direction is about 15°. The temperature ranges from about 60° F in summer to − 5° F in winter. The wind, moderate in the summer, is extremely fierce in the winter and the cable railway stops in stormy weather. The laboratory is stocked with food, fuel, and medicine, against this contingency.

The laboratory is not yet provided with a proper library, for lack of money. Every scientist who has worked on cosmic rays and will send copies of his publications to the laboratory will do us a very great favor which we and everyone who will work in the laboratory will appreciate. We rely on the effective collaboration of our friends in every country, and we wish to say expressly that the laboratory has been set up to welcome everybody who will want to work in it.

We are greatly indebted to Professor E. Amaldi, head of the Centro di fisica Nucleare, for his untiring efforts and extremely valuable advice; and also to the loyal collaboration of the younger members of the Centro, Dr. M. Conversi, Maria Ferretti, L. Mezzetti e F. Nappo, and to Mr. Renato Berardo, the foreman.

Everything needed to build the Laboratorio della Testa Grigia was granted chiefly, through the deep interest of Dr. R. Morandi, Minister of Industry and Commerce, by private enterprise, industry, and business firms. We wish to express our thanks to the Snia Viscosa, S. A. Montecatini, S. A. Pirelli, Ente Metano, Fiat, and to the Comune di Milano for their contributions to the expenses.

We are particularly indebted to Dr. P. Solbiati, who started the contributions with an appreciable sum; and to the Conte Lora-Totino and the staff of the S. A. Cervino for the generous assistance given to us during the assembling of the laboratory.

G. BERNADINI, C. LONGO, E. PANCINI

GREAT BRITAIN

Nuclear physics today is in a unique position among sciences. It stands at the frontier of the unknown; the nuclear physicist, more than any other investigator, is searching for the unexpected. One might expect, as is usual in science, that the applications would come along twenty years behind the fundamental work. But in the case of nuclear fission the exigencies of the war shortened the time between the discovery and its application to six years, and nuclear physics therefore carries the prestige both of the most fundamental of the sciences and of the progenitor of a decisive weapon. We, in this country, have seen how, as a consequence, this research is supported in America by the armed services, and we wonder whether this is because further nuclear research may produce bigger and better weapons, or whether it is merely felt that nuclear physicists turned out to be useful and adaptable men in the last war, and in any future emergency the more the country has of them the better. Whatever the reason, we have the greatest admiration of the energy with which your universities are making the most of your opportunity.

In this country before the war nuclear physics was mainly carried on in the universities, particularly in the Cavendish Laboratory, which in Rutherford's day was the leading centre in the world. In the postwar situation it suffers perhaps more than any other branch of physics from the interruption of the war, for two reasons: the first is the time that is necessary to build the big machines for nuclear research, and the second is that so many British nuclear physicists were in the United States working in the Manhattan Project until the end of 1945. As a consequence, with one or two exceptions, one can write now only of plans.

Schools of nuclear physics are being built up in British Universities with the help of the government's Department of Scientific and Industrial Research, and also the Nuffield Foundation endowed by Lord Nuffield, the automobile manufacturer. Outstanding centres where cyclotrons and similar instruments exist, or are being built, are: Cambridge (Professor Frisch), Birmingham (Professor Oliphant) where a 60-inch cyclotron is just ready, and Liverpool (Professor Chadwick). In Scotland, Professor Dee (Glasgow) is developing the betatron, and Professor Feather (Edinburgh) is working on beta-ray spectra. In addition, there is the government's experimental establishment at Harwell (near Oxford) under the direction of Professor Cockcroft, which is responsible for the development of atomic energy, and where, in addition to uranium piles for scientific purposes, an 84-inch cyclotron is being built.

Privately-owned industry is also interesting itself in nuclear physics, and at least one laboratory for these researches has been started.

For the reasons that I have already given, the

Continued on page 27

emerging from the target can usually be identified. Neutrons will not leave trails, but may produce recoils, and disintegrations do leave regular and easily identified cloud tracks. Similarly, photons do not leave cloud trails, but may originate cascade showers if of high energy, or they may originate photoelectrons or Compton recoil electrons at both high and low energies.

