help in the construction of the apparatus, to Messrs. W. G. Hawley and R. V. Whelpton for their assistance with the cathode ray oscillograph, and to Mr. A. P. M. Fleming for permission to publish this note.

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Energy of Cosmic Rays

IN NATURE for September 3, 1932, p. 364, I published the curve of the intensity of cosmic radiation in the high atmosphere, deduced from measurements made with a self-registering electrometer. It was possible by extrapolation to find the intensity I_∞ of radiation at its entrance in the atmosphere. The preliminary value given has now been corrected by the experimental determination of the factor which reduces the measurements with the ionisation chamber at 5 atmospheres to 1 atmosphere. Now the value I_∞ is found corresponding to a production of 333 pairs of ions cm.$^{-3}$ sec.$^{-1}$ in air at 0° and 760 mm. mercury pressure.

The graphical integration of the curve, giving the ionisation as a function of the height, makes it possible to calculate the total number of ions, produced by total absorption of cosmic rays by a column of air of 1 sq. cm. section. The high value of $1{\cdot}02 \times 10^8$ pairs of ions is found. Some time ago, Millikan and Cameron[1] made a similar calculation, which gave a value of only $1{\cdot}28 \times 10^7$ pairs of ions, due to an insufficient knowledge of the intensity in the high atmosphere. Taking the energy required to produce a pair of ions in air[2] as 32 electron-volts the flux S of energy coming to the earth from the cosmic rays is found to be $5{\cdot}2 \times 10^{-3}$ erg. cm.$^{-2}$ sec.$^{-1}$.

From an astrophysical point of view, the great energy of cosmic rays is remarkable. A body which absorbs all the cosmic rays would be heated by them. Equilibrium will be attained when the absorbed flux S of cosmic rays is equal to the heat radiation σT^4 of that body. T works out as 3·1° Kelvin. The value is equal to the temperature (3·18°) which Eddington[3] finds for a black body heated only by the heat and light radiation of stars. Eddington's calculation relates to a point in our local system of stars, but not in the neighbourhood of one of them. If at such a point the flux of energy of cosmic radiation is equal to that on the earth, the temperature of a black body, absorbing entirely the *two* radiations, rises only to 3·7° Kelvin, according to the T^4 law. But at a point in space among the spiral nebulæ, the ordinary radiation is very small and causes only a very small rise of temperature. Supposing that cosmic rays originate in such intergalactic space, they would produce an elevation of temperature corresponding to the flux of cosmic rays.

A more detailed report will be published shortly in the *Zeitschrift für Physik*.

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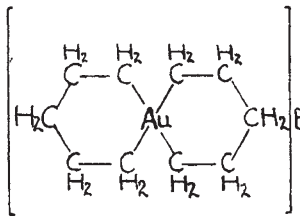
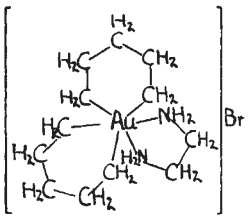
[1] *Phys. Rev.*, **31**, 930; 1928.
[2] H. Kulenkampff, *Phys. Z.*, **30**, 777; 1929.
[3] "Internal Constitution of the Stars", German edition, p. 468, 1928.

Organic Compounds of Gold

THE reaction between hydrobromoauric acid and magnesium pentamethylene bromide in ethereal solution proceeds somewhat differently than with the simpler magnesium alkyl bromides[1]. A colourless, crystalline, sparingly soluble salt is obtained which must be *spiro*bis(pentamethylene)gold bromide (i).



(i)



(ii)

This compound has been identified through its ethylenediamine derivative, ethylenediamino*spiro*bis-(pentamethylene)gold bromide (ii), which is a fairly stable colourless crystalline salt having a greater solubility in water than compound (i).

These compounds present several points of interest. In (i), the gold atom, as in many gold compounds, is 4-covalent with an octet of electrons and it is significant that a gold atom attached to four carbon atoms can function as a cation. In (ii) the gold atom is 6-covalent, and while gold compounds have been described in which the gold atom is 6-covalent, they are very few. Further, since the groups attached to the gold atom must have an octahedral configuration, compound (ii) should be capable of being resolved into optically active isomers. This is the first compound to be described in which a configuration of groups attached to a gold atom permits of this possibility.

The investigation indicated is being continued and extended in various directions. The small amounts of these organic gold compounds obtained at present in any one reaction which takes at least two weeks is only one of the factors which explain the slow progress of the work.

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[1] Pope and Gibson, *J. Chem. Soc.*, 2061; 1907. Gibson and Simonsen, *ibid.*, 2531; 1930. Gibson and Colles, *ibid.*, 2407; 1931. Gibson, "Chemistry at the Centenary (1931) Meeting of the British Association", p. 260.

Iodoacetic Acid, Glutathione and Tissue Glyoxalase

DUDLEY[1] has shown that the action of tissue extracts in converting methyl glyoxal to lactic acid, or phenyl glyoxal to mandelic acid, is inhibited by iodoacetic acid. Lohmann[2] considers, however, that this is probably not the cause of the poisoning action of iodoacetate on animal tissues, since, in the case of the crude extracts used, a much higher concentration of iodoacetate was needed than that required to stop glycolysis.

Quite recently Lohmann[3] has made the important discovery that reduced glutathione can function as a co-enzyme to methyl glyoxalase deprived of its activity by dialysis. Working either with such extracts of rat liver purified by isoelectric precipitation of much of the protein and by dialysis, or with undialysed extracts, I find that the action of iodoacetic acid in arresting glyoxalase activity is com-