specimens have been recorded from this general region. And secondly, because the head fisherman of the crew that caught the first Havana specimen reports that after the capture of this fish he had two months later seen in the same locality and had tried to harpoon another huge spotted shark. The same reports come to us now for a second specimen in the waters of Cojimar. Then again we have seen recent newspaper accounts (unconfirmed) of a specimen seen off Bimini, Bahamas.

It is a matter of regret that the demise of Sr. Fernández took place some months before the realization of his dream for the taking of this great shark, the search for which he had maintained for many months. However, the mounting of the fish seems to be going forward under the direction of his widow and of the head fisherman and it is to be hoped that the exhibition of the mounted fish may bring in sufficient returns to recoup at least some of the expenses of its capture and preparation.

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QUOTATIONS

REMARKS ON THE HISTORY OF COSMIC RADIATION[1]

IN previous articles I have never sought to assign the origin or history of the speculative ideas about atom building in cosmic processes—a very ticklish thing to do, since during the past twenty years this question has aroused general interest. But if the historian of this domain can find anything useful in it, I will be glad to contribute my own knowledge of the history of the subject.

In the year 1904, when I was engaged in the study of certain rare ores for their uranium content by the action of radioactivity, Professor F. R. Moulton, of the University of Chicago, came to me with the statement that even if the sun were originally of pure uranium it could not have given up as much energy as he would regard as necessary for a minimum of the life of the sun, and that, therefore, it was necessary to postulate a store of cosmic energy from a previously unknown source for the stellar energies.

Now this source had already been found, although I did not, at that time, fully appreciate it; the interchangeability of mass and energy was demonstrated in 1901 for special cases by the experiments of Kaufmann, and the discovery of radiation pressure some years before was also of great importance. A few years later (1905) Einstein discovered this interchangeability as a consequence of the special theory of relativity, and from this time on this theory was available to any one who, like Professor Moulton, was seeking a new source of energy for the continued existence of the life of the celestial bodies. Certainly, for something less than ten years it was a theme of general table conversation at the University of Chicago. As soon as the Mosleyian relations (1913–14) and the existence of the isotopes were discovered, atom building within the stars, accompanied by a change of the superfluous mass into radiation, was considered as a source of stellar energy. Harkins[2] explained in detail this loss of mass, or packing effect, in the atom building process. I mentioned this fact in the first edition of my book "The Electron."[3]

That this phenomenon is not sufficient to explain the energy of the universe was shown later on. In *Nature* (1917) Eddington mentioned the idea of the annihilation of matter by collision and the complete superposition of the positive and negative electrical fields, and ascribed the idea to Jeans.[4]

Certainly by the year 1915 the idea of the building of the elements from hydrogen as a source of universal energy was prevalent, and in 1917 the total destruction of mass as a more active source found its way definitely into the literature, and was familiar at other universities than Chicago, since these ideas are obvious consequences of the Einstein equations (1905) and the known existence of isotopes (hydrogen with the atomic weight 1.008 instead of 1).

In our conversations at Chicago W. D. MacMillan constantly held out for the view that a still further step forward should be taken and that the idea of the "running down of the universe" should be given up by the assumption that atom building went on in space by the condensation of radiation into atoms. He discussed this idea with me in detail in the year 1915, and in July, 1918, he published it in full.[5] Any one who is interested in the history of this subject should read MacMillan's other articles,[6] since this investigator, on the theoretic side, is the foremost representative of the idea of the development of cosmic energy by the process of atom building.

These three ideas, first, atom building from hydrogen; second, the radiating away of mass, and third, the condensation of radiant energy into atoms, are

1 Translated from the *Physikalische Zeitschrift*, Nr. 6, March, 1930.

2 *Phil. Mag.*, 30: 723, 1915.

3 P. 203, 1917.

4 *Nature*, 70: 101, 1904.

5 *Astrophysical Journal*, 48: 35, 1918.

6 SCIENCE, 62, July 24 and August 7, 1918.

the three hypotheses for which we have obtained partial experimental proof.

Heretofore I have not tried to assign priority to any one with respect to speculative ideas, since we have considered it our problem to show how far our experimental results were of significance to these now familiar ideas. We made a small step forward in giving a quantitative proof for the cosmic origin of the radiation in 1925, in that the longest wave-length observed, according to our method of calculation, agreed with the Einstein equation corresponding to the building of helium out of hydrogen; and last winter (February, 1927) we found clear and authentic proof that this and other atom building processes are actually the source of the cosmic radiation. We proved further, contrary to all previous assumptions, aside, perhaps, from the assumption of MacMillan, that the atom building process does not occur in the stars, but in the depths of interstellar space.

If there is any one besides Einstein who was a pioneer in the development of the theoretical ideas for which we have found experimental proof it is W. D. MacMillan. Any one who since 1918 may have sought to write the history of the atom building processes should have given him a deserved recognition.

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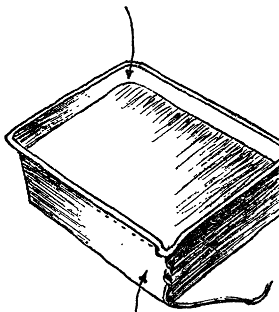
SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR HANDLING PARAFFIN RIBBONS

THE need for a convenient means of handling several paraffin ribbons at one time was the incentive for contriving the following piece of apparatus.

A good-sized photographic tray was fitted into the top of a metal box containing an electric heater and a thermostat. The tray was filled about half full of water. Water at a temperature of approximately 30° C. spreads the ribbon out smoothly yet is not so hot as to make the paraffin soft enough to be inconvenient to cut with small scissors.



The paraffin ribbons are cut to about the length of the tray and transferred to the water with a pair of tweezers. The bath is large enough so that several long ribbons can be spread out side by side. With the aid of a strong light and a hand lens the unwanted parts of the ribbon can be detected and removed from the bath. Then the ribbon is cut to proper lengths, the fixative-covered slide is slipped under the section and the piece of paraffin ribbon floated to the exact position.

The tray may be removed and a plate placed on top or the whole box turned over, resulting in an ordinary constant temperature embedding table, which can be used for drying slides and for softening the paraffin before dissolving the ribbon in xylol.

Briefly summed up, this piece of apparatus does the following: (1) Spreads the paraffin ribbon out flat and smooth. (2) Holds several long ribbons. (3) Undesirable parts of the ribbon can be detected and removed. (4) The paraffin ribbon can be easily cut to desired lengths. (5) Provides a convenient method for placing the piece of ribbon on the slide. (6) Turned over it functions as a large embedding table.

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SPECIAL ARTICLES

THE METABOLISM OF THE LOCAL EXCITATORY PROCESS AND OF THE PROPAGATED DISTURBANCE IN NERVOUS TISSUES[1]

IN an earlier paper I tried to show that the chemical changes produced in a tissue by means of an electrical stimulation differ from those caused by the physiological conduction of excitation waves. I was at first brought to this opinion by the following facts. Nearly all investigations of the metabolism of the excitatory process in the nervous system were carried out in such a manner that the part to be investigated was stimulated directly. Parker alone for methodical reasons stimulated the nerve outside of

[1] Some of these results have been communicated in an evening lecture at Woods Hole and published in the *Collecting Net*, Vol. IV, No. 8.