and by midday I was already telephoning one of the numbers on the sheets. It was answered immediately by a male voice. I asked: "Is this Moscow State University?" The voice answered "No" and the receiver was put down. I rang a second time and expressed myself more precisely: "I want Landau". This was the standard telephone form in Tbilisi. "Who sent you up, girl?" asked the voice. I said: "Tbilisi University". The voice at the other end laughed and in nearfalsetto asked: "And what for?" My Russian was not very good at that time and I did not understand the reason for the laughter and very coldly said: "I want to take the minimum examination. And who are you-Landau?" "Landau" confirmed the voice. "And why didn't you own up when I asked for Moscow State University?" Landau answered, mimicking my Georgian accent: "I could not. This is not Moscow State University. In any case, I am going away and tomorrow I won't be in Moscow, and I cannot accept you for any examination." The whole conversation seemed to me so absurd that I did not even get directly that I had come for nothing. I realised that later and at that moment what struck me most was that the best physicist in the country had so readily confessed that he was not at Moscow State University at all. Where is he then, I thought, and I asked: "And where are you then, if not at Moscow State University?" It was clear that to Landau also all this conversation was absurd and, clearly angry, he said: "There is Vorob'evka and a tiny institute there. Kapitza built it." And he hung up. I was naturally distressed that the picture of the sunlit high-rise building of Moscow State University was replaced by the unfamiliar words "Kapitza in Vorob'evka" and his "tiny institute", but I soon calmed down. That's fine, I thought. I'll telephone tomorrow, maybe something will change.

The next day was Thursday. And this was my luck. Theoretical seminars are held on Thursdays at the Institute of Physical Problems. This time the telephone was answered by a different voice, male again. I started immediately: "You know, I have come from Tbilisi, I want to pass the Landau minimum examination, and he says he is going away and probably has gone away. It will be very bad if I return without taking the examination. Do you know whether I can take this examination with somebody else in place of Landau?"

The voice answered: "Landau is not going away anywhere. He simply does not accept girls for the theoretical minimum examination. Let us try to catch him once more.

"Where are you?"

"Near the Kiev Station."

"Do you know Moscow?"

"No."

"That's all right, take the No. 7 trolleybus. Leave it at the stop 'The House of Footwear'. When you leave the trolleybus, turn with your back to the 'The House of Footwear' and then across a slanting road, called Vorob'evskoe Shosse, you will see small two-floor yellow houses. They are surrounded by thick greenery. That is the Institute of Physical Problems and all of us are here. Vorob'evskoe Shosse, No. 2. From the trolleybus stop you will cross this road. You will enter through a wrought-iron gate and you will see on the left a two-floor building with the sign 'ZhETF' and to the right there will be a row of residential cottages. But you must go straight through to the most imposing building with columns. When you enter it, walk up to the stairs to the first floor. There is only one corridor from the stairs and it leads to the left. Walk along this corridor and pass the library on the right. Enter the door after the library. I'll be waiting for you inside. But come immediately. No. 7 trolleybus is infrequent and it will take you 20-25 minutes. And you must come here before 11 o'clock. At 11 we begin a seminar. Understood?"

I answered simply: "Yes", and then: "But what is your name?" The voice laughed loudly. Who are these people, I thought, everything is funny to them.

"Isaak Markovich Khalatnikov. Yes. Indeed. And what is your name? You have a Georgian accent. Right?"

"Right. My name is Rita Kemoklidze."

"I shall be very pleased to meet you, Rita Kemoklidze. I wish you success and run fast to No. 7 trolleybus."

I then easily found the No. 7 trolleybus stop and went to the unknown to me "tiny institute in Vorob'evka which was built by Kapitza". I had such accurate directions that by half past ten I was already at the "door past the library". And I was ready, without any gualms and without knocking, to pull the door, when it opened itself and a short round man flew out. He stood in the doorway and continued to talk evidently to all the people, as I noted, in three different rooms, simultaneously. The door from the corridor proved to lead to a very tiny entrance room from which there were three more doors, all open, and behind them I could see each of the three rooms and the people there. So small were these rooms. And the number of people was large. I felt lost. How could I know which of them was Khalatnikov? They were loudly and excitedly arguing about something, talking to one another and at the same time to the round man in the doorway who did not move and who did not let me pass. His cheeks were burning, the eyes were shining, and he waved his hands. Nobody noticed me. Finally, from the room on the extreme right a very nice man looked out and immediately seemed glad to see me. He said "Oh, you must be Rita Kemoklidze. Move away, Alesha[†], from the door and let the girl pass". The round man let me pass and I reached the only free corner. "Hi, Rita", said Isaak Markovich. "Do vou know Elevter?" I did not know Elevter[‡]. "That's all right (said Isaak Markovich). We shall now telephone Dau; he usually arrives about 11." Khalatnikov telephoned Dau, but said nothing about me. He did say that here everybody is dying without him and he is needed here badly. This was probably quite true. Landau appeared like lightning, instantaneously. I did not know that he was living in the same courtyard. I was shaken, not only by this unexpected appearance of Landau. When he appeared, everything changed, he filled all the space himself, and this was an almost physical feeling. Everybody was drawn to him. Khalatnikov immediately forgot about my existence. And only just before everybody was getting ready to go to the seminar, Khalatnikov remembered:

"Dau, somebody is waiting for you here".

