

calculated. The results of such calculations are in entire agreement with the types deduced from the numerous analyses of spectra which have now been made.

QUANTUM MECHANICS

These developments of the theory of atomic structure took place in intimate relation with spectroscopic research. The result was a conception of the atom, definite so far as application to experimental results was concerned, but containing basic *ad hoc* assumptions which violated the principles of classical mechanics. Throughout the development of the theory it was evident that some fundamental system of mechanics was required from which the assumptions of the existing quantum theory would follow as natural consequences.

The foundations of such a system were laid by Heisenberg, de Broglie and Schrödinger, and what is probably the most fundamental statement of the resulting quantum mechanics has been given by Dirac. In the derivation of this system, the knowledge gathered from the analysis of spectra has been supplemented by that obtained from other experimental work. It would therefore take

us outside the scope of our subject to enter into these advances, and it only remains to indicate in general terms the reaction of quantum mechanics on the question of atomic structure. This may be summed up by the statement that, while the arbitrary postulates of the empirical theory have been expressed as necessary consequences of fundamental mechanical principles, the orbital picture and vector representation of the atom have been discarded, and no equally picturable substitute has been given. A partial picture is possible in terms of a rather indefinite distribution of electricity, one such distribution corresponding to each stationary state, or electron configuration, of the atom according to the earlier ideas. It is impossible, however, to locate the electron at a precise position in this distribution.

Nevertheless, for the practical purposes of spectroscopy, the vector model retains its usefulness. Many of the results obtained by its application are identical with those given by quantum mechanics, and where divergence occurs, a simple modification—as, for example, the substitution of $\sqrt{l(l+1)}$ for the l of the vector model—produces close agreement. The vector model is likely, therefore, to remain as a guide to spectroscopists for some time to come.

University of Heidelberg and New Conceptions of Science

From a Correspondent

THE general character of the changes in the German universities was expounded by Herr Rust, Reichsminister for Education, at the recent celebration of the 'jubilee' of the University of Heidelberg. His address is translated in the November issue of the *Universities Review*. Herr Rust believes the New Germany to be the true heir of Sparta and suggests that these changes are as though Sparta had triumphed over Athens. Had that calamity befallen the world, all that we could have inherited from Greece would have been 'discipline', for Sparta had no other gifts to bestow. But the new "Weltanschauung", Herr Rust assures us, "is the life-blood of a new science . . . National Socialism has provided science with new principles from which she can derive the strength of self-confidence. . . . The old idea of science based on the belief in the supremacy of the intellect is finished."

The effect on a university of the arbitrary treatment of its staff is not numerically expressible. Injustice to one teacher may overawe the entire

faculty and deprive its work of all value. Staff changes at Heidelberg tell, therefore, of only a fraction of the injury to learning. We give, however, a summary of what has happened at Heidelberg; and it suggests what is going on throughout the universities of Germany.

The calendar of the University of Heidelberg for the academic year 1936-37 may be compared with that of 1932, the last year unaffected by the new regime. The historical account of the university, which opened previous calendars, is omitted this year. Any record of either benefactors or distinguished alumni would have to include names of many of Jewish or partly Jewish origin. The very title of the official head has been altered, and Rector Groh is now Führer Groh. The order and many of the titles of the staff are changed. After Führer Groh follows the *Leiter* of the body of dozents, Herr Schlüter, who, oddly enough, is not himself a dozent. Next is the undergraduate Herr Ernst Kreuzer, who is both a member of the Senate and "Officially designated Undergraduate Leader at

Heidelberg of the Nazi Student Union of the Nazi Party". (*Kommissarischer Hochschulgruppenführer der Hochschulgruppe Heidelberg des NSD Student-erbundes der NSDAP.*) After this student follow the deans and other members of the Senate. Six of the ten ordinary members and seven of the twelve deans and sub-deans were not members of the teaching staff in 1932. The academic authority that occupies the next place is the "Nazi Teachers' Union" (*Nationalsozialistische Dozentenbund*). Of this the "District Führer" (*Gaudozentenbund-Führer*) is Party Member Professor Dr. Ernst Krieck who, for a short time, held uneasily the rectorship of the University of Frankfurt. The promotion of Dr. Krieck, not long ago teacher in a *Mittelschule*—that is what we should call the 'modern side' of a secondary school—has been very rapid.

