



NOTES

from ABROAD

Mexico

In the course of the last decade research in physics and allied sciences in Mexico has progressed a good deal. At the Institute of Physics of the University of Mexico in Mexico City theoretical research in the theory of gravitation and in cosmic rays has been going on for some time while experimental work has been carried out in the latter field, and x-ray analysis of the structure of matter is being started.

Interest in the theory of gravitation owes its beginning to a lecture given by the late Professor George D. Birkhoff of Harvard on the occasion of the inauguration of the new astrophysical observatory at Tonanzintla in 1942, which was followed by two more seminars on the same subject led by him. Birkhoff fired the imagination of a number of young physicists, and a group headed by Dr. Carlos Graef, a graduate of the Massachusetts Institute of Technology, and Dr. Alberto Barajas set out to explore the new theory. Birkhoff's postulates give rise to much simpler developments than Einstein's and so a good many problems can be set up and solved which can only be handled with great difficulty, or not at all, in classical relativity. Graef, for instance, solved the two-body problem and showed where the formulas in the two theories are different. An experimental test in this case is difficult but the three classical tests of general relativity come out the same in both theories so that Birkhoff's ideas still await experimental backing. Luis Enrique Erro, Director of the Tonanzintla Observatory, has also been working in this field.

As already mentioned, research in cosmic rays has been both theoretical and experimental. On the theoretical side we have been interested in the paths cosmic rays take, the stability of periodic orbits, the theory of ring currents circulating around the earth and its bearing on certain types of magnetic storms, the consequences of the existence of a permanent

magnetic field of the sun, and so forth. Recently work has been started on the orbits of a charged particle in the magnetic field of a sun spot and how such particles can acquire high energies as the spot's magnetic field changes with time. How such particles escape from the sun has also received attention. Research now being planned in cooperation with the Carnegie Institution of Washington and the Institute for Advanced Study, which will require the use of the ENIAC, will, it is hoped, clear up remaining doubts.

On the experimental side research was carried out on the sign and the energy spectrum of primary cosmic radiation. For this purpose a counter telescope having certain novel features was designed and built. The results are not conclusive, since they depend on meson production in the high layers of the atmosphere by the impact of primary cosmic rays. The research team working on these problems is led by the present writer and has included Alfredo Baños, now at the University of California in Los Angeles, Graef, Perusquía, now at the Monterrey Institute of Technology, Oyarzábal, Romero Juárez, Lifshitz, and several others. Dr. Gill, formerly of the Tata Institute of Fundamental Research in Bombay, India, and now at the National Physical Laboratory of India in Delhi, Dr. Forbush, and Dr. Vestine have collaborated in the work at the Carnegie Institution.

Very interesting research on the theory of nerve and muscular action has been carried out at the laboratory of physiology of the National Institute of Cardiology in Mexico City. This research, led by Dr. Arturo Rosenblueth, director of the physiological laboratory, and by Professor Norbert Wiener of Massachusetts Institute of Technology, brings in together the most advanced ideas on the physical principles of the transmission of intelligence and refined experimental methods of physiology. It is giving rise to a new branch of science, dubbed cybernetics by Wiener, which is concerned with the application of physical principles to complex biological situations. A number of persons have co-

operated in this project, among whom we might mention Dr. García Ramos and Dr. Pitt.

Research on methods of accelerating charged particles has been going on at the Research Laboratory of Physics of the Polytechnical Institute. This work has not only been concerned with tried methods to obtain high energy particles, such as the Van de Graaff electrostatic generator and the linear accelerator, but has also led to new methods which are now under study, such as the use of a variety of the Tesla coil and a new device which, for lack of another name, has been called the electrostatic transformer. Research on the former has been led by Dr. Manuel Cerrillo, now at Massachusetts Institute of Technology, and a number of workers have taken part. Work on the latter has been led by Mr. Mireles Malpica, who has built a small model of the new apparatus which is now undergoing tests. Cerrillo has also been concerned with research on the propagation of signals through wave guides and other problems of interest.

Research of very great importance for the future of building construction in Mexico City has been carried out in soil mechanics. The valley of Mexico, seven thousand five hundred feet above sea level, has no natural outlet. The city itself is built on soft watery clay, extending downward to unknown depths. Mixed with this clay there are relatively thin layers of sand. It is on this foundation that all buildings in this city must stand. Active seismic conditions add to this difficulty. With greatly increased land values, and a population which has increased from less than five hundred thousand to over two million in the last quarter of a century, the tendency is to build higher and higher structures. All this has created an intense need to study the nature and properties of the subsoil. A research team headed by Dr. Nabor Carrillo, and consisting of Messrs. Hiriart, Landázuri and Marsal, working in the Laboratory of Soil Mechanics of the Comision Compulsora y Coordinadora de la Investigacion Cientifica has been solving many experimental and theoretical problems connected with this

question. Lately Dr. Carrillo has been appointed consultant for the Stanford Research Institute on problems involved in the fast sinking of the Long Beach area in California.

Many other research projects might still be mentioned. The discovery of uranium deposits in northwestern Mexico, for example, has necessitated the creation of adequate laboratories for the study of radioactive ores. It is our earnest hope that some day the present political troubles having to do with the international control of atomic energy may be cleared up so that we may contribute our share to the study of peaceful applications of nuclear energy, particularly to the generation of industrial power. The economy of whole large regions of Mexico would be radically changed if nuclear power were available.

We cannot close this article without emphasizing certain important points. First, it is a matter neither of design nor of accident that theoretical research is developing at a faster rate than experimental work. The explanation is found in the fact that the former is much less expensive than the latter, and hence much more within reach of a country with limited economic means. Research in Mexico is financed chiefly by the Federal Government through various agencies in the form of subsidies and grants. Secondly, the present condition of physical research and its prospects for the future could never have been attained without the help provided by a number of organizations and institutions in the form of fellowships and scholarships for study abroad. The Guggenheim Foundation, the Institute of International Education, the U. S. Department of State, the British Council, Princeton, Harvard, Massachusetts Institute of Technology, have given decisive assistance. Practically no other help has been granted by foreign institutions to research in physics in Mexico. Conversations with representatives of the Rockefeller Foundation, for instance, which has contributed to research in agriculture and in the humanities, have never been fruitful for physics.

Manuel Sandoval Vallarta