rises and sets (see p. 111). Of the Katcina ceremonials the most elaborate is that termed Powámû. Extensive preparations are made before the dance, the old paint left from previous occasions being scraped off the masks, which are then carefully redecorated and ornamented with clusters of feathers. The dancers also decorate themselves, using iron oxide for painting their legs, knees and waists a pale red. On the occasion Mr. Fewkes describes, preliminary ceremonies took place at Walpi for a week before the first ceremonial day of the Powámû, in which masked men from the neighbouring villages of Tewa and Hano took part. We have not space here to enter into any detailed account of the elaborate ceremonials performed on this and the succeeding days, including songs, a kind of primitive drama, dances, ceremonial smoking, flagellations, sprinkling of liquids, casting of meal and pollen into liquids, the making of small dolls or images, &c. Mr. Fewkes has not attempted to explain the theoretical significance of the ceremonies, but has contented himself with accurately describing them as they were performed. We may note, however, that in his subsequent paper on the snake-dance he throws out the suggestion that these Katcina ceremonies are to be traced to a totemic origin.

Mr. Fewkes' paper contributed to the sixteenth annual report is entitled "Tusayan Snake Ceremonies," and is based on a comparative study of the snake-dance, which is now known to be performed at five Tusayan villages. At Walpi it is celebrated in its most elaborate form, and lasts for twenty days, though only on nine days do ceremonies actually take place. Sixteen days before the snake-dance occurs it is formally announced at sunrise, the chiefs of the village having been engaged in ceremonial smoking during the previous night. For the next seven days no ceremonies are performed, but on the eighth day the assembly takes place, and for nine days secret ceremonies continue, which close at sunset on the ninth day with a dance, in which snakes are carried in the mouths of the dancers; the four following days are days of purification. Mr. Fewkes admits that the meaning of the snake-dance is obscure, but inclines to the belief that the elaborate ritual is performed for two main objects—the making of rain and the growth of corn. He does not consider that the dance is in any way connected with actual snake-worship.

We have said enough to indicate the great interest of these papers, not only to the student of Indian ritual, but to anthropologists generally. If we may make one criticism, it is that in places they would, perhaps, have gained a little by compression.

ON A NEW CONSTITUENT OF ATMOSPHERIC AIR.[1]

THIS preliminary note is intended to give a very brief account of experiments which have been carried out during the past year to ascertain whether, in addition to nitrogen, oxygen, and argon, there are any gases in air which have escaped observation owing to their being present in very minute quantity. In collaboration with Miss Emily Aston we have found that the nitride of magnesium, resulting from the absorption of nitrogen from atmospheric air, on treatment with water yields only a trace of gas; that gas is hydrogen, and arises from a small quantity of metallic magnesium unconverted into nitride. That the ammonia produced on treatment with water is pure has already been proved by the fact that Lord Rayleigh found that the nitrogen produced from it had the normal density. The magnesia, resulting from the nitride, yields only a trace of soluble matter to water, and that consists wholly of hydroxide and carbonate. So far, then, the results have been negative.

[1] Paper to be read before the Royal Society on June 9 by Prof. William Ramsay, F.R.S., and Morris W. Travers. Received by the Society June 3.

Recently, however, owing to the kindness of Dr. Hampson, we have been furnished with about 750 cubic centimetres of liquid air, and, on allowing all but 10 cubic centimetres to evaporate away slowly, and collecting the gas from that small residue in a gas-holder, we obtained, after removal of oxygen with metallic copper and nitrogen with a mixture of pure lime and magnesium dust, followed by exposure to electric sparks in presence of oxygen and caustic soda, 26·2 cubic centimetres of a gas, showing the argon spectrum feebly, and, in addition, a spectrum which has, we believe, not been seen before.

We have not yet succeeded in disentangling the new spectrum completely from the argon spectrum, but it is characterised by two very brilliant lines, one almost identical in position with D_3, and almost rivalling it in brilliancy. Measurements made with a grating of 14,438 lines to the inch, kindly placed at our disposal by Mr. E. C. C. Baly, gave the following numbers, *all four lines being in the field at once*:—

D_1	... ...	5895·0
D_2	... ...	5889·0
D_3	... ...	5875·9
D_4	... ...	5866 65 + 1·7 to correct to vacuum.

