

Letters to the Editor

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A Suggested Explanation of β -Ray Activity

IN continuation of our letter on the above subject which was published in NATURE of November 11, 1933, p. 747, we wish to add the following remarks:—

We have changed the term 'electrodivision of quantum' used in that letter to 'electrofission of quantum'. Under the intense electrical field of the nucleus, a quantum of sufficient energy undergoes fission into an electron and a positron, the energy being distributed between them in varying proportions, but the law of conservation of energy continues to hold good.

Our interpretation offers an unforced solution of Bohr's paradox that though the nucleus contains no electrons, free or bound, but only positive particles (α -rays, protons) and neutrons—a view which is now universally held—a β -ray can be created inside it and ejected with high speeds. It has further been established that radioactivity, whether marked by an α -ray or a β -ray disintegration, is mainly due to the leakage of loosely bound α -particles through the potential barrier. The β -ray is only a by-product, when the α -particle cannot escape, but on leaking to the second crater falls into a lower level, and gives rise to a γ -ray which undergoes fission into an electron and a positron.

We should further add that the phenomenon of 'electrofission' is different from the reverse process of annihilation of charges or conversion of radiant energy into mass postulated by many astrophysicists. For when a positron and an electron combine to form one or two γ -ray quanta, the charges do not neutralise but form a dipole which can be again disrupted into its constituents. This does not bring us nearer to the problem of the total conversion of mass to radiation, for the main amount of mass resides in the neutron, which according to one of us (Kothari) is a dipole formed of two Dirac magnetic poles of opposite sign, separated by a distance of e^2/Mc^2 . The neutron evidently cannot be disrupted by the nucleus; the binding is too strong. It may be disrupted, however, by the electromagnetic action of cosmic rays, giving rise to free magnetic poles. Such phenomena, to our knowledge, have not yet been observed.

Much other evidence, physical as well as astrophysical, in favour of these views has been obtained.

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Dec. 5.

Activities of Life and the Second Law of Thermodynamics

IN "The New Background of Science" Sir James Jeans, in discussing the activities of life in relation to the second law of thermodynamics, states that living organisms must possess some method of evading this law. He points out, for example, that a visitor to this planet from some other universe would observe various curious and highly improbable

arrangements of matter, such as collections of gold in various places, numerous collections of ice in hot climates, etc. These improbable arrangements or organisations imply presumably a decrease of entropy, that is, a violation of the second law. Surely, however, these actions are functionally inter-related with other simultaneous actions; namely, the metabolism and oxidation of food by the human organisms and the oxidation of fuel in such engines as they employ, and these causally inter-related actions involve an increase of randomness, that is, disorganisation and consequent increase of entropy. I presume that Sir James Jeans would agree that the total effect will be a net increase of entropy.

An essential feature of the second law is that a finite amount of organisation may be purchased at the expense of a greater amount of disorganisation in a series of inter-related spontaneous actions. If for a single moment the blood sugar circulating through the brains of Sir James Jeans's humans should cease to be oxidised, they would fall down unconscious and cease to be able to collect gold or ice. Is it good logic to pick out a series of actions which imply an increase of organisation and therefore a decrease of entropy, whilst neglecting simultaneous interlocked actions in the same system which involve a greater increase of entropy; and then to announce as a mysterious result that the former actions evade the second law? Could one not reason in a similar manner that a crystal evades the second law when we watch a crystal growing in a supersaturated solution? No doubt the growth of the crystal involves *per se* an increase of organisation, but this increase is purchased at the expense of a greater decrease of organisation in the inter-related actions, as may very readily be demonstrated. Such examples in inorganic Nature can be multiplied almost *ad infinitum*.

I do not wish to assume the rôle of a die-hard *fidei defensor* of the science of the nineteenth century, or to assert or even suggest that the present known principles of science suffice to offer an adequate description of the phenomena of life. Indeed, in various publications I have striven to show that such an opinion or assertion would be quite unjustified. Nevertheless, I would humbly suggest that eminent physicists must not ignore the known and relevant facts of biochemistry, and that a knowledge of these facts may serve to remove a certain amount of mystery from their minds.

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Artificial Production of the Blue Fluorescence of Fluorite

CATHODO-LUMINESCENCE, thermo-luminescence and phosphorescence of fluorite show the well-known rare earth lines. These are, as a rule, not conspicuous in the fluorescence excited by filtered ultra-violet light, except in certain cases, especially when the concentration of the rare earths is high, as in yttrifluorite and yttrocerite, but also in some ordinary fluorites, especially after suitable heat treatment.

Generally the fluorescence shows only three diffuse bands in the red, green and blue-violet, differing also in their behaviour towards temperature. As has been