There were 215 teachers at the University in 1932. There are now only 180*. Of these, 99 survive from the old regime, while 81 have come in with the new regime. The displacements do not imply promotion. On the contrary, many higher positions are now occupied by previously unknown men, and some by men who hold, in addition, ministerial office (*Ministerialrat*), a combination forbidden under the old regime. Nazi influence is most evident, however, in the lower ranks of university teachers, the list of whom teems with 'Party Members'. A few teachers have been permitted to keep nominal positions but deprived of stipend. Among those dismissed are, remarkably enough, a number who have been added to the staff since the advent of the present regime. The career of a professor in Germany has become, like the life of Hobbes's primitive man, "poore, nasty, brutish and short".

The actual causes of dismissal have not been published, and to ascertain them with accuracy would involve a long and a dangerous research. In the majority of cases doubtless the victim was a Jew or had some more or less distant Jewish affiliations. Nevertheless, in the Faculty of Medicine, where dismissals have been most numerous, only half of the dismissals seem explicable on such grounds. "Political unreliability", that is to say, connexion with any 'left' party before the advent of the present regime, or want of submissiveness to the present regime, is a common cause of dismissal. It is difficult to say in how many cases dismissal has been produced or stimulated by direct action by the students. These have violent national socialist leaders, and there can be no doubt that they have had and have a large share in the control of the University.

* The number of teachers is approximate. As in an English university, many members, for example, librarians, junior demonstrators or physical instructors, belong doubtfully to the teaching staff. The figures 215 and 180 are conservative.

The constitution of the reduced staff may be learned from the following table :

Faculty	Percentage of new appointments
Science	31
Theology	36
Law	38
Philosophy	49
Medicine	56

The changes in the Faculty of Law are peculiarly significant. The Institute for Historical Jurisprudence has lost its former name "Rudolf-Mosse-Stiftung", which indicates that it is a Jewish benefaction. The Jewish endowment is retained. Important fields of legal knowledge are no longer represented. In the list of 1935-36 the subject of "International Law" still appeared under the reduced dignity of "Foreign Law" (*Ausserstaatliches Recht*) to be expounded by one undesignated. In the current list it has vanished and left not a wrack behind. A subject which makes its first bow to the learned public is "Reform of the Penal Law", but no room is found for "Penal Law" itself. The hand of the secret police is here discernible. Special instruction is provided in "Recent Political History", "Folk Elements in Law" (*Rechtliche Volkskunde*), "Family Heredity", "Folk and Race", and "German Military Law".

In the Philosophical Faculty there are new courses by new men on "Foundations of National Socialist Philosophy" as well as on "Folk Philosophy", "German Philosophy", "Educational Policy", "The Nature of the Folk Community", and "The Nature of Ancient German Religion". The Philosophical Faculty has now a new "Professor of Modern War History". His work would seem to overlap that of Herr Minister Schmidthenner, who is "Professor Ordinarius of History with special reference to the History of War and Military Knowledge" (*Wehrkunde*). Herr Professor Minister Schmidthenner will lecture on "The World War", "Politics and War Leadership", "The Total War", "Germany's Right to Colonies" and on "Political Geography of the German East". He holds a seminar on "Being and Action of the German Soldiery".

In the Faculty of Science the following are among the dismissed : the two ordinary professors of mathematics, Liebmann and Rosenthal, the professor of geology, Salomon-Calvi, honorary Professor Victor Goldschmidt, Extraordinary Professors Merton (Zoology) and Gerta von Ubisch (Genetics), Privatdozenten Lemberg, Wolf and Schmitz. There is now no ordinary professor of mathematics at Heidelberg. Many courses in mathematical subjects are suspended or advertised as by teachers as yet undesignated.

