and weighed. The chlorine contained in a third portion was determined by means of silver nitrate in the ordinary manner. From the numbers so obtained the equivalent of masrium was calculated. A pure preparation of masrium oxalate was also obtained by precipitating the neutral solution of the chloride with ammonium oxalate, masrium oxalate resembling the oxalate of calcium in being insoluble under such conditions. The precipitated oxalate was washed, dried, and ignited in a combustion tube whose forward end was filled with copper oxide, when the salt was decomposed with elimination of its water of crystallization, which was absorbed and weighed in the usual manner. The residual oxide was also weighed, and the oxalic acid, in another quantity of the salt, was determined by means of a standard solution of potassium permanganate. The crystals of the oxalate were thus found to contain 52.70 per cent. of masrium oxide, 15.85 per cent. of oxalic anhydride, and 31.27 per cent. of water.

From the whole of the analytical data yet obtained, assuming, as the reactions of the salts would indicate, that masrium is a divalent element, the atomic weight would appear to be 228. An element of atomic weight about 225 is, indeed, required to occupy a vacant place in the periodic system in the beryllium-calcium group, and masrium appears likely to be the element in question.

Masrium has only yet been observed to combine with oxygen in one proportion, to form the oxide MsO . Masrium oxide is a white substance much resembling the oxides of the lime group. The chloride, MsCl_2 , is obtained upon evaporation of a solution of the oxide or hydrate in hydrochloric acid. The nitrate, $\text{Ms}(\text{NO}_3)_2$, crystallizes from 50 per cent. alcohol, and the crystals contain water, the amount of which has not been determined. The sulphate, $\text{MsSO}_4 \cdot 8\text{H}_2\text{O}$, is a white salt which crystallizes badly from water, but which separates in well-developed crystals from 50 per cent. alcohol. It combines with sulphate of alumina to form an alum, also with potassium sulphate to form a double sulphate. The oxalate above referred to, $\text{MsC}_2\text{O}_4 \cdot 8\text{H}_2\text{O}$, is a white salt, soluble in acetic acid, and also in excess of masrium chloride.

The most important reactions of the salts of masrium, as far as they have yet been studied, are the following. Sulphuretted hydrogen produces no precipitate in presence of hydrochloric acid, but yields a white precipitate in presence of acetic acid. Ammonia precipitates the white hydrate of masrium from solutions of the salts; the hydrate is insoluble in excess of ammonia. Ammonium sulphide and carbonate produce white gelatinous precipitates, likewise insoluble in excess of the reagents. Ammonium phosphate yields a white precipitate of phosphate. Caustic alkalies precipitate the hydrate, but the precipitate is readily soluble in excess of the alkaline hydrate. Potassium ferrocyanide produces a white precipitate which is soluble in excess of masrium chloride, but not in dilute hydrochloric acid. Potassium ferricyanide yields no precipitate. Potassium chromate precipitates yellow chromate of masrium, which is soluble in a further quantity of masrium chloride. Potassium tartrate yields a white tartrate precipitate which dissolves in excess of the reagent, but the solution is not reprecipitated by the addition of ammonia.

Metallic masrium has not yet been obtained. Attempts to isolate it by heating the chloride with sodium under a layer of common salt, and by the electrolysis of a solution of the cyanide proved unsuccessful. The chloride, moreover, is not sufficiently volatile to permit of its vapour density being determined.

From the above interesting reactions, however, it will be evident that masrium possesses a strong individuality, although on the whole behaving somewhat like the metals of the alkaline earths and those of the zinc group. Further work will doubtless afford more definite information concerning its nature and properties. A. E. TUTTON.

ON A NEW METHOD OF VIEWING NEWTON'S RINGS.

IF we observe the reflection of a rectangular strip of any opaque substance (A) about $\frac{1}{4}$ inch wide in a piece of plate glass of about the same thickness, it appears thus:—

FIG. 1.

A_1 A_2 being the reflections caused by the upper and lower surfaces of the glass respectively.

If a second glass plate, of the same thickness, be added beneath the first, there is a third reflection (A_3) added below A_2 thus, drawing only the reflections for simplicity's sake:—

FIG. 2.

Now if the upper slab of glass be *gradually* raised above the lower, the opaque strip remaining in position, the reflection A_2 (Fig. 2), which generally exhibits traces of colour when plate glass is used, splits up into two (A_2 A_3), thus:—

FIG. 3.

