30 years of the Landau Institute. Selected Papers

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I guess a brief historical perspective of what is now known as the Landau Institute for Theoretical Physics will be appropriate here. From the beginning, there was the Institute for Physical Problems, later to be named after P.L. Kapitza, and there was a theoretical department at the Institute, which was headed by Landau. It is safe to say that the Institute was the best of the Academic institutes of the time. In 1946, after World War II, there were only two people at Landau's disposal, E.M. Lifshitz and myself. In 1962, there were six of us, and one postgraduate student, A.F. Andreev. I will not list all the coworkers, but I am pleased to say that they were later elected to the Academy. At that time though, we were just boys under Landau's command. But after that tragic car crash in January 1962, it became clear to all of us that Landau would never be able to come back to science.

Now, to call Landau a department head is to say nothing. What he actually was is the head of a school, and this is a point I would like to emphasize here. A scientific school, and alliance of people who follow and cherish the same tradition and the same style of thought, is something typical of this country. Indeed, this is a unique phenomenon which cannot be found anywhere else in the world.

This being so, what then distinguished Landau's school of theoretical physics? The answer is twofold. Firstly, the Landau school was in close touch with real down-to-earth physics-as opposed to some, may I say detached schools of thought. Secondly, this is an extremely wide range of interests. What interested Landau was physics in general. He was not at all 'fixated' on theoretical physics, nor his coworkers were allowed to. You must have heard of Landau seminars. We all read Physical Review, which was all-things- to-all-men at the time, and it was compulsory for all of us, in turn, to make synopses of whatever papers, Landau's curiosity chose to tick in a newly delivered issue. It was sometimes tempting to tell him, "Well... you see... I am not sure... it is not my field...", or something like that. But every one of us knew that immediate excommunication would be the outcome.

It is my firm believe that hyperspecialization is a very serious phenomenon of the present time, one having a devastatingly harmful effect on the progress in physics. Some time ago, I had an opportunity to talk to a member of the French Academy, a well-known physical theorist with some bent towards mathematics in his work. I wanted to discuss some hydrodynamics with him, and you know what he told me: "Sorry, he said, I don't know hydrodynamics". It was totally impossible to tell Landau anything like that because he simply would not work with you after that. Such was the spirit of his school. There were other schools as well, and you could always tell Landau's pupil from, say, Bogolyubov's, and so on.

So there were different schools and each one had its own distinct face. Each formed a corps d'esprit whose members were quick to understand each other, ex- changed ideas and stimulated one another's work. This was a tradition. Western scientists know nothing of the kind. In the West, each scientist is a "Lone Ranger," people are unwilling, in fact, afraid to speak of their work. Is it for fear of being robbed of one's ideas?

Such was the situation we faced m 1962, when it became clear that our chief is lost for theoretical physics. Indeed, it was clear that the very existence of the Landau school was in balance.

The trouble was that at that period of time, centrifugal forces started to work. Landau's pupils were invited to run theoretical departments at various institutes, and it was becoming increasingly evident that our department was in danger of collapse. While theoretical physics invariably enjoyed the support of P.L. Kapitza, his was not entirely a self-denying support. First and foremost, P.L. Kapitza was a great scientist, and as such he had his own interests to pursue. We theorists were supposed to provide theoretical service for the Institute's experimental research, but we also had interests of our own and these involved somewhat more general and global aspects of theory. Pace P. L. Kapitza, this was not what concerned him most.

So when it became clear that the School was in jeopardy, the four of us, Abrikosov, Gor'kov, Dzyaloshinskii, and myself, came to the conclusion that something must be done to keep it going. It was then that the idea of the Institute for Theoretical Physics emerged.

Parenthetically, an institute for theoretical physics is not an entirely alien con- cept to the West as well. But in the West, there are institutes, and I am aware of some, where all of theoretical physics is embodied in just one person, the director. An institute in the West is something like our sub-faculty, with a personnel of two or three at most. What we had in mind was a full-fledged academic-style institute like, say, Lebedev Institute-although, surely a down-scaled Lebedev Institute.

The idea of the project was like this. I hope it won't be too much to say that we were quite competent, highly qualified physicists in the Landau tradition, but of course, none of us were anywhere near his level to be able to replace him. Now, one of the strongest points of Landau was his critical mind and it was our hope that at least in this one respect, we could "model" him. The role of criticism in theoretical physics can hardly be overestimated because its absence means a speedy and unavoidable lapse into scholasticism and other sins. There was a widespread idea in this-or rather that-country at the time, that of team leadership, and it was decided that we would attempt to create a team critical mind so necessary for us. We assembled a number of strong physical personalities from various fields and various scientific centers and we submitted our project to the Academy.

It is now time to pay tribute to the founding fathers of the Institute. It was at that time that M.V. Keldysh, then the President of the Academy, was obsessed with the idea of setting up scientific centers around Moscow. It was hoped that in some time, we would have our own "oxfords". Today, it can be argued that we do-in a sense. The newly born centers certainly have a role to play and offer serious competition to their metropolitan counterparts.

