

## OUR ASTRONOMICAL COLUMN.

COMET 1915a (MELLISH).—A postcard from the Copenhagen Observatory gives the following ephemeris for comet 1915a, for Greenwich mean midnight:—

		R. A.			Decl.			Log Δ	
		h.	m.	s.	°	'	"		
Jan. 1	...	5	17	31	...	+43	4'1	...	0.7406
9	...	11	34	...	...	42	59.8	...	0.7502
17	...	6	28	...	...	42	51.8	...	0.7610
25	...	2	16	...	...	42	41.2	...	0.7726
Feb. 2	...	4	59	5	...	42	29.0	...	0.7848
10	...	5	56	53	...	42	16.2	...	0.7975
18	...	5	55	40	...	42	3.7	...	0.8103
26	...	5	55	23	...	41	52.0	...	0.8231
Mar. 6	...	4	55	59	...	+41	41.3	...	0.8357

The estimated brightness of the comet is from the 14th to the 15th magnitude. At the time of discovery, on February 10, 1915, the comet was of the 9th magnitude, and became visible to the naked eye during the following summer.

ROTATION AND RADIAL VELOCITY OF N.G.C. 4594.—At the Mount Wilson Observatory an ingenious device has been employed by Mr. F. G. Pease to facilitate spectroscopic investigations of motion in faint nebulae (Proc. Nat. Acad. Sciences, vol. ii., p. 517). In this arrangement a silvered glass plate replaces the ordinary slit, and a slit is cut in the silver film at a place corresponding to each bright spot shown in a direct photograph of the nebula to be investigated, taken with the telescope to which the spectroscope is to be attached. The slits, of course, are chosen so as to prevent overlapping. For the comparison spectra another silvered plate is prepared, but with interrupted cuts, so that the central portions cover the parts previously exposed to the nebula when the comparison spectra are impressed. In view of the long exposures required, great economy of time is thus secured. Mr. Pease has successfully employed this arrangement on the spiral nebula N.G.C. 4594, for which a total exposure of eighty hours was given. It was found possible to determine the velocity at five places in the nebula, and the values are represented by the equation  $y = -2.78x + 1180$ , where  $y$  is velocity in km./sec. and  $x$  the distance from the nucleus in seconds of arcs. The radial velocity of the nebula is +1180 km./sec., while the rotational velocity at a point two minutes of arc from the nucleus is more than 330 km. Within the limits of error the rotational velocity increases linearly in passing from the nucleus, indicating that the nebula is rotating as a solid body, or, as seems more probable, that the material is moving in accordance with a law which will give a linear velocity curve. On certain suppositions the parallax would be 0.00013". In observations of such exceptional difficulty it is satisfactory to find a close accordance with the velocity +1100 km. given by Slipher for this nebula.

THE COOKEVILLE METEORITE.—A recently found iron meteorite, from Cookeville, Putnam County, Tennessee, is described by G. P. Merrill in the Proceedings of the U.S. National Museum (vol. li., p. 325). The meteorite is obviously very old, and so much oxidised that its original form is greatly obscured. The weight before cutting was 2132 grams. A cut surface shows an unusual feature in its very regular octahedral coarse crystallisation. Practically the entire mass is made up of broad kamacite bands 2 to 6 mm. in width, between which lie very thin plates of taenite. The total iron, of which nearly 20 per cent. occurs as oxides, is 81 per cent., while nickel amounts to 6 per cent. in the metallic form and 1 per cent. as oxide. Cobalt, phosphorus, sulphur, and carbon are present in small quantities.

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## THE PYROGENESIS OF HYDROCARBONS.

THE growing demand for low-boiling paraffins for use as fuel, and aromatic hydrocarbons for the manufacture of dyes and other materials, is directing increased attention to the possibilities of their synthetic production from natural sources, namely, the higher-boiling paraffins, coal and shale. It is well known that the superheating of the higher-boiling paraffins causes them to break up, or "crack," into lower-boiling liquids, and the effect of temperature on the nature of the distillation products of coal has long been recognised.

In a paper read before the Institution of Petroleum Technologists on November 21 the authors, Messrs. E. L. Lomax, A. E. Dunstan, and F. B. Thole, brought together not only a valuable bibliography of the literature on the subject (part i.), but, in the latter section (part ii.), also discussed in a comprehensive way the scientific aspects of this obviously complex process, and the various theories advanced by different workers in this field of inquiry.

The earliest systematic study of "pyrogenic decomposition" (i.e. decomposition at high temperatures) of hydrocarbons was initiated by Berthelot, who regarded the change as due either to simple polymerisation or condensation with loss of hydrogen. Moreover, each change being reversible, at a given temperature an equilibrium was established between a complex series of decompositions, polymerisations, and condensations. Among the decomposition products acetylene was assumed to play an important rôle and to be the source more especially of aromatic hydrocarbons. Berthelot, in fact, obtained the latter by heating acetylene to a dull-red heat. Later observers have opposed this view on the ground that the presence of acetylene could not be demonstrated, and as an alternative suggested that hydrogen was first eliminated with the production of olefine and that the carbon chain was broken down atom by atom as methane.

From a careful series of experiments on the thermal decomposition of methane, ethane, ethylene, and acetylene by Bone and Coward, it appeared that acetylene was the source of aromatic hydrocarbons, and was derived from the decomposition of ethylene. This polymerisation of acetylene takes place at 600°-700°. At these high temperatures the "nascent radicals,"  $\text{CH}\equiv$ ,  $\text{CH}_2\equiv$ , and  $\text{CH}_3\equiv$ , are assumed to be formed, and either unite or, if hydrogen is present, undergo reduction.

The authors of the present paper proceed to discuss the possible changes which may occur based on thermochemical data, and point out that the reactions which proceed by absorption of hydrogen are in the main exothermic, and the products, therefore, relatively stable, whereas cracking or decomposition is mainly the result of endothermic change. Now, according to the law of Le Chatelier, an exothermic synthesis will, at a high temperature, tend to be reversed, and the same is true of increased pressure, the tendency here being to bring about, under increased pressure, that change which diminishes the total volume of gaseous products.

That the process of cracking is necessarily complex is easily realised when the nature of the material, and especially the temperature conditions, are considered; for an exothermic reaction which may occur at low temperatures may very well be replaced by an endothermic one at a higher temperature with a complete change in the nature of the products. Thus, at moderate temperatures up to 500° the tendency is for the formation of a mixture of paraffins and olefines, whilst at about 700° the effect is the generation of aromatic hydrocarbons. The effect of temperature has been well illustrated in the experiments made on ethane, coal, and isoprene