The last important type of ionization detector is the photographic emulsion. Suppose that an alpha particle were to pass through an emulsion. It would ionize many of the atoms along its path. Ionization will, in general, render developable an unexposed silver halide grain. Hence an alpha particle will leave behind it a row of grains which turn black when developed. Similarly, an electron will leave a much thinner trail, i.e., a trail consisting of only a few grains. Photographic emulsions, therefore, may be used not only to detect and count, but also, from track-density, to identify the nature of the particle passing through the emulsion. Neutrons again do not leave tracks; but if the plate is impregnated with some boroniferous compound, the resulting alpha particles are easy to spot. Photons also will affect only one grain, and unless present in great quantity are less suitable for this technique. Ordinary photography, of course, is photon-detection by emulsions, but this is a problem involving billions of photons and so is outside the scope of the present discussion of individual effects. Photographic emulsions are normally in a plane, and hence it is easy to miss tracks which would lie at a large angle with respect to the plane of the emulsion. Location of the tracks may be expedited by projecting the film on a large screen; but the actual track measurements must be done under a microscope and are laborious. Nevertheless, the plate has also its place in detection and is especially useful for slow, heavy particles.

CONTRIBUTORS

Richard P. Feynman went from work on his doctorate thesis at Princeton to a critical position as theoretical physicist at Los Alamos during the war years. With the close of hostilities he went to Cornell where he is now Associate Professor of Physics at the Laboratory of Nuclear Studies.

Serge A. Korff began tracking down cosmic rays as a Research Fellow at CalTech when he headed their 1934–35 expedition to Mexico and Peru. He searched them out in Peru again in 1937 and later at the Mount Evans Laboratory in Colorado. Now Professor of Physics at New York University, Dr. Korff's most recent trip was the January 1948 Puerto Rico expedition of NYU.

Howard A. Robinson started out in academic work as an instructor in physics at Ohio State, with a background of study at MIT and in Germany and Sweden. In 1937 he joined the Armstrong Cork Company, where he is now chief physicist and manager of physical research. He is also Professor of Physics at Franklin and Marshall College where he is giving courses in atomic and molecular spectra.

ABROAD *Continued from page 15*

most striking advances since the end of the war are not those that involve the use of big machines. Especially fruitful have been the studies of cosmic radiation. For cosmic radiation the best-known centre is Professor Blackett's at Manchester and, more recently, Professor Powell's at Bristol. In a field like this, one can still hope to do something—if not with string and sealing wax, at least with quite limited resources. This is shown particularly well by the recent success of Professor Powell and Dr. Occhialini in the discovery of the heavy meson. For a number of years Professor Powell had been developing the photographic plate as an accurate method, comparable with the Wilson chamber, for the determination of the range of charged particles. Given this long and painstaking background, the experiment was simple enough; just to leave some plates on the top of a mountain for three weeks, and then to look through a microscope to see what reaction the cosmic rays had produced. Out of this came the heavy meson, which has gone such a long way to simplify current nuclear theories. An experiment, we feel, in the true Rutherford tradition.

Professor Blackett's school at Manchester specialises in the development of large Wilson chambers for cosmic-ray work; a recent success has been the discovery by Dr. Rochester of a yet heavier form of the meson.

Nuclear physics, of course, is not the only subject under investigation in British universities, though some of our industrial friends may feel we do too much of it, because what they want is young men trained in industrial subjects. Actually, apart from the heavy meson, it is probably true that the most striking advances since the war on this side of the Atlantic have come in other subjects, in the study of the solid state and of low temperature. The next article in this series, therefore, will tell of the researches here on the mechanical properties of metals, which have gone a long way toward turning an obscure technical subject into a respectable part of physics.

N. F. MOTT

One of our isotopes, a small boy aged six, recently passed judgment on physics. The bridge of his nose was taking a terrible battering as he tried to retrieve three ice cubes stuck to the bottom of an up-ended glass. "Physics," he said in disgust taking the glass from his face, "this physics! Three ices and all physicked together."