So I decided to exploit the idea. It was about that time that Academicians G.V. Kurdyumov and Yu.A. Osipyan were organizing the Institute of Solid State Physics in Chernogolovka, and I found this to be a nice place perfectly suitable for our Institute for Theoretical Physics. To tell the truth, I had a fortune to enlist the support of Academicians N.N. Semenov (Nobel Prize winner in Chemistry) and A.P. Aleksandrov.

We had once worked together with A.P. Aleksandrov in the Kapitza Institute, during those eight years that Kapitza was in his dacha exile. I told A.P. Aleksandrov that we were planning an institute of our own. A.P. Aleksandrov called L.A. Artsimovich. "I am now talking with Khalatnikov," he said, "The theorists have got an idea to set up a kind of a gypsy encampment". Anatolii Petrovich was a man of insight. We did set up the institute. But we have never had what might be called an office or premises, and ours have always been a gypsy way of life.

Then, the question was, what kind of an institute were we going to have? At that time, an institute had to have at least 500 people for the project to be considered by the Council of Ministers. It was impossible to assemble 500 people, nor was it reasonable to have that many theorists. As we had 15 leaders at that time, we thought of 15 sectors, each with not more than 5 people; this gives 75 people, and including the ancillary staff, we have a total of 100.

Then came a phone call from a Kosygin's (then the Prime Minister of the Soviet Union) aid: "How come 75? It is completely beyond me." Well, a little bit of foot-dragging again. "Oh," I explain, "It's ve simple, tovarishch. We will have 15 sectors, each sector has 5 people. Just mult 15 by 5. You see? It is 75, isn't it?" "Oh, sure," he replied, "I got it." After that call, it took only two days for Kosygin to sign the project.

So, when dealing with clerks, remember that they just need some logical construction. Tell him that 15 times 5 is 75, and all problems are solved.

The Institute's location was in Chernogolovka, but it was our great concern to retain connections with the outside world. Of course, we could not break off with physics and so we kept in touch with Moscow institutes, especially with Kapitza whose orientation on fundamental physics was particularly in line with our interests.

Speaking of our relations with Kapitza, it is not at all a simple question. His being perhaps the single best institute in all the Academy, the exodus of theorists was completely beyond his understanding. It took him 10 years to agree. He told me: "It was perfectly right of you. Looking back, we did need an institute OK." But as for Chernogolovka, he never accepted this. Why not in Moscow?

There was one further source of concern. Normally, theorists are immersed in a physical environment and their work goes hand in hand with experiment. But we were in danger of breaking away from physics, and this was a very serious ever- present problem calling for unremitting attention.

If there is no contact with practical physics, then theoretical physics is just scholasticism, having nothing to do with life. However, all of the 15 famous theorists we brought together had had good experience of working with experimentalists, and this tradition came over to the Institute. Also, a number of high-rank mathematicians were invited, who had a background of working with physicists and were familiar with their ways. It was then that S.P. Novikov and Ya.G. Sinay joined in, with a staff of one or two for either. This comprised 1/15 of the entire Institute. We also organized a Nonlinear Hydrodynamics Sector, a semi-mathematical unit under V.E. Zakharov's leadership. He had two people to work with. However, most of us were physicists, and it is physicists who determined the atmosphere of the Institute.

So we obviated this break-away problem after all. By the way, A.M. Prokhorov (Nobel Prize winner for the laser, with C. Tauns and N. Basov) was also among the doubters. He was afraid that theorists would break away from physics. He told me later that this had not happened.

The atmosphere that dominated in the Institute was a pretty hard one for a loafer, even though it was all very democratic and no disciplinary measures were ever taken. The running of the Institute was very much a common responsibility. To join the staff implied an approval by the Academic Council, in secret voting, and the Council was rather a big body. One needed a two-thirds majority of the Council list, and considering the not infrequent absence of its members, this was quite a bottle-neck to squeeze in. This was not the only filter we had, though. The first one was at the Moscow Institute of Physics

and Technology, at the stage of admitting students. This is the privilege we have enjoyed and are enjoying in MIPT, that not only we select students for our own sub-faculty, but we also have the 'right of the first night' in choosing students from other specializations. So there are three filters for a future theorist to go through; the student admission, postgraduate selection, and finally, the work admission. This three-stage selection was a very important feature of our life, it was important to retain the homogeneity of the Institute, so that people would be able to understand each other and to feel the atmosphere they work in. P. L. Kapitza told me once that even a single loafer is a great danger for the Institute, not so much because he does not contribute himself, but because he binders his workmates in their work. So if you have a good efficient team and if somebody is out of line, this has an adverse effect on the working atmosphere. Therefore, we have had periodic votings and carried out work fitness interviews, a rather obsolete notion today, and these were very demanding interviews, and when someone failed, we just informed him and helped in getting another job. It was all solved peacefully and nobody have ever complained of being mistreated. It was our point, to keep cleansing our ranks. Even one single work-shy was an eyesore to the rest of us and was out of tune.

To assess our activities during the period 1970–1985, it is perhaps simplest to refer to the official statistics.

In 1989, the Journal "Scientist" gave the list of the best ten institutes of what was then the Soviet Union, and these were the best ten from all branches of science. The Moscow State University and the Dubna Center entered the list. I am not any more the Director of the Institute, I am only an honorary director, so, with all due modesty, let me tell you that it is the Landau Institute which was on the top of the list.

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