The main features of the Hydraulics Laboratory are a level flume, 3 ft. wide, 2 ft. 6 in. deep, with an overall length of 82 ft. and glass sides to allow of easy observation; a smaller flume with one end capable of being given a maximum tilt of 1 in 20; a river model table 10 ft. wide and 70 ft. long for the study of river and tidal flow; and a general purpose bench for experiments on the flow of water in pipes.

In the Structures Laboratory, a 350,000-lb. precision hydraulic testing machine has been installed for compression and bending tests. This is fitted with an automatic loading device giving ten different rates of loading and reading to the nearest 10 lb. A 75,000-lb. machine for tensile tests and permitting of compression and bending tests on short struts and beams is on order and will have autographic load-deformation recording apparatus. There are also several test-beds for testing members and structures, and the accessories provided are of the latest types.

The investigation of structural problems by various methods of mechanical analysis employing small-scale models will be carried out in the Model Analysis Laboratory, the equipment of which includes a Continostat apparatus for the experimental determination of influence lines using spline models and a Lobban deformeter. In the Highway Engineering and Materials of Construction Laboratory the main space has been divided into three sections: (1) tar, bitumen and asphalt; (ii) soils and aggregates; (iii) cement and concrete. Each has been suitably provided with apparatus and equipment which will enable tests and investigations to be carried out in conformity with present-day practice in this field, in which there is so much scope for development.

IRISH SALMON, SEA TROUT AND EELS

THE Fisheries Branch of the Irish Department of Agriculture has published a brief summary of the catch of salmon, sea trout and eels in Eire between 1927 and 1939*. Alternate years only are given, the figures are neither averaged nor compared, and no comments are made or inferences drawn. But the statistics themselves are of no small interest, as the following epitome of part of them is enough to show.

	1927	1929	1931	1933	1935	1937	1939
Salmon							
Total catch (wt.)	100	48	75	68	78	45	46
do. rod only	100	24	53	31	50	38	34
Average wt. per fish (lb.)	12·9	13·5	9·7	11·8	9·8	10·7	10·2
	100	105	75	91	76	83	79
Value per rod (shillings)	189	77	85	66	84	69	72
	100	41	45	40	49	37	38
Sea Trout							
Total catch (wt.)	100	101	101	91	100	96	101

The period is not long enough, nor the data complete enough, to let us speak of any lasting *trend*; but it is clear that the catch of salmon has greatly diminished of recent years. Since 1927, the annual catch (as shown in alternate years) has never reached 80 per cent, and has three times out of six been less than 50 per cent, of that year's catch. The catch by rod is worse still; for it has been so low as a quarter, and has only once been more than a half, of the catch of 1927. On the other hand, the catch of sea trout, while it has its ups and downs in the various rivers, averages out over all to a nearly constant total, year by year.

More remarkable than the diminished catch of salmon is a diminution in the average weight of the same fish. From 1931 onwards the average weight has been much below that of 1927–29; and in the last five annual periods it has only averaged about four-fifths of the weight in the first two.

The returns from the several rivers or fishery districts show many interesting things. We have seen that the salmon catch of 1939 was only 46 per cent of that of 1927; but the decrease, though it extended well-nigh all round the coast of Eire, was very far from uniform. The three contiguous east coast districts, Dundalk, Drogheda and Dublin, had in 1939, 90, 99 and 90 per cent of the catch of 1927; but the next succeeding regions, on the south-west and south coasts, namely, Wexford, Waterford, Lismore, Cork and Bandon, show only 34, 38, 26, 21 and 19 per cent, in the same comparison. The commercial importance of all these statistics is, as usual, the least interesting part of them. D. W. T.

* Eire: Roinn Talmhaidheachta (Department of Agriculture), Brainse Iascaigh (Fisheries Branch). Statistics of Salmon, Sea Trout and Eels captured during each of the Years 1939, 1937, 1935, 1933, 1931, 1929, 1927. (P. No. 4658.) Pp. 20. (Dublin: Stationery Office, 1941.) 6*d*.

ELECTRIC STRENGTH OF SOLID DIELECTRICS

IN a paper, by W. G. Standring, of the National Physical Laboratory, which is published in the Power Engineering Section of the *Journal of the Institution of Electrical Engineers*, of August, a discussion is given of the behaviour of a number of insulating materials under disruptive voltages. Experiments were carried out with the object of filling large gaps in our knowledge in a field which has only been partially explored. At the present time, a knowledge of electric strength is of twofold interest. It is of fundamental importance to the engineer, and values of electric strength should provide guidance to the mathematical physicist in developing theories to explain the mechanism of electric breakdown.

Measurements of the electric strength of solid dielectrics have been made on samples up to a few millimetres in thickness. The values obtained are of the same order as those maintained on thin samples under maintained voltages. They indicate that a solid dielectric has a characteristic strength or gradient which causes breakdown, independent of thickness and not greatly dependent on the rate of application, or on the duration of the stress. Continental physicists have formed a similar conclusion for liquids.