There is also a green line, comparable with the green helium line in intensity, of wave-length 5566·3, and a somewhat weaker green, the wave-length of which is 5557·3.

In order to determine as far as possible which lines belong to the argon spectrum, and which to the new gas, both spectra were examined at the same time with the grating, the first order being employed. The lines which were absent, or very feeble, in argon, have been ascribed to the new gas. Owing to their feeble intensity, the measurements of the wave-lengths which follow must not be credited with the same degree of accuracy as the three already given, but the first three digits may be taken as substantially correct:—

Violet	4317	Blue	4834
,, ...	4387	,, ...	4909
,, ...	4461	Green	5557·3
,, ...	4671	,, ...	5566·3
Blue	4736	Yellow	5829
,, ...	4807	,, ...	5866·5
,, ...	4830	Orange... ...	6011

Mr. Baly has kindly undertaken to make a study of the spectrum, which will be published when complete. The figures already given, however, suffice to characterise the gas as a new one.

The approximate density of the gas was determined by weighing it in a bulb of 32·321 cubic centimetres capacity, under a pressure of 521·85 millimetres, and at a temperature of 15·95°. The weight of this quantity was 0·04213 gram. This implies a density of 22·47, that of oxygen being taken as 16. A second determination, after sparking for four hours with oxygen in presence of soda, was made in the same bulb; the pressure was 523·7 millimetres, and the temperature was 16·45°. The weight was 0·04228 gram, which implies the density 22·51.

The wave-length of sound was determined in the gas by the method described in the "Argon" paper. The data are:—

	i.	ii.	iii.
Wave length in air	34·17	34·30	34·57
,, ,, gas	29·87	30·13	

Calculating by the formula

$$\lambda^2_{air} \times \text{density}_{air} : \lambda^2_{gas} \times \text{density}_{gas} :: \gamma_{air} : \gamma_{gas}$$
$$(34·33)^2 \times 14·479 : (30)^2 \times 22·47 :: 1·408 : 1·666,$$

it is seen that, like argon and helium, the new gas is monatomic and therefore an element.

From what has preceded, it may be concluded that the atmosphere contains a hitherto undiscovered gas with a characteristic spectrum, heavier than argon, and less volatile than nitrogen, oxygen, and argon ; the ratio of its specific heats would lead to the inference that it is monatomic, and therefore an element. If this conclusion turns out to be well substantiated, we propose to call it "krypton," or "concealed." Its symbol would then be Kr.

It is, of course, impossible to state positively what position in the periodic table this new constituent of our atmosphere will occupy. The number 22·51 must be taken as a minimum density. If we may hazard a conjecture, it is that krypton will turn out to have the density 40, with a corresponding atomic weight 80, and will be found to belong to the helium series, as is, indeed rendered probable by its withstanding the action of red-hot magnesium and calcium on the one hand, and on the other of oxygen in presence of caustic soda, under the influence of electric sparks. We shall procure a larger supply of the gas, and endeavour to separate it more completely from argon by fractional distillation.

It may be remarked in passing that Messrs. Kayser and Friedlander, who supposed that they had observed D_3 in the argon of the atmosphere, have probably been misled by the close proximity of the brilliant yellow line of krypton to the helium line.

On the assumption of the truth of Dr. Johnstone Stoney's hypothesis that gases of a higher density than ammonia will be found in our atmosphere, it is by no means improbable that a gas lighter than nitrogen will also be found in air. We have already spent several months in preparation for a search for it, and will be able to state ere long whether the supposition is well founded.

LYON PLAYFAIR.

IT is now fifty-three years since I first met Playfair. He was President of the Chemical Section of the British Association in 1855 at Glasgow. Frankland and I were the Secretaries. Liebig attended the meeting, and stayed with his friend Walter Crum, and it was appropriate that Playfair, who was one of Liebig's most promising English pupils, should preside over a meeting of chemists at which his German master was present. Playfair then was in the height of his activity. His addresses in 1855, and again thirty years later, when he was President of the Association, although not containing much of striking originality, were clear, luminous expositions, as indeed were his speeches in the House of Commons, and latterly in the House of Lords.

