

and can be carried out with great rapidity. Incidentally, the existence in aqueous solution at temperatures between 0° and 40° of four hydrates of potassium persulphate is established.

SOME experiments by Mr. K. E. Guthe, published in the April number of the *Physical Review*, show that fused steatite or soapstone can be used as a substitute for fused quartz in the production of fibres of very small elastic fatigue suitable for suspensions. The soapstone can be melted in a gas-oxygen jet, and very fine fibres are easily drawn out from the clear bead thus obtained. The elastic fatigue and tensile strength of these fused steatite fibres have approximately the same value as fused quartz fibres of the same dimensions. In the same journal Mr. J. H. Hart describes a continuous method of steam calorimetry which, with simple apparatus, gives results which compare very favourably with the best results obtained by the admittedly excellent continuous electrical method.

AN exhaustive account of investigations with the respiration calorimeter, by Messrs. Armsby and Fries, on the available energy of timothy hay has been issued as *Bulletin* No. 51 of the Bureau of Animal Industry of the U.S. Department of Agriculture. According to well known experiments of Rubner, different nutrient materials—proteids, fats, and carbohydrates—can replace each other in the animal metabolism, and "isodynamic values" can be deduced for the various nutrients. The authors question the applicability of Rubner's generalisation to herbivorous animals, and their experiments indicate that the digested matter of hay is not isodynamic with body tissue when the food supply is below the maintenance ration. It was found that only 63 per cent. of the metabolisable energy served to prevent loss of tissue, while 37 per cent. simply increased the heat production of the animal.

A VERY interesting paper dealing with the constitution of the ammonium compounds is contributed by Dr. J. C. Cain to the current volume of the *Memoirs and Proceedings* of the Manchester Literary and Philosophical Society (vol. xlviii., No. 14). To take examples, the author's suggested formulæ for ammonium chloride and ammonium hydrate are $H_3N=ClH$ and $H_3N=OH_2$, in which the chlorine and oxygen are respectively trivalent and tetravalent. The conception involved in this new formulation explains a large number of well known facts in a very satisfactory manner. It accounts for the difference between solutions of ammonia and of the alkaline hydroxides, and for the existence of isomeric quaternary ammonium salts. By means of it the formation of metal-ammonia compounds and of diazonium salts, the reduction of diazonium derivatives to hydrazine, and the process of diazotisation are all capable of simple representation.

OUR ASTRONOMICAL COLUMN.

SPECTRUM AND ORBIT OF δ ORIONIS.—Some very interesting results have been obtained by Dr. Hartmann in a research carried out at Potsdam on the spectrum and orbit of δ Orionis. The variability of the velocity in the line of sight—or, as Dr. Hartmann prefers to designate it, the "oscillation"—of this star was first discovered by Prof. Deslandres at Meudon, who determined the period as 1.92 days, and the orbit as very eccentric. Dr. Hartmann's results, however, do not confirm these conclusions, for he finds the period and the eccentricity to be

$$5d. 17h. 34m. 48s. \pm 17s.$$

and 0.10334 respectively.

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A striking feature on the spectrograms obtained is that the calcium line at λ 3934 ("K") is always sharp, whilst the other lines are characteristically hazy, and it does not share in the periodic displacements of the lines caused by the orbital motion of the star. Seeking an explanation of this anomalous behaviour, Dr. Hartmann has arrived at the conclusion that the absorption producing K does not take place in either of the components of the δ Orionis system, but in a separate "cloud" of calcium vapour situated somewhere between that system and our own. The distance of this cloud cannot be determined, but Dr. Hartmann suggests that its extent, perpendicular to the line of sight, might be approximately determined by the observation of the K line in stars situated in the same region and having "oscillations" similar to those of δ Orionis (*Astrophysical Journal*, No. 4, vol. xix.).

ANOMALOUS DISPERSION AND SOLAR PHENOMENA.—A further exposition of anomalous dispersion, and its action relative to solar phenomena, by Prof. W. H. Julius, appears in No. 10 (May 30) of the *Revue générale des Sciences*. After reviewing the current theories as to the sun's physical constitution, Prof. Julius proceeds to demonstrate that the "apparent" excessive speed of prominence variations, the abnormal solar spectrum photographed by Prof. Hale in 1894, the periodical variation of the solar radiation, the eleven-year period of solar activity, the connection between allied terrestrial and solar phenomena, and several other phenomena, may all be explained by considering the relative geometrical positions of the sun and earth, and the consequently variable distorted paths of the solar radiations. For example, he states:—"The eleven-year period may be the combined consequence of a progressive variation (not necessarily periodic) of the system of the surfaces of discontinuity and the periodic displacement of the Earth in regard to the rotating mass of the Sun."

PRIMITIVE CONDITIONS OF THE SOLAR NEBULA.—An interesting mathematical study of the conditions which probably obtained in the primitive solar nebula has been communicated to the Academy of Science of St. Louis by Mr. Francis E. Nipher, and is published in No. 4, vol. xiv., of the academy's *Transactions*. According to the equations developed by the author, it seems impossible that at the time when the planets were separating from the parent mass the nebula was wholly gaseous. The idea that the planets were formed from condensing swarms of meteorites is the only reasonable one which conforms with the numerical results obtained. It also appears that at the times when the moon separated from the earth, and Mercury from the sun, the respective parent masses must have been in the solid state, the sun having fused and become vaporised since the separation of Mercury. Further, it seems unnecessary, and even improbable, that the earth should ever have been in a state of fusion. By substituting the proper conditions in one of his general equations, Mr. Nipher finds that the isothermal 7000° C. is probably the one existing at the sun's surface at the present time.

INVARIABILITY OF SPARK AND ARC WAVE-LENGTHS.—In a paper communicated to No. 4, vol. xix., of the *Astrophysical Journal*, Messrs. Eder and Valenta describe the results they have obtained from a series of experiments performed in order to test the various theories as to the variability of wave-lengths, in arc and spark spectra, with the amount of vapour present or with the nature of the electric stimulus used.

As the result of his experiments, Prof. Haschek proposed, in a paper published in February, 1902, a system of quantitative analysis based on the measurement of the amount of "shift" a line experienced when varying quantities of the material under analysis were used. Taking most stringent precautions to eliminate subjective photographic effects, Messrs. Eder and Valenta have shown that these "shifts" do not really exist, and they state their conclusions in the following words:—(1) That at ordinary atmospheric pressure there exist no relative shifts between the arc and spark spectra as were said by Exner and Haschek to occur; (2) that there also exist no shifts in the spark spectrum which could be attributed to a reduced quantity of the element present in the vapour.