state & society

Physics in Japan: budgets still meager despite economic boom

The contributions of the Japanese to physics in the days when Japan was a poor country have always seemed disproportionately large in relation to the support that could be made available for physics research. Now that Japan has become the world's third largest economic power and looks to be second or even first by 2000, we might expect that, with decent levels of funding obviously forthcoming, the turn of the century would find a new golden age of physics centered in Japan. Unfortunately it is not so clear that support for physics research will even come close to keeping up with the phenomenal growth of Japan's GNP. Physicists in Japan are particularly concerned that basic physics, in contrast to applied physics, will soon run into the same difficulty now faced by American basic physics—an inability to compete for government funds in the face of the mushrooming needs of a highly technological and urbanized society.

At first glance the funding situation for research would seem to be reasonable. Out of a current gross national product of $160 billion Japan invests 1.8% or a total of $2.7 billion in research and development activities, which is about the same fraction as the $16 billion the US puts into R and D out of its $940 billion GNP. But unlike the US, most of Japan's R and D funding is provided by private industrial companies for applied research in their own laboratories. Basic research is done only at the universities with funds supplied solely by the government. The government's Ministry of Education provides a little less than $500 million annually to the universities for basic research in all fields. By comparison, US university physics itself gets $400 million for research annually from the Government. For the 20 000 university research physicists in the US this figures out to be $20 000 per physicist. The total budget for Japanese university physics is $33 million. Out of the 8000 Japanese physicists (Japan's physics population ranks fourth in the world behind third-place UK), 4000 are at universities. Thus the government provides only about $8000 (including salary) per researcher in basic physics. The expenditure per researcher in Japanese industrial labs is two and a half times this sum or close to the figure for US physicists.

Ten years ago the total budget for university research was much lower still and has been brought to its present point by increases of about 10% in the government's outlay each year. This might seem a rather generous rate of increase, which actually matches the growth of the total economy. Not considered in the figure, however, is a 7% loss per year due to inflation. Thus physicists in Japan on the professorial level midway in their careers complain that, at the 10% rate of increase, funding will still not have reached reasonable levels by the time they are ready to retire.

One conclusion: University physics in Japan may have many things to interest the Western physicist but a job is not one of them.

Japanese physicists and scientists

continued on page 70

TOMONAGA

US to spend more on new energy programs

The President's energy message to Congress on 4 June, the first such comprehensive statement on energy policy by a President, commits the Federal Government to spending $3 billion on new energy programs during the next decade. For physicists the most significant aspect of the message is that it shows the Administration's recognition of the tough fundamental problem of providing sufficient clean energy, and the need for examining all the technological opportunities.

The President has requested his science adviser, Edward E. David Jr, to take a hard look at all the opportunities that are available and to recommend additional areas for priority action. A spokesman for the Office of Science and Technology told us that over the coming year basic research and development in energy will be augmented and strengthened, and that this would provide employment opportunities for physicists in the future, but not immediately.

Promising areas for future support identified by the spokesman are controlled-fusion research, solar energy and magnetohydrodynamics. He would not quantify the prospects, however, saying that the office must first take a comprehensive, long-term look at all kinds of energy sources.

For fusion research in fiscal year 1972, the Administration has already requested a supplemental appropriation of $1.8 million to tack on to the original budget of $28.0 million. The spokesman said that fusion work is likely to be expanded in the coming year because progress is good enough that larger-scale experiments are warranted. AEC Chairman Glenn Seaborg, at a press conference on the energy message, said he believed that the scientific feasibility of fusion power would be demonstrated by the end of the decade and that we should have a practical, economic fusion reactor by the year 2000.

In discussing energy research and

development the President called for a commitment to complete the demonstration of a liquid-metal fast-breeder reactor by 1980, more than twice as much Federal support for sulfur-oxide-control demonstration projects in fiscal year 1972, an expanded program to convert coal into gas, and support for a variety of projects in controlled fusion, magnetohydrodynamics, underground electric transmission, solar energy, coal mine health and safety, coal liquefaction, reactor safety and technology, and advanced reactor concepts.

The message also dealt with the leasing of energy resources on Federal lands, methods of improving energy utilization, legislative proposals, and the proposed Department of Natural Resources, which would contain a single organization uniting all important energy resource development programs. Within the department AEC would remain intact to execute nuclear-energy programs and related energy research.

