this connection, viz. that in Sáukaravijaya of Vidyáranya, the same positions are given for the planets at the birth of Sáukarácharya, with the exception of the Moon, which is in Árthra, *i.e.* Gemini, 6° 40′ to 20° 0′ of the Hindu zodiac. These positions of the Sun, Moon, Jupiter, and Saturn took place on the 1st of *Mesham*, Kali Yuga 4221, corresponding to March 30, A.D. 1119, without change of the present style.

I am afraid, however, that these dates will hardly suit my Hindu friends, whose devotion to these great personages gives them a sense of "distance" which is best satisfied when expressed in *years!* I give these notes, however, for what they may be worth.

Adyar, Madras. WALTER R. OLD.

NOTE.—According to the Suryasiddhanta rules for computing the longitudes of the planets, I find that Mars was in Capricorn, its "exaltation" Sign, in the month of *Mesham*, K.Y. 1341, as required by the data given for Rama's epoch, its longitude in the Hindu zodiac being Capricornus 13°.—W. R. O.

On the Latent Heat of Steam.

SINCE the invention of M. Berthelot's extremely elegant and simple apparatus, described in his "Mécanique Chimique," vol. i. p. 288, the approximate determination of the latent heat of vaporisation of liquids has become comparatively easy. The exact evaluation of the correction due to the heating of the calorimeter from extraneous sources is, however, a matter of considerable difficulty with the original form of apparatus. The correction is necessarily calculated from data supplied by the thermometric observations made previously to, and after, the actual condensation of the liquid has taken place. For this calculation to be as simple and satisfactory as possible, it is essential that during the whole experiment the temperature of the bodies in the immediate neighbourhood of the calorimeter shall remain approximately constant. In M. Berthelot's method of determination this condition is however not strictly fulfilled. For during the "preliminary period," although the flame is lighted over the calorimeter, the liquid in the flask has not yet begun to boil, so that the radiation to the calorimeter varies, and during the "final period" the flame is extinguished and no further heat reaches the calorimeter from this source. Also during the beginning of the "middle period," a considerable amount of liquid which has been volatilised from the flask at a temperature below its boiling-point, reaches the worm and is there condensed. We therefore modified the apparatus in such a way that the flame was at a constant height and the liquid was boiling *during the whole time of the experiment*, including both the preliminary and final periods. We found that under these circumstances, with a rise of 3° or 4° in ten minutes, the Regnault-Pfaundler correction is perfectly accurate. We propose shortly to publish a complete description of our apparatus, and shall not therefore go into details at present. It differs mainly from that of M. Berthelot, by the insertion in the interior of the boiling flask of a glass valve, which is opened when the rise of the thermometer in the calorimeter has become steady, and closed when sufficient liquid has been condensed in the worm. The vapour during both the preliminary and final periods passes into a reversed condenser.

Our main reason for this communication is to record the somewhat remarkable results obtained with water, and to ask if any of your readers can give information as to any accurate work upon the latent heat of steam published since that of Regnault (*Mémoires de l'Académie des Sciences*, t. 21) in 1847.

We give the results of five experiments (done at pressures differing but little from 760 mm.), which are still subject to certain corrections not exceeding ± 1 unit.

	Wt. of water condensed in grams.	Time of condensation in minutes.	Rise of temp. in calorimeter in deg. C.	Latent heat of steam (L).
(1)	10·122	7½	3·491	525·6
(2)	12·546	15	4·416	524·7
(3)	9·278	8	3·235	526·6
(4)	9·854	7	3·439	525·0
(5)	2·742	6	·991	523·9

It will be noticed that in experiment 5, where the amount of water condensed was purposely reduced, so as to increase as far as possible the experimental error, the result obtained differs but slightly from the mean. This mean, 525·2 (omitting experiment 5, 525·5) is over 2 per cent. lower than that of Regnault. The thermometer used was one divided into fiftieths of a degree, by Baudin, and was compared with a thermometer calibrated at the International Bureau of Weights and Measures. Every precaution was taken to ensure accuracy of reading.

