



Rio de Janeiro Ewing Galloway

A Note from Abroad . . .

PHYSICS IN BRAZIL—WAYS AND MEANS

*I'll tell thee everything I can;
There's little to relate.*

(from a song called
"Ways and Means" by Lewis Carroll.)

Like its prominent representative C. M. G. Lattes, physics in Brazil is young. In the tens and twenties a considerable effort to orient the main directions of Brazilian research was made by Henrique Morize, a physicist of French origin, who became professor at the Technical College in Rio de Janeiro and director of the Astronomical Observatory; his orientation is still kept at these institutions by his successors. On a wider scale, organized research in physics started after the first faculties of science and technical research institutes came into existence. Since then it has developed at an astonishing pace in spite of many handicaps which are caused by Brazil's great

distance from the principle centers of scientific and industrial production.

In 1934 the State of São Paulo took the initiative by creating the first faculty of science. Organization was in the hands of Teodoro Ramos, himself a brilliant mathematician; in a short visit to Europe he selected a few outstanding men who were to be put in charge of the main departments of the new faculty. His task was made easier by the liquidation of a considerable fraction of European science brought about at that time by the rising fascist tide; his judgment of character and scientific skill was such that not one of these men proved to be a failure. It

was in this way that a physicist from Italy, Gleb Wataghin, not widely known at that time, came to Brazil. Today a great number of Brazilian research physicists, directly or indirectly, are his pupils and with his help the physics department in São Paulo has become the best equipped in South America. Several lines of research are currently being pushed: experimental work on cosmic rays, which in 1940 led to the discovery of the penetrating showers by Wataghin, Santos, and Pompeia; development of machinery for nuclear research directed by Souza Santos (a 30 million volt betatron is expected to be ready for action soon and a Van der Graaff generator is being built by O. Sala); research in Raman spectrography by H. Stammreich; and finally, fundamental theory as represented, for instance, by the work of M. Schoenberg on the point electron.

The Rio de Janeiro faculty, originally a municipal establishment, was taken over by the Federal Government in 1939. In its department of physics, experimental work on dielectrics is carried out by J. Costa Ribeiro, and research on the theory of nuclear forces and mesons by Leite Lopes and J. Tiomno; since the two theorists are at present at the Institute for Advanced Study in Princeton, where they hold research fellowships, the reader may possibly have easier access to their current work than the writer.

An Institute of Biophysics has recently been founded in Rio at the School of Medicine by Carlos Chagas, who is concerned with borderline problems between physics and electrophysiology. An example is the work on the electric eel which for so many years shocked and baffled the curious observer.

The National Institute of Technology, also a federal institution but not associated with the University in Rio, has developed from a modest experimental establishment for minerals and fuels founded in 1921 to its present sizeable condition; its nine major divisions cover most fields of modern technology. In a country where the backbone of heavy industry, similar to that characterizing the highly industrialized areas of the world, is now just growing, the development of such an Institute is a formidable task; it has been made possible by the scientific and administrative ability of its director, E. L. da Fonseca Costa, who succeeded in proving to both government and industry the need for organized industrial research. Research in the physics of electricity has been done by the present writer, who together with O. Castro and P. S. Rocha worked on dielectric theory and insulation, and relaxation phenomena. More recently cosmic ray research has also been taken up.

A factor, which in Brazilian scientific life is becoming increasingly important, is the work of the Academy of Sciences. For more than twenty years it has regularly published the only nationwide scientific periodical covering all fields of science; in recent years a trend in the published papers towards physics and mathematics may clearly be discerned. The publication of the *Anais da Academia Brasileira de Ciências* is a great personal achievement of its editor, A. Moses, whose broadmindedness is well characterized by the fact that he accepts

papers in all languages using the Latin alphabet. The president of the Academy, Admiral Alvaro Alberto, who also is the Brazilian representative in the United Nations' Atomic Energy Commission, is putting all his weight into the balance in favor of a project, now being discussed in Parliament, to establish a National Research Council. Once realized this may well exercise considerable influence upon scientific development in Brazil.

Something entirely new for Brazil is the Center of Physics, which a few months ago was founded by C. Lattes. Its purpose is twofold: to stimulate research in cosmic rays and nuclear physics and to bring up a big brood of physicists according to modern standards. Much stress is laid on the second point which obviously is a necessary condition for the first. The novelty consists in the fact that Lattes' institute will constitute the first tentative approach in pure research not entirely sponsored by public administration; it will be a private establishment deriving its funds from private sources, although the Government may also contribute, but without administrative interference. In this way the new institute will be free of the red tape which otherwise would stick to it.

Five years ago an enterprise like that of Lattes probably would not have had much of a chance. The difference today is the result of the widespread recognition and interest which Lattes' discoveries have aroused in Brazil. It will not astonish anybody that to a great extent this interest by the public can be traced back to the drastic demonstration of the utility of physics brought about by the liberation of atomic energy.

The impact of the atomic bomb upon public opinion in Brazil has been strong but fortunately it may be said that the reaction was healthy. In consequence of Brazil's distance from the center of perturbation, its enormous territory, and last although not least its confidence in Anglo-American strength, here perhaps more than elsewhere it has been possible to keep a certain perspective and to appreciate not so much the fearsome consequences but the enormous possibilities which development of atomic power offers for a country that in the century of thermal power has been hampered by its lack of high-grade coal. It is realized that science, even pure science, and in particular physics, is not something which like a flower is to be cultivated for the delight of tourists, but is really fundamental to the big scale industrialization for which Brazil is making its bid. Public authorities have also clearly recognized that the trail to be blazed cannot begin with an expensive scheme of heavy machines and nuclear reactors, but has to start with a program for training scientists for the army of research workers with which the battle of science is fought today. The very palpable results already achieved by the relatively small group which so far has participated in the advance of physics in Brazil has inspired confidence that, under an able management, conditions for a successful effort are given and that moves in this direction are justified. As a result, the Federal and State authorities are spending more freely for scientific research, the private Maecenases are opening their purses, and the outlook for physics seems bright.

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