On 21 June AEC announced that it will give access to its uranium-enrichment technology to a limited number of US-owned companies who want to do research and development on uranium enrichment. The technology will continue to be classified as Restricted Data, and the R&D will be financed by the private companies. In the period 1961–1967 five private companies had access to information on the gas-centrifuge method, and some did development work; then AEC decided to stop such private activity. Now AEC is again allowing private companies to do such development, but it will limit the number of firms participating. —GBL

Budget for solid-state physics at Tokyo U

The meager scale of financial support for basic physics in Japan is well illustrated by the budget for Tokyo University's famous Institute for Solid State Physics. As Japan's preeminent center for basic research, the Institute has been the most generously equipped and funded of any government-supported laboratory. But by Western standards the amounts invested in this prestigious center are small. Initially, when the Institute was established in 1957, $1.7 million was provided for buildings and $4 million for research equipment. The annual operating budget grew steadily in the first several years until five years ago it reached about $450 000 per year where it has stayed ever since. The Institute's director, Taira Suzuki, notes that this less than half a million dollars supports the research activities of 100 physicists on the permanent staff plus housekeeping costs for the Institute. To anyone walking along one of the corridors of the main building it is obvious that little of the original capital investment has been squandered on frills. No sleek surfaces of marble, glass and stainless steel greet the eye. Instead there is open brick, inexpensive wood and exposed heating pipes.

More importantly, Suzuki points out that the experimental equipment purchased with the original investment has grown obsolete to the point where the laboratory has been confronted with a serious crisis. Fortunately the Institute was able to obtain a special additional budget last year of $1.5 million for capital equipment that will be spent over a four-year period. This sum plus the inroads of inflation on the operating budget will not allow the Institute to continue with all of the twenty odd areas of basic research it has been pursuing. The decision has been made to specialize in a few areas such as laser optics and ultrahigh magnetic fields, and perhaps one or two new fields such as earth physics and "nuclear solid-state physics." In the latter the aim would be to introduce the apparatus and techniques of nuclear physics into solid-state physics and eventually extend solid-state physics to neighboring disciplines such as biophysics and astrophysics.

Physics in Japan

continued from page 69

doing basic research are agreed that what is needed to put Japanese science in a healthy condition is a sizeable step-function increase (say 50%) followed by the current 10% annual increments. Beyond the need for massive injections of funds, scientists also have been aware of the need for a well defined government policy to guide the support and development of public-supported research. It was with these two objectives in mind that Sin-itiro Tomonaga, Nobel prize-winner, accepted the presidency of the Japan Science Council several years ago. (The Council is an organization of some 200 eminent scientists that plays a role similar to the US National Academy of Sciences in advising the government on scientific matters.)

Under Tomonaga's leadership the Science Council formulated a five-year plan that would achieve the ends of improved funding and enlightened policy. A central feature was the proposal that the government establish first-rank research centers for each of 24 disciplines.

In addition the plan included things like an uncommitted fund that could be spent flexibly as unforeseen interests developed (NSF has such a fund). The plan was submitted to the government more than five years ago, and Tomonaga has since resigned as Council president with feelings of "regret and disappointment." His feeling is that the government has never seriously considered the substance of the JSC proposal. As a result, Tomonaga points out, the problems have not changed—no area of basic research is really adequately funded and what money there is gets distributed unevenly among the various disciplines.

Not quite so pessimistic is Seiji Kaya—solid state physicist, former president of Tokyo University and now chairman of the Science Deliberation Council. It is this body of scientists, officially a part of the Ministry of Education, that is directly involved in the Ministry's in-house discussion of the science budget.

While Kaya agrees in principle that Japanese research needs substantial budget increases, he feels that the JSC showed a lack of political *savoir faire* in the way it went about presenting its five-year proposal. Unlike the US, there has been in Japan for some time a wide gulf politically between the science community and the majority party of the Diet.

Diet members view the 210 members of the JSC as "leftists," whereas the scientists accuse their elected representatives of being "establishment conservatives." In Kaya's view the JSC has so far done little to resolve this mutual antagonism. As a result there has been no realistic base of political support for pressing the Finance Minister to allot a larger piece of the pie to science.

Standing with a foot in each camp, Kaya is optimistic that this year some progress may be made. He notes that the new Minister of Education, Michio Sakata, had been a staunch supporter

KAYA