In the Faculty of Medicine the dismissals have been very numerous. Among them are Ordinary Professors Baeyer, Bettmann, Blessing, Sachs, Willmanns; Honorary Professors Fränkel and Löwe; Extraordinary Professors Gruhle, Gyorgy, Klopstock, Meier-Grosz, Münter, Schreiber, Serr, Steiner, Zade; Privatdozents Laser, Pagel, Stern, Strauss, Wittebski and Wurm. Nearly the whole of the cancer research staff has been dismissed. The first medical lectures advertised are "Nazi Philosophy and Race Theory", "Folk and Race", "Medical Outlook on Physical Development", "First Aid with special reference to Military Sport and Gas Defence".

We cannot discuss student life at Heidelberg, but note that before matriculating a student must produce documentary evidence of the religion of both of his parents and of his four grandparents. The recession of learning and the significance of propaganda in the life of the University is revealed in the programme of the official "Students' Faculty Discussion Groups" (*Arbeitsgemeinschaften*). Subjects for debate there are "Self-consciousness of German Culture", "Education of Nazi Youth",

"Labour Service and Military Law", "Claims of the Germans in Czecho-Slovakia", "Laws concerning Race", "Care for Healthy Inheritance", "Eastward Expansion of Germany", and "Professor Lenard and his Significance for German Science".

Faced with a series of unprecedented attacks on the interest of learning as well as on their own rights, no member of the staff has had the temerity to utter any word of public protest. There are several retired or very senior members of independent standing from whom one might have reasonably hoped for some sign of courage. But Germany has openly reinstated serfdom, the essence of which is to restrain the worker from marketing his labour as he will and to place him at the disposal of an overlord. It is, therefore, appropriate that the minds of Germans should be enslaved along with their bodies, for slavery mercifully provides its own spiritual anaesthesia. This, in truth, is the 'new principle' for science which Reichsminister Rust has discovered. But, to speak yet more plainly, science has been abolished in the German universities and its spirit has abdicated from the Reich.

Obituary Notices

Dr. A. A. Robb, F.R.S.

ALFRED ARTHUR ROBB, who died on December 14 at the age of sixty-three years, won distinction by his contributions to the theory of relativity during the early period of its development. His life-work is contained in a book "A Theory of Time and Space" first published in 1914; it is a happy circumstance that he lived to complete a revised edition which appeared a few months ago. This work consists of an axiomatic and logical development of the geometry (Minkowskian geometry) of the space-time of special relativity theory, arranged as a sequence of more than two hundred theorems. It is generally recognized to be a model of its kind.

To the analyst, the difference between Euclidean and Minkowskian geometry seems trivial, being merely the substitution of an imaginary for a real variable in one of the co-ordinates; but the formal simplicity of the change often causes insufficient attention to be paid to its implications, so that serious misconceptions arise later on. In an axiomatic treatment, the two geometries show little resemblance to one another; in particular, Robb's theory could not be applied to Euclidean space, nor could anything even remotely analogous be substituted. His work shows more clearly than any other how by dissecting space-time into spatial sections we lose the very essence of its constitution. Robb developed his theory on the sole basis of an irreversible relation of

'before' and 'after', which, as he pointed out, is simpler than the spatial relation of 'between'. This leads to the study of a type of order of points which he called 'conical order'. His work, which he attributed to the inspiration of Sir Joseph Larmor, was partially independent of that of Einstein and Minkowski; and, coming at a time when their theories were little known or discussed, it has been very helpful in elucidating the paradoxes that seemed to arise.

There was an unusual combination of the abstract and the practical in Robb's mental outlook. He took great trouble in designing models to illustrate his theory. Apart from relativity, he was interested in geometry and mechanics, not in a systematic way, but on the look-out for neat devices, subtleties and curiosities. He delighted in exposing the traps which catch unwary text-book writers, and was rather merciless to the victims. It was difficult to persuade him that a man might have a sound understanding of relativity in spite of his having described a geodesic in space-time as a track of minimum (instead of stationary) length. He was no less severe on those who too unguardedly assert the equivalence of electric circuits and magnetic shells, producing to confound them the example of a circuit bounding a surface which has only one side. But if he had to some extent the 'gadget mind', he had also exceptional critical insight and logical power. To discuss a problem with Robb was most stimulating; and