In the year 1834, when he was fifteen years of age, he began to study chemistry under Graham, who was then professor at the Andersonian at Glasgow. After a short visit to his parents in India, where his father was Chief Inspector-General of Hospitals in Bengal, he followed Graham to London, and in 1838 went to Giessen to study under Liebig, then the rising star in the chemical firmament. There he became not only Liebig's pupil, but his friend ; he worked at organic chemistry, publishing in 1841 his first paper on a new fatty acid contained in the butter of nutmegs, and in the following year he published an abstract of Liebig's report on organic chemistry as applied to chemistry and pathology. On his return to England, through Liebig's influence with James Thomson, a man who even in those early days saw the value of science as applied to industry, Playfair was appointed as chemist to the well-known calico printworks at Clitheroe. After a few years he exchanged this position for a more suitable one in the Royal Institution, Manchester, where he found more congenial society in the friendship of Dalton and Joule. It was whilst he was in Manchester that Playfair induced Bunsen, who had just perfected his process of gas analysis, to come over to Alfreton to collect the gases of the blast furnace. The results of this visit furnished the first evidence concerning the chemical changes occurring in the blast furnace, and were published in the British Association Reports for 1845.

It was in conjunction with Joule that Playfair's name is best known as an investigator, several memoirs on atomic volume and specific gravity appearing in their joint names in the Chemical Society's *Journal*, the most important result of which was the discovery of the well-known laws relating to the disappearance of the volume of the acid and of the base of crystals of hydrated salts. If Playfair had remained under the influence of Dalton and Joule, his record of original work would probably have been much longer than it is, but his activity was destined to be turned into other channels. Sir Robert Peel, who had heard of Playfair and formed a high opinion of his powers, appointed him on a Commission to inquire into the sanitary condition of large towns, and such matters he found more to his taste than purely scientific research. In recognition of the services which he performed on this Commission, he was appointed chemist to the Museum of Practical Geology. It was here that he carried out his best-known research, namely that on the nitro-prussides, a new class of salts characterised by giving a splendid purple colour with alkaline sulphides. A year or two later preparations were being made for the first great exhibition of 1851, and Lyon Playfair was chosen as a competent man to visit the manufacturing districts to secure the co-operation of persons interested in manufactures and commerce. This somewhat difficult task he accomplished with tact and success, and later on he took a leading part in the classification and arrangement of the exhibits, and the appointment of the juries was mainly left in his hands. A good story is told of his *savoir faire* at the opening of the exhibition, where it was of course desirable to have all nations represented. A very gaily-dressed Chinaman found himself in the procession side by side with the Archbishop of Canterbury, and was about to be removed to some less conspicuous position when the Prince Consort desired he might be left where he was. Playfair's efforts had been successful in obtaining the recognition of China, for, in the absence of any yellow-jacketed mandarin as ambassador, Playfair had got hold of a Chinese ticket-collector of a junk then being exhibited in the docks. Not only during the existence of the exhibition, but even up to the present time, Playfair left his mark on the results of that exhibition, for he was the guiding hand in the numerous and complicated transactions which have taken place since the purchase of the South Kensington Estate by the Royal Commissioners. The foundation of the Science Scholarships, which are now proving such a boon to the aspirants to scientific fame, was entirely Playfair's idea. Working in connection with the exhibition of 1851 brought him into personal contact with the late Prince Consort, in whose household he accepted a post, and it was to Playfair that the Prince was much indebted in his various schemes of land improvement and other scientific matters. A few years later, when the Science and Art Department was put upon a new footing, Playfair was appointed joint secretary with Sir Henry Cole ; this partnership, as might be foreseen from the character of the two men, did not last long, and Playfair became Inspector-General of Government Museums and Schools of Science. A more permanent and satisfactory position was, however, now open to him. In 1856 he succeeded Gregory as Professor of Chemistry in the University of Edinburgh, and in this position he remained for thirteen years, and the wags said that he was the only Scotchman who, having tasted the flesh-pots of Egypt,