"Who?" asked Landau briefly. My eyes did not leave Landau from the moment of his appearance. But he did not see me.

†A A Abrikosov. (MR)

 \pm Elevter Andronikashvili, low-temperature physicist, founder and director of the Physics Institute in Tbilisi, Georgia. (*MR*)

"A girl from Tbilisi. She is ready to take the mathematics and mechanics examinations. Accept her, isn't it interesting. Any girl in Georgia is Nona Gaprindashvili§."

"I already talked with this Nona Gaprindashvili yesterday. That was enough for me. Tell her that I have gone away."

Khalatnikov said: "It is wrong to lie. She is here." And he looked in my direction. I wished the earth could swallow me up, but I continued to stare point-blank at Landau. He saw me immediately and for some reason looked amused. "So skinny", said Landau. I thought, in Georgian as if he could hear me, "You are skinny yourself". Landau said "Well, all right, I surrender". Pen and paper appeared in his hands just on the spot. An right away, standing as he was, Landau started writing down the problems for me very fast. All of a sudden I felt amused: Landau was a tall man and indeed very thin. In order to write standing, he did not simply bend over a table but sort of folded in a funny way. He said "Here you are. Go to the library and solve this. I'll come to you in an hour and a half."¶

I did not need an hour and a half and when Landau came to me, I said so: "In the time you have given me I could have done more." Landau did not pay any attention to this and indifferently wrote me some new problems and disappeared. But this time he came back faster. And this went on until he said: "Fine, you can say that you passed mathematics. Here are the problems on mechanics. Solve them as you please, but as fast as possible. In general, two examinations are not taken here in one go; yours is an exception." By some nervous gesture I revealed bewilderment, although I did not say anything aloud. Landau reacted to my silent perplexity by a fast boxing punch: "Why do you look in this silly way, are the problems difficult?" And he ran away. My perplexity was due to the fact that Landau practically went through the whole of the Mathematics 1 programme and asked nothing from Mathematics 2. The latter included complex variables, the steepest descent method, and all that which contributes to the shining pride of a student who has just learnt these things and has not had a chance to use them yet. All the time I was solving problems on mechanics. I was thinking of Mathematics 2. I did not know that Mathematics 2 was the last number 9-examination, after all the examinations on physics. Moscow students knew this, but we did not. I sort of solved mechanics problems. Landau came and asked: "What have you done?" "Probably all. One problem I am dissatisfied with." "Let us look", said Landau and literally after one minute he announced:

"It will do. You can now go home with the job well done."

"How can I go home? What about Mathematics 2? You recall, Lev Davidovich, that all the problems which you gave me were from Mathematics 1?"

"Yes, of course".

"Then, you will examine me tomorrow on the subject of Mathematics 2?"

"Oh no, my darling, what a demand! Mathematics 2 is taken right at the end, if you get that far. First you must

\$Nona Gaprindashvili was for many years the women world chess champion.

¶The policy was simple: when solving these problems one could use books in the library, but the main point was discussion of the results with Landau. From this he could know for sure one's worth. pass *all* the examinations on physics. I don't know how you would fare in them. I can count on the fingers of one hand those who reach Mathematics 2 and pass the whole theoretical minimum. It is a difficult task, more difficult than heavy athletics. Precisely. And that type of sport is quite unsuitable for girls".

This shook me:

"So that's it. What shall I do with all this knowledge?" Landau softened:

"In which year are you?"

"In the fourth year, i.e. I completed the fourth."

"And do you know you are late? Serious people begin to take the theoretical minimum from their second year. Isn't it the diploma[†] time for you?"

"Yes, but I did not know about Teorminimum earlier."

"All right, forget about the Mathematics. I shall try to make allowances for you. Do you want to take the Statistical Physics[‡] examination in, say, September? Then talk to Khalat[§], it is his responsibility. If you pass, come to us to do the diploma work."

This was my baptism at the Institute of Physical Problems.