We have sought for confirmation of our results in the indirect determinations of other observers. If we insert the latest values for the specific volume of steam at 99·6° given by Perot (*Ann. Chim. et Phys.* [6] 13, p. 159) and for the mechanical equivalent of heat by Griffiths[1] (NATURE, vol. xlvii. p. 476) in the thermodynamic formula,

$$L = \frac{T}{J}(S - S')\frac{dp}{dt},$$

we find the number 527·43 for the value of L at 99·60° C.[2] The number given by Regnault for 100° C. is 536·7. We have also selected from the numerous results obtained by Joly (*Proc. Roy. Soc.* vol. xli. p. 358) with his steam calorimeter those relating to silver, which is a substance easy to obtain in a state of purity. If we take the number given by Regnault for the specific heat of silver, we find his own determination of the latent heat of steam confirmed. On the other hand the concordant numbers for the specific heat of silver, given independently by Kopp and Bunsen, lead to a result about 1½ per cent. lower than that of Regnault.

The complete discussion of such results, however, is a matter of great difficulty owing to the uncertainty which prevails with regard to the specific heat of water. We have not as yet succeeded in discovering any constant error capable of explaining the discrepancy between our result and that of Regnault, but further experiments are now in progress.

The question, as need hardly be pointed out, is of considerable practical importance in connection with problems relating to the steam engine. P. J. HARTOG.

J. A. HARKER.

Physical Laboratory, Owens College, October 19.

Artificial Amœbæ and Protoplasm.

IN No. 1251 of NATURE, Dr. John Berry Haycraft has written a review on Prof. O. Bütschli's investigations of microscopic foams and protoplasm.

The biological parts of the contribution I may leave my colleague, Prof. Butschli, to answer, but as my investigations are also mentioned, and my name several times quoted, though always mis-spelled as "Nuincke," instead of Quincke, I may perhaps be allowed to call attention to the fact that I, not Prof. Bütschli, as the reviewer asserts, was the first who tried to explain the movements of amœbæ and protoplasm by physical laws, by the periodical spreading of a soap solution. In 1879 I explained the voluntary formation of an emulsion observed by Prof. Gad, and the amœboid movements of oil-drops by the periodical spreading of a soap solution upon the common surface of oil and water, and I said "that foam is an emulsion of air instead of oil, and that the durability of foam depended on the same conditions as the durability of an oil emulsion."[3] In a continuation of these investigations I explained in the year 1888 the movements of protoplasm by the same physical principles, making the supposition that it was intermixed with thin oil-films, and in the cells of plants, surrounded by an oil-coat.[4] I therefore believe I was the first to point to the foamy structure of protoplasm, which was later on further investigated by Prof. Bütschli.

Is Dr. John Berry Haycraft acquainted with my investigations, and from whence does he deduce the right of calling them "toys for the physicist"? They form the conclusion of a series of researches on capillarity which I began 37 years ago, and by which I, for the first time, showed that surface-tension is considerably altered by layers of a foreign substance of far less thickness than 1/10 of a light-wave; for the first time, also, the

[1] We understand that Mr. Griffiths' number is still subject to a slight correction, but that this does not amount to 1 part in 1000.

[2] $\frac{dp}{dt}$ was calculated from Roche's formula quoted by Hirn, Théorie Mécanique de la Chaleur, *t.* I. p. 325.

[3] G. Quincke, "Ueber Emulsions bildung und den Einfluss der Galle auf die Verdanung" (*Pflüger's Archiv.* 1879, p. 144).

[4] G. Quincke. "Ueber periodische Ausbreitung an Flüssigkeits oberflächen und dadurch hervorgerufene Bewegungserscheinungen" (*Sitzungsber. der Berliner Akad.* 12, 7, 1888. *Wiedem. Ann.* 35, p. 580-642, 1888). "Ueber Protoplasma bewegungen und verwandte Erscheinungen" (*Tageblatt der* 62 *Versammlung Deutscher Naturforscher und Aerzte*, Heidelberg, 1889, p. 204-7).