Physics in the German Federal Republic

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Germany has a long tradition of fostering physics research at the universities and, in addition, a tradition of encouraging applied physics and close relations with industry. "Technical physics" was introduced at some universities in the twenties, at a time when theoretical research was at the height of its success which may explain why about one third of all physicists work in industry. Germany's leading position was lost after 1933 through the expulsion of many of the best scientists, the government's neglect or fear of science, and finally through the war. Reconstruction began at first slowly but was greatly accelerated in the fifties and sixties - a little later than in most other countries. The expansion came to a stop in the early seventies. Today, about 3500 physicists hold posts at universities while the number of physics freshmen entering university is about 1300 per year. The corresponding figures for 1955 were about 600 and 300.

The number of physics students has ceased to increase in recent years, so we seem to be approaching an equilibrium in the employment situation. In 1971, the German Physical Society made a survey of physicists in the German Federal Republic excluding high school teachers. It found that about one half of them work in industry, one third at universities and research institutions; the rest work in Ministries, administration and health services. The total number of physicists in Germany is about 15,000. If conditions remain stationary, we calculate a yearly need of physics graduates of less than 1000 but pessimistic estimates of their number suggest that it will be nearer 3000 in 1990. Unless therefore, the number of students decreases, considerable flexibility will be required of them when it comes to their future employment. In 1976, about 500 physicists were registered as unemployed, that is roughly three percent.

At the universities, about one half of the research is funded from the universities' budgets. Per physics chair (one professor and about four positions for scientists) about DM 150,000 are available per year for equipment and materials. The most important contribution beyond this comes from the Deutsche Forschungsgemeinschaft, for additional personnel, large equipment and smaller cost items. A typical grant is DM 50,000 per year; one million DM is exceptional. Grants, in what is called "Normalverfahren" are awarded on application to the scientists after refereeing, but without giving priorities to special fields. A scientist may also file an application in a "Schwerpunkt" which has been suggested by a committee of scientists as a field where increased activity is desirable. For an increased local activity, especially in a field where several specialities must cooperate, a "Sonderforschungsbereich" may be created, with a yearly budget of one to several million DM. Tables 1-3 give break-downs of the three funding systems and, at the same time, provide a rather valid description of the distribution of research at universities in the various branches in physics.

Other funding sources for university research include foundations, of which the most important is the Volkswagenstiftung, and the "Bundesministerium für Forschung und Technologie" which makes important contribu-
A typical institute has about a hundred scientists, with a budget around DM 20 million. The Institute of Plasma Physics is larger with 250 scientists and DM 50 million.

The "Bundesministerium für Forschung und Technologie" (together with the regional Land governments) finances mostly industrial projects. In research it finances the "Grossforschungseinrichtungen", namely:

Deutsches Elektronen-Synchrotron (high energy physics) (DESY), Hamburg
Deutsche Forschungs- und Versuchs­anstalt für Luft- und Raumfahrt e.V. (aeronautics and space) (DFVLFR), Köln
Gesellschaft für Kernforschung mbH Karlsruhe (nuclear research) (GfK), Karlsruhe
Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffs­fahrt mbH (nuclear ships) (GKSS), Gießen-Marktheidenfeld
Gesellschaft für Strahlen- und Umwelt­forschung mbH München (radiation and environment) (GSF), Neuherberg
Gesellschaft für Schwerionenfors­chung mbH (heavy ions) (GSI), Darmstadt
Hahn-Meitner Institut für Kernfor­schung Berlin GmbH (nuclear research) (HMI), Berlin
Max-Planck-Institut für Plasmaphysik (plasma physics) (IPP), Garching
Kernforschungsanlage Jülich GmbH (nuclear research) (KFA), Jülich

Their total budget is DM 1100 million a year, with more than 4000 scientists, engineers and staff.

The part of physics in all this is difficult to estimate, because many of the programmes are mixed. It may be of the order of 15 percent.

The Ministry also finances the German contribution to international projects like CERN, ESA, the Grenoble High Flux Reactor and the European Southern Observatory. It also finances large new projects, the latest examples of which are the storage ring for electrons and positrons "PETRA" at DESY in Hamburg and the Heavy Ion Accelerator Unilac at GSI, Darmstadt. Such projects are proposed and refereed by scientists, but the decision is taken by the Minister.

Other ministries operate institutions for research in physics, too. The most important is the "Physikalisch-Technische Bundesanstalt" with 300 physicists and a yearly budget of DM 80 million. One other is the "Bundesanstalt für Materialprüfung" in Berlin, which has a strong component of engineering research. A relatively large number of smaller institutions are funded from various sources, often by one of the German "Länder". Examples are the "Institut für Spectroskopi" in Dortmund, financed by Nordrhein-Westfalen or the "Fraunhofer Institut für Sonnenforschung" in Freiburg, Baden-Württemberg. Physicists are of course active in many fields outside physics, for instance chemistry and engineering. An interesting example is research in theoretical medicine, which in Germany, for some reason is not very attractive to students with medical training.

We see that physics in the Federal Republic is quite varied in scope and resources, and in its inter-connections with other fields. Planning in research usually originates with the scientists themselves. This has led to a good use of the human resources in the field, and since the scientists are citizens like other members of the community, their plans and wishes do not usually diverge from those of the rest of the population. The scientist wants to be useful, and he himself knows best what he can do and what his limitations are. Therefore, it is probably all to the good that in the German Federal Republic there is no strong central planning authority for research.

For the future, flexibility is the most important aim. Nobody knows what the important fields will be in the lifetime of those who are now students. In the German Federal Republic, physics has not been divided into too many specialized fields and the connections with other disciplines, especially engineering, are still strong and we hope, growing. This again is a good omen for the future.

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