Secondary phenomena such as surface discharges and thermal effects are more easily eliminated under impulse conditions than under sustained voltages, since short time limits the production of effects such as the generation of heat, and because a wider range of liquids exists for the selection of a satisfactory immersion medium. In measuring the electric strength or gradient which causes breakdown of solid dielectrics, an immersion medium is necessary to avoid flash-over; also breakdown must not occur first in the medium of the electric field applied to the material under test, as the field is then disturbed and deduction of the breakdown stress from the applied voltage and the geometric configuration becomes impossible. It is not usually practicable to embed electrodes in a solid dielectric in such a way that only the material under test is stressed.

In general, gases have lower electric strengths than liquids and liquids than solids. Discharges may therefore occur in the surrounding medium before the breakdown gradient of the material under test is reached. These discharges act as pointed extensions of the electrode with high concentration of stress at their tips, and the solid test material may break down owing to the local incalculable stress or on account of the high local temperature of the discharge. It is therefore necessary to avoid discharges in the immersion medium. Glycerine has been found to be a suitable immersion medium for testing many dielectrics at atmospheric temperatures under impulse voltages.

Mr. Standring points out that in forming physical theories of the mechanism of breakdown, experimental data on crystalline materials such as mica are likely to be of most help. When maximum results were used, the highest value obtained on the thinnest light amber was nearly the highest obtained with the best mica, which was the same at all thicknesses. For purposes of physical theory, therefore, it may be desirable to take the highest experimental values obtained rather than the average value.

ACCRETION THEORY OF STELLAR EVOLUTION

BEFORE the advent of the accretion theory of stellar evolution, physical theory had progressed sufficiently to suggest the transmutation of hydrogen as providing practically all the stellar energy. Astronomical evidence, especially from double stars, led to the view that there must be a further potential source of energy from outside the stars which replenished the hydrogen in the stars. The existence of interstellar matter in gaseous form in certain regions of the galaxy was known but this knowledge did not simplify the problem. The chief constituent of the cloud was regarded as calcium, and possibly other similar elements such as sodium were also present, but accretions from such elements would merely increase the mass of the star and would not prolong its life.

The subject is dealt with in a recent paper by Messrs. F. Hoyle and R. A. Lyttleton (*Mon. Not. Roy. Astro. Soc.*, **101**, 4, 227), though most of the authors' work has been published elsewhere[1] on different occasions. In their discussion of the problem they postulate the presence of a hydrogen cloud and then consider the conditions which such a cloud must satisfy. The formula arrived at for the rate of change of mass when the motion has become steady is

$$\frac{\partial M_A}{\partial t} = 18\gamma^2 M^2 \rho / \bar{v}^3,$$

where ρ is the density of the cloud in the neighbourhood of the star, M the mass of the star, γ the constant of gravitation and $\bar{v}$ the relative velocity of the star and cloud appropriately averaged to allow for the motion of the star in the galaxy.

Three hypotheses are stated as the requirements of the accretion theory formulated by the authors:

(*a*) That the cosmical cloud in its regions of highest density contains an appreciable proportion of hydrogen molecules—10 per cent by mass would suffice;

(*b*) That the cosmical cloud is not everywhere evenly distributed but possesses local small irregularities;

(*c*) That the cosmical cloud is irregularly distributed also on a large scale, and in particular it is strongly concentrated towards the galactic plane, where the density rises to the value of order 10^{-21} gm. per c.c.

In the solution of the problem of the source of energy of the bright stars the authors invoked a hypothesis which, they claim, has also solved the question of the dynamical evolution of binary stars, and hence the new process has unified the dynamical and physical evolution of stars. In the accretion process no question of a mechanism unknown to science is introduced and thus speculation is almost entirely absent in the theory—a remark that cannot be applied to other theories, for example, that of the complete annihilation of matter. Nevertheless if, as is possible, future investigation should disprove one or more of the three hypotheses previously referred to, the theory would require considerable modification or it might be necessary to abandon it.

Evidence is cited to show that there is support for the hypotheses. Thus, (*a*) requires an appreciable proportion of the cloud to be in molecular form, and Adams and McKellar have recently found the occurrence of vibrational-rotational transitions in the molecules CH and CH in the cosmical cloud. The hypothesis (*c*) may be doubted by many, but one very interesting result follows from the asumption, which is confirmed; namely, that the most massive and luminous stars should be concentrated to the galactic plane. As this agrees with observation a result is obtained for which theoretical astronomy has not previously been able to give any adequate explanation.

Many objections have been urged by Atkinson[2] and these are dealt with in the paper, but limits of space forbid a detailed consideration of these. One, however, is worth noticing. Atkinson considers that a density 10^{-21} gm. per c.c. near the galactic plane is too high. It is interesting to notice, however, that Jeans has obtained central densities of the order 10^{-21} for a number of extra-galactic nebulæ of the spiral type, and the objections could not apply to stars situated in