of the velocity of the atoms in the direction of the line of sight was reduced to one twentieth of the normal atomic velocity. The Doppler width of the absorption lines produced by the atomic ray is therefore only one twentieth of that given by potassium vapour at the same temperature with random distribution of velocities; this is equivalent to absorption by potassium vapour at one four-hundredth of the temperature, that is between 1° and 2° Abs. The spectrograph used for examining the atomic ray absorption contained as high resolving power instrument a Fabry-Perot étalon (this instrument is particularly effective in the infra-red on account of the high reflecting power of silver) with a plate separation of 10 cm., and a resolving power of about six million. In the absorption, each of the resonance lines was found to consist of two very close components; the separation of these components was approximately 0·015 $cm.^{-1}$.

The observed doublet hyperfine structure corresponds to a splitting of the $4\ S_{1/2}$ term of the lighter isotope, 39, of potassium (the heavier isotope is present to the extent of about 5 per cent, which is insufficient to give rise to absorption under the experimental conditions). This indicates a value of the nuclear magnetic moment between 0·3/1838 and 0·5/1838 of a Bohr magneton, according to the quantum number of the nuclear spin (I).

The resonance lines of sodium were also examined by absorption in an atomic ray, an étalon of 4 cm. plate separation being used. Both the lines were found to be close doublets, the separation of the two components being 0·06 $cm.^{-1}$. This is in agreement with the structure of the sodium lines found by Schueler, working with a liquid air cooled, hollow cathode discharge tube.

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Negative Nuclear Spins and a Proposed Negative Proton

THE atomic nuclear spin data obtained from the analysis of fine structures in line spectra show that odd atomic weight atoms have nuclear spins. There are two groups of odd atomic weight atoms, namely, those with odd and those with even atomic charges. The nuclei of the first group contain an odd number of protons and the nuclei of the second group an odd number of neutrons. A significant experimental fact is that all the nuclei in the first group have positive nuclear spins, whilst nuclei of the second group can exhibit either positive or negative spin values.

Landé[1] has proposed a theory to account for the nuclear spin properties of the first group by assuming that only the single odd remaining proton, which has both spin and orbital momenta, produces the nuclear spin properties. This theory gives approximately correct values for many nuclear magnetic moments. If the theory is extended to the second group of odd atomic weight nuclei, a difficulty arises because of the negative spins. Schüler[2] has suggested that the remaining nuclear core also has spin properties, and by introducing a new quantum number infers that the neutron has a negative magnetic moment. There are, however, difficulties in the theory.

It seems possible to account for the negative and positive spins of the members of the second group mentioned above by postulating the existence of two types of nuclear neutrons, namely: (*a*) *proton* plus *electron*, (*b*) *negative proton* plus *positron*. Atoms which have a remaining odd neutron of type (*a*) will exhibit positive nuclear spin, and those with a remaining odd neutron of type (*b*) will exhibit negative spin. On this view the numerical values of the positive and negative $g(I)$ factors should be similar, which is indeed found to be the case.

It is assumed that the negative protons only exist in the bound state of neutrons when they are in the nucleus. Since the difference between the two types of neutrons lies in the relative orientations of the mechanical and magnetic moments, it is not likely that disruption experiments will distinguish between them. The confirmation of the existence of the positron suggests, on grounds of symmetry, that a negative proton might be expected to exist*.

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* *Note added in proof.*—After my letter was communicated to NATURE, a note by Schüler and Schmidt (*Naturwiss.*, **22**, 418; 1934) was received wherein the existence of two types of neutrons is also suggested. Tamm and Altschuler (*C.R. Acad. Sci. U.R.S.S.*, **1**, 455; 1934) have attempted to explain the difficulty of negative spins by assuming that several neutrons can contribute to the spin properties.

[1] Landé, *Phys. Rev.*, **44**, 1028; 1933.
[2] Schüler, *Z. Phys.*, **88**, 323; 1934.

The Changing British Fish Fauna

INTRODUCTIONS of foreign species, the results of which deserve close scrutiny, are not confined to mammals. Rainbow trout are now a permanent element in our fauna, black bass are established in certain places, and now the case of the pike-perch in East Anglia deserves to be put on record. On March 4, 1934, a *Lucioperca* of $11\frac{3}{4}$ lb. was caught in the River Delph, near Welney, in the Ouse basin, and was brought here for identification. Five species of the genus are known, two in the rivers and lakes of eastern and northern Europe, one in the Black and Caspian Seas, and two (placed by some authors in a separate genus *Stizostedion*) in Canada and the northern U.S.A. Comparison with specimens in the B.M. (Nat. Hist.) revealed that the Welney fish resembles the American species in five characters and the European in four, but in view of the structural importance of the American characters (especially the distance between the pelvic fins) it is reasonably certain that it came from the American species *Lucioperca vitrea*, Mitchill.

It seems that only one successful introduction of pike-perch to Great Britain has been made, and that was the European *L. lucioperca*, of which 24 fish were put in a pond on the Duke of Bedford's estate at Woburn in 1878. The only explanation of how an American species came to be in England, however, is that it was introduced in mistake for black bass. Inquiries have shown that some nine years ago 20 fingerlings hatched from American eggs which were supposed to be black bass, were put into the Ouse at Erith Bridge, and Prof. Gardiner concludes from scale examination that the Welney fish was in its tenth winter, which suggests that it was one of these 'black bass'. Now a pike-perch can easily be mistaken for a gaunt black bass, so it is

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