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THE SOURCE OF SOLAR ENERGY¹

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INTRODUCTION

It has been wisely said by Dr. W. W. Campbell that a scientist does not create the truth. He does nothing whatever to the truth; he simply uncovers it. Through the analysis of physical science, the universe is resolved into atoms—protons and electrons, and the cosmic laws are reduced to action and reaction of these integral parts. A general simplification has resulted; in the terms of atoms many complicated phenomena have been solved, and it is hoped that the new physics will shed some light on the problem in hand—the source of solar energy.

It is known that throughout entire geological time the sun has been radiating energy at a rate which has varied but little. With the generally accepted estimate of the age of the earth² each gram of the sun has accounted for about 2×10^9 calories, and the well-known problem arises: whence came this heat. The great quantity of the solar radiation and the inadequacy of the simpler theories to account for it have been so frequently discussed that a short review of them will suffice here.

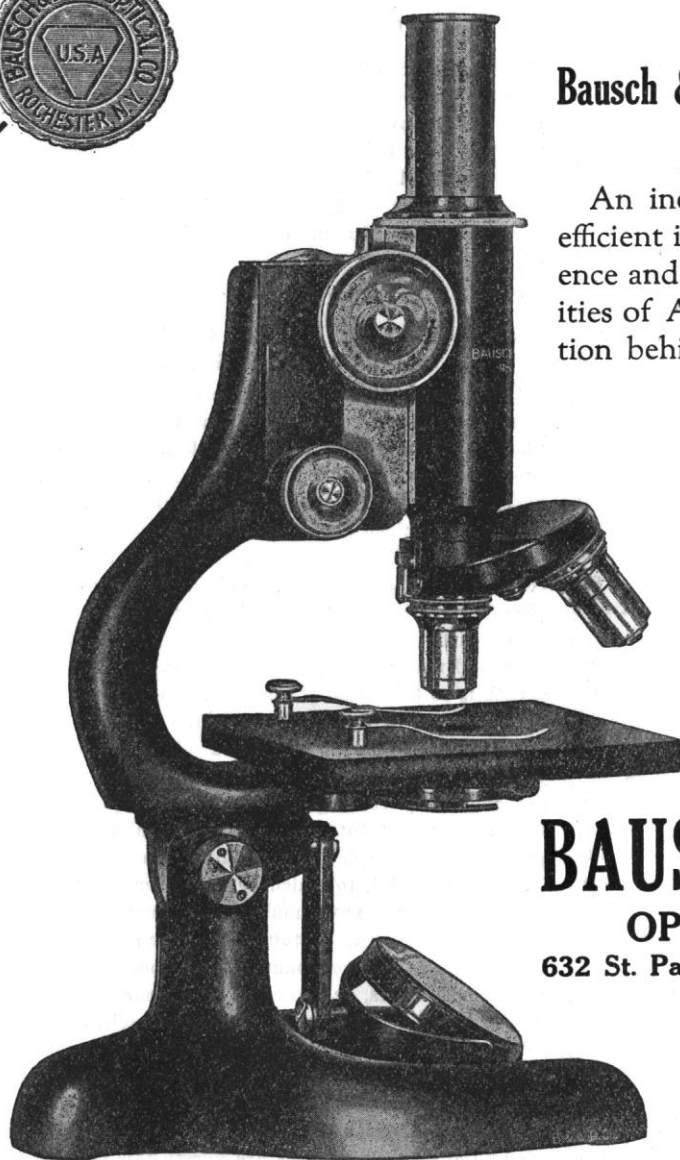
It does not come within the scope of this paper to reexamine the data for determining the age of the earth. Estimates have ranged from 10^8 years to Russell's absolute maximum of 6×10^9 . Since even the minimum value given above is far in excess of that demanded by the following theories it is not necessary for our present purpose to defend any specific value. For the sake of definiteness we adopt the value 10^9 as of the proper order of magnitude, especially since this figure has apparently met with wider acceptance than any other.

(1) ORIGINAL HEAT

The sun radiates about two ergs per second, or 1.5 calories per year, for each gram of its mass. The researches of Emden, Eddington, Jeans and others have shown that, in order to maintain the observed mean density of 1.4 against the enormous pressures existing in the far interior, a critical temperature of some 10,000,000° to 30,000,000° K is required. The opacity of the interior, by setting up a negative temperature gradient, reduces the temperature of the photospheric surface approximately to 6,000° K.

¹ Awarded the A. Cressy Morrison Prize in 1926 by the New York Academy of Sciences.

² 10^9 years.



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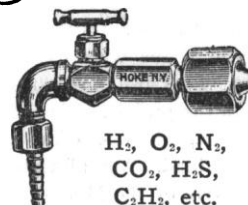
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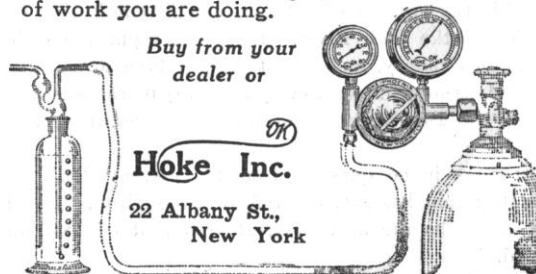
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