In October I passed the Statistical Physics examination of Khalatnikov. In January I was asked to come for the diploma work. My Dean, Vagan Mamasakhlisov, was ready to cancel my winter session. He said: "What examinations? She is going to Kapitza's Institute. She will do the diploma there." Naturally I did take the winter-session examinations and during one of the examination days, the news struck like lightning: Landau was involved in a car accident and was close to death. This tragedy happened on 7 January. Newspapers wrote about this and everybody talked about it. They said that he had in fact died, but that he was kept - in some state unknown to medicine-by the latest means delivered by special planes from the ends of the world. These rumours seemed so unbelievable that I did not listen to them much. I had already bought a train ticket for 15 January and I was impatiently thinking that I would come on 17 January to Moscow and the same day visit Landau in hospital. I had bought pomegranates and a bottle of Sapheravi¶ for Landau, so that he could recover faster. This was what we did in Georgia. However, it all turned out differently in Moscow and the unbelievable tales were confirmed: Landau was dying and nobody, but nobody in the whole world wanted to accept this. The fight for his life was on.

My first Scientific Council was very sad. It took place on 23 January and the first item on the agenda was Landau's state. By that time I was fully plunged into the calamity which has befallen the Institute and, as everybody else lived a life shaped by a single force— LANDAU. It was then when I heard Petr Leonidovich for the first time and understood how deep is a calamity spoken of little and simply.

Petr Leonidovich said: "Landau is in a bad state. The situation is very serious. The Institute is trying to do all that is possible to help the doctors. Everybody participates in this matter of their own will. This shows once again how

†Equivalent to master degree.

[‡]The fifth examination in the usual order.

§K halatnikov's nickname.

¶Georgian dry red wine.

much loved Dau is by the staff of the Institute. The day before yesterday he had his 54th birthday. We all wish him health, but we cannot send a letter because he is unconscious. This state will go on for at least half a year. We have to prepare ourselves for his absence and turn back to normal work It is necessary to help Landau, but it is also necessary to work. At the suggestion of the theoreticians, the organisational work in their division will be taken up by Khalatnikov. The theoretical seminar should be continued, but the theoreticians themselves must decide."

Such was the sad time when I arrived at the Institute to do my diploma work. My course supervisor, my godfather, and my good teacher was Isaak Markovich Khalatnikov. Later, my scientific supervisor was Aleksei Alekseevich Abrikosov. My main teacher became Lev Petrovich Pitaevskii and my guardians were Igor and Lena Dzyaloshinskii. I regard Lev Pitaevskii and Evgenii Mikhailovich Lifshitz also as my teachers of Russian. Fellow students became my best friends for life. But this was still to come, like the general fate of those who were associated with the tiny institute in Vorob'evka, which was built by Kapitza, the fate to remember and love always the yellow walls of the Institute and the ground on which it stands.

* * *

I am very grateful to Aleksandr Fedorovich Andreev and Lev Petrovich Pitaevskii for their constant support and hospitality. That is, if one can call simply hospitality the fact that for eight months I was at the Institute of Physical Problems, concerned with my own work, but thanks to them I did not feel a guest. In the autumn of 1991 I had to be in Moscow for two or three months. My Director, Aleksandr Nikolaevich Skrinskii, gave his blessings, did not stop my salary, and said that I could stay there longer. That in fact happened: I remained in Moscow up to the summer of 1992. At the Institute of Physical Problems, they immediately gave me a bunch of keys, and a permit for going 'down'; they gave me a weekly food ration (normally not given to those on temporary assignment), which could be maintained during this hungry year in Moscow because of the old friendship between the Institute and the 'Sputnik' grocery store. I had my own office in the Theoretical Department, a computer, electronic mail, etc. In other words, I had everything that I needed for normal work. And most important, this was still the same tiny Institute in Vorob'evka, which Kapitza built, and to which I headed every day with the sweet feeling of belonging there. Thus, since I married Mitya Ryutov and left with him for Novosibirsk, Fizproblemy has naturally remained for me the main place where I would go immediately as soon as I arrived in Moscow. But this time I had become fully absorbed in the daily life of the Institute and shared its difficulties brought about by changes of the system. I would like to thank all the staff at the Institute for the great warmth and attention they have given me. I am particularly grateful to my good friends Lyudmila Andreevna Prozorova, Nikolai Vladimirovich Zavaritskii, Natasha Kreines, Sanya Parshin, Garik Landau, Klavya Zinov'eva, and Moisei Isaakovich Kaganov. Their experience, advice, jokes, and simply silent meals, comments, and reprimands (from Nikolai Vladimirovich) have been very valuable to me. I thank Andrei Stanislavovich Borovik-Romanov, Pavel Evgen'evich Rubinin, Zhenya Kosarev, Volodya Zavaritskii, Sasha Smirnov,

Valerii Edel'man, and Lev Luganskii for their constant help. I am grateful to all the members of the Coffee Club, which is a modest Order of Chivalry at the Institute.

My special thanks go to Anna Alekseevna Kapitza. Meeting and talkng to her was very enjoyable for me. A feeling of admiration is surely one of the healthiest human feelings. And I do not know anybody who did not admire Anna Alekseevna. I want to wish her good health. I am grateful to Tanya and Sergei Petrovich Kapitzas for their warm hospitality.