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Collective Research in European Physics

The European Great Projects

Europe is building or planning a number of major physics tools that will occupy much of our attention and resources over the last part of this century. In Rome on March 26/27, EPS is holding a seminar, at which these projects will be presented to an invited audience of leading physicists. The following is a summary of a conversation on the trend towards centralization with Donato Palumbo of Brussels, Abdus Salam of London and Trieste, Herwig Schopper of Hamburg and Sam Ting of Boston, USA.

Europhysics News will be reporting on the Rome seminar in the April issue.

The traditional figure of the solitary scientist, white-coated of course, working away in a dingy laboratory, pencil in hand, surrounded by an assortment of make-shift apparatus held together by string and sealing wax, contrasts sharply with the modern image of a trained team, manipulating vast engineering complexes and feeding results directly into a computer for direct transmission to some foreign land.

Will the trend always be towards bigger and bigger machines?

A. Salam

Before considering these large collective endeavours that are necessary if we are to make progress in many fields of physics let me emphasize two points; one is that there is still room for the individual. Even teams are made up of individuals. One still needs the imagination and initiative that comes from a single person exercising his intellectual powers. The second point is that we must not identify good with big. I strongly dislike the phrase "big science" as it tends to give a false emphasis to size, and leads to the impression that high quality is associated with enormous expense and, as a collorary, modest projects and low cost activities are somehow inferior. That said let me then say how important I think these collective projects are for the future of physics. LEP, for example, is a machine that is absolutely necessary for us to push forward our theories on unification. Moreover, it would be a very great pity if such a machine were built too small so that it was not quite capable of providing the results that are looked for. There is no question either here or generally in physics of the machine builders devising something large for their own satisfaction. Again if I may quote LEP, never has there been a machine in particle physics more full of purpose since the Berkeley 6 GeV synchrotron. It is the same in other disciplines.

H. Schopper

No doubt, some disciplines, like elementary particle physics or astrophysics, need larger and larger equipment resulting in bigger research centres. However, even other parts of science which traditionally could work in very small groups become involved in "Verbundforschung" – collective research, which is centred around big installations provided by large centres. A notable example is synchrotron radiation, which is being used by research groups that typically consisted of one or two people working at small laboratories. These people now need the service of accelerators or storage rings, or if they work with neutrons they have to use big reactors. This trend is spreading to the solid state physicists, surface physicists, biologists, mineralogists and so on.

D. Palumbo

A distinction must of course be made between machines that are built to provide a central facility for research into fields that have no basic connexion with the machine technology, and machines that form the essential object of the research. Such is the case for the experimental thermonuclear experiments like JET; the building of the machine and its operation constitute the research objective, and size is something intrinsic. This is why talks are being held already at world level on what should happen after JET. So closely does the thinking in the various continents correspond, consideration of a global programme through the International Atomic Energy Agency is now feasible. Here it is the physics

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of plasma, quite apart from the importance of the research from the point of view of energy supplies for future generations, that imposes a certain scale on any experiment.

Does centralization also mean compartmentalization ?

H. Schopper

Certainly there is a danger of big centres becoming ivory towers. The obvious solution is to keep very close contact with the Universities and with other laboratories. However, when considering the difficulties which might arise, one should distinguish two separate situations. In some fields like high energy physics, comparatively large groups work together to build the sometimes huge detectors. The people are usually well integrated in the centre and they become more or less permanent users. As a result, the relation to their home institution might be weakened. On the other hand, where for instance synchrotron radiation sources or reactors as neutron sources are used for diffraction experiments, small groups come for a few days to expose their specimens and then return to their own laboratories. Here a continuous flow to the centre is produced which requires strong support from the centre. There can be a danger then that the centre becomes just a service laboratory.

D. Palumbo

Again you have to make the distinction between the source machines as tools and the experimental machines, where necessarily the research is concentrated in the project. But this research covers a wide spectrum of disciplines and one has to admit that there are not many people who understand sufficiently other branches of science outside their own. Everyone has a tendency to bury himself in his own subject.

In general, there is no problem of communication between people in the same field, where there are lots of channels even if people do not always make good use of them. Also people speak the same jargon – they understand each other without effort. It is much less easy to communicate with someone who has a different preoccupation and a different way of expressing himself.

H. Schopper

One encounters the same problem with industry particularly in the medium sized establishments which also have an important role to play in future developments. For the big laboratories with their large academic force this is not the case; their background is similar to the non-applied physicist and they speak the same language but then again, they have their internal interests. In some instances industry can become fully involved from the beginning in a new project such as in the construction of a space telescope or a new research reactor, and in some areas of technological development such as superconductivity the cooperation can be at a high level. There are still nevertheless major areas where information transfer could be much improved.

This is not a new phenomenon. Unfortunately it seems that if there is no conflict there is no awareness. Within physics, communication lines are in principle good, but reaching the individual is still difficult. This is why special means have to be used to draw people's attention to new activities. People concentrate on their own subject, ignore what is published in the literature and then complain if something happens that they did not have the information.

A. Salam

We also have a duty to explain what we are trying to do. These big centres cost a lot of money and it is incumbent on us, when we ask for large sums, to justify these demands to the public and to our fellow scientists. This is not the same as lobbying for special treatment. It is quite wrong to think of these collective projects being in competition with each other or, for that matter, with other parts of their same discipline. We should understand that they are all part of science and the battle is not with fellow scientists, but against the vast unthinking expenditure on wasteful enterprises where destruction not creation is the objective.

Physics is a creative activity and I applaud the initiative which brings these projects together so that they can be discussed in a spirit of cooperation and not of competition. Hopefully this will stimulate others to do the same thing, so that success in one field will give encouragement to other fields.

D. Palumbo

We need more meetings where there are no parallel sessions and where everyone can, for once in a while, escape from his specialized subject and listen to what is happening in other subjects. Then we might find there were fewer conflicts of interest and that we could draw strength from each other.

Is it easier when the formal language of communication is the same, as in the USA?

S. Ting

Communication is not essentially a problem of national language. The USA and Europe are therefore similar when it comes to matters of communication ; that is to say that they are quite adequate in any particular discipline but outside, we tend to rely on personal contacts. These may be well developed if you are in the fortunate position of knowing where to go but are much less easy if contacts have never been built up.

Comparing projects in different disciplines — like apples and oranges — is never easy and in this perhaps the USA has an advantage as there are organizations like the Department of Energy and the National Science Foundation which assign priorities for the whole country. In Europe, each separate country has its own national council which operates more or less independently.

On the whole, the public bodies work pretty efficiently – perhaps not as fast as one would like and certain detailed decisions are not everybody's – the real problem is to get the physicists to take notice of what is happening and to take an interest in what is being planned for the future. Most physicists have the tendency to be wrapped up in their own immediate research, whereas because of the long lead times, we are now required to build machines for our children to use. I am very conscious that when "Isabelle" is complete it will be very difficult for young people to get involved in the experimental programme of this machine. Again, you have the problem that so far, the most important results that have come for example from the high energy machines have been unexpected so that the ultimate justification of the machine construction is quite different from what was being put forward at the time when it was proposed.

There are fields where less speculation is needed. Synchrotron radiation is new and fundamentally important. One can see also the same fundamental value in instruments in space outside the earth's atmosphere. Nevertheless, how can you consult the future users when to a large extent they are unknown. You have to rely on good management with a broad awareness of what is going on, what is possible and what might be. There is no simple formula and so a variety of consultative channels offers the best way of covering the situation.