

suscitating the oilfields. To offset damage to operating fields, exploration to discover new ones must be accelerated. British interests, whether co-operating or competing with those of the United States, must enlarge their fields of action, and they will need to engage large staffs of oil geologists to do this effectively. Moreover, geologists in oil companies are continually being attracted out of the exploratory phase into production and field management.

In addition, after the War there is likely to be a widespread development of young mining fields and a general exploration for new metallic and non-metallic mineral deposits, which will involve the services of many mining geologists. Such men must also be recruited into the Government Geological Surveys in greater numbers than has hitherto been the practice.

GRAVITATION, ELECTROMAGNETISM, AND QUANTUM THEORY

A RECENT paper by Einstein and Bargmann¹ declared that "Ever since the theory of general relativity has been developed there has existed the problem of finding a unified theory of the physical field by some generalization of the relativistic theory of gravitation . . . a decisive modification of the fundamental concepts is unavoidable". Schrödinger² has also explained the need for a generalization of Einstein's original postulates in order to unify the theories of gravitation, electromagnetism, and the mesonic field responsible for binding the nucleus. There is no danger of the work of Einstein and Schrödinger being overlooked, but there is great danger that what is apparently an investigation of great importance, namely, "The Theory of Indeterminate Space-Time", by F. R. Saxby, may be missed by physicists, as it appears not in any of the usual scientific journals, but in the *Bulletin of the Research Laboratories of the National Cash Register Company* (pp. 13-72, September 1943), of which laboratories he is mathematics staff engineer.

Mr. Saxby proceeds on something like the general lines of the recent work of Einstein and Schrödinger, being influenced, like them, by the variations introduced into the original relativity theory by Weyl and Eddington; but his treatment has one strikingly original feature, which seems to link up quantum theory with relativity. If this claim can be substantiated, a great advance has been made. As Schrödinger² remarked: "At the back of our striving for a unitary field theory, the great problem awaits us of bringing it into line with quantum theory. This point is still covered with deep mist."

It is difficult to give a summary of Saxby's paper without complicated mathematics, but at any rate it can be indicated how it is related to Schrödinger's investigations. Both agree that the first step is to assume, as a postulate, that a certain correspondence exists between two vectors at two neighbouring points of space, or more generally between two *tensors* at two neighbouring points of space-time. The relation assumed is of a special form, known technically as an 'affine connexion'. It contains sixty-four arbitrary coefficients. In Einstein's original theory there were certain additional assumptions which restricted these coefficients, in particular an assumption of symmetry. Both Schrödinger and Saxby emphasize the non-symmetric case, the former

to account for the meson field, the latter to account for the quantum. In both cases the gravitational part of the theory is much the same as in Einstein's older theory, but there are novelties in the electromagnetic part, particularly in Saxby's treatment, which differs radically from any previously given. It is claimed that the new theory links up the indeterminism of the electromagnetic potentials with Heisenberg's principle of uncertainty.

Mr. Saxby admits that much has yet to be done in developing his theory, and it is to be hoped that he will be able to publish an account of it in periodicals usually taken by university libraries. Einstein's own new investigations¹ go more deeply into the purely mathematical side of the correspondence between two tensors, but he says: "whether we have succeeded in approaching the solution of this physical problem [that is, that of a unified theory of physics] is still uncertain. The answer to this question depends, among other things, on a mathematical problem which we have not yet been able to solve".

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¹ Einstein, A., and Bargmann, V., *Ann. Math.*, **45**, 1 (1944).

² Schrödinger, E., *Nature*, **153**, 572 (1944).

IMPERIAL FORESTRY INSTITUTE, OXFORD

THE nineteenth annual report of the Imperial Forestry Institute, Oxford, for 1942-43 is inevitably coloured by war conditions. It proves somewhat difficult for those interested but not connected with Oxford to distinguish the actual staff of the Department or School of Forestry from that of the Imperial Forestry Institute; in other words, the part of the forestry staff maintained by the University of Oxford from its own funds as compared with the grants expended upon the Institute coming from Government sources, Forestry Commission, several Colonies, and so forth.

As the report remarks, the Forestry Commission has issued a White Paper (Cmd. 6447) on future forest policy in Great Britain, which has not yet received the sanction of the House of Commons. A Supplementary Report (Cmd. 6500. London: H.M. Stationery Office, 2d. net), dealing with the forest policy of private woodlands, was published early in 1944. There had been controversy on the proposals in the first White Paper for the treatment of the private landowner and his woodlands (which had provided the bulk of the timber and other forest materials required for the War) and considerable opposition became apparent throughout the country. A conference was held between the Forestry Commission and representatives of landowners and forestry societies, and the reconsidered proposals agreed upon, mainly connected with the help which could be granted to private landowners towards afforesting and re-afforesting their felled-over lands, were published in the Supplementary White Paper.

The portions of the White Paper alluded to in the Imperial Forestry Institute's report are the sections on education and research, which particularly concern the Institute. It appears that during the year the Committee for Forestry at Oxford considered a report on the future policy of the Institute drawn up by a sub-committee. The report was adopted with certain modifications, "but it was considered necessary to keep it pending the expected publication