Thus it is proved that A_2 (Fig. 2) is the resultant of the reflections of the strip by the lower surface of the upper plate, and the upper surface of the lower plate (A_2 and A_3 , Fig. 3, respectively).

In saying that A_1 is the reflection of A caused by the top surface, we mean that light which would fall on that surface and be reflected to the eye is prevented from so doing by the presence of A; and so with respect to the other reflections: thus, if any one of the reflections is not perfectly dark, we can assert that the light seen in it is at any rate not due to reflection (for the first time) at the corresponding surface; e.g. A_4 (Fig. 2) appears anything but dark, and we may assert that the light seen in it is not reflected from the bottom surface of the lower plate (at all events for the first time).

Now by means of two similar rectangular strips A and B, placed with their long sides parallel to the surface of the glass, B being further from the observer and from the top plate, it is very easy to arrange them so that B_4 —the reflection of B in the lower surface of the lower plate—

apparently coincides with A_1 —the reflection of A in the upper surface of the upper plate; and thus, neglecting for the time light which has undergone more than one reflection, we see this A_1B_1 combination of reflections illuminated by light which has undergone reflection at the two inner surfaces only.

It is clear that if we substitute for the two glass plates the apparatus generally sold for exhibiting Newton's rings, we can by this simple method view the rings by the light proceeding from the two inner surfaces only. Thus viewed, the central dark spot appears of a rich velvety black, and the coloured rings very brilliant. The experiment can easily be projected, and the difference in the appearance of the rings on the screen, with and without the opaque screens, is very striking.

The effect of the two screens can be still more simply given by cutting a slit in a piece of blackened cardboard of about the same width as the thickness of one of the glass plates in the rings apparatus; it is almost needless to state that the cardboard in the region of the upper and lower edges of the slit performs the functions of the screens B and A respectively. In this way the backing of the lower glass plate (to get rid of the reflection from its lower surface) may be avoided; an obvious advantage when it is desirable to show the interference in the transmitted as well as in the reflected light.

But the interest of the method does not only lie in its simplicity. Besides affording an easy proof that the rings are caused by light reflected at the inner surfaces of the plates, it also gives a method of seeing and possibly differentiating the interference curves produced by light which has undergone only one reflection, *i.e.* the rings commonly known as Newton's, from the curves produced by the interferences of waves which have undergone two reflections or more (and these last, so far as I know, can only be shown by this method); for if, using the ring apparatus and a single opaque screen, say 3 inches $\times$ $\frac{1}{2}$ inch, we look into the central reflection (A_2) carefully, two sets of rings, intersecting, can be seen. These cannot be due to light reflected at the points whence the rays which form the primary rings are reflected—by what has gone before.

To indicate, without attempting for the present any further analysis, how some of the other interference systems may be rendered visible:—Take a strip of blackened cardboard, say 8 inches $\times$ $2\frac{1}{2}$ inches, and view its reflections in the Newton's rings apparatus. C (see Fig. 4) being the lower portion of this new screen, its

FIG. 4.

reflection will be seen to consist of a number of shaded strips, C_1 , C_2 , C_3 , &c.; and in each of these will be evident different interference curves (plainer, of course,

when monochromatic light is used); in C_1 the primary rings; in C_2 two series of rings crossed; in C_3 still more complicated forms, and so on; each set fainter than the last, the light to which it is due having undergone more reflections than its predecessor. The method suggested for the experimental analysis of these interference systems can only be sketched roughly here. It is, by the use of a second screen, possibly a third, so to combine the reflections of the screens with observations of the consequent alteration in the interference curves, as to completely verify the results a mathematical analysis of the problem would predict. T. C. PORTER.

JEAN SERVAIS STAS.

FEW, if any, among the men of science of the present day have at once done such important work and earned so little popular recognition as Jean Servais Stas. The names of Faraday, Liebig, Dumas, Darwin, have become household words beyond the laboratory and the lecture theatre, and are frequently taken in vain by the purveyors of "science for the million." But, whether among the "classes" or the "masses," if we mention Stas we are apt to be asked, Who was he? What has he done? If we mention his determination of the atomic weights, we have to follow this statement up with a popular lecture on stoichiometry, and are then told that there is not much in it.

Stas was born at Louvain, on August 21, 1813. Like many young men of scientific tastes in the earlier part of the century, he entered upon the study of medicine, and graduated as M.D. But, feeling himself strongly drawn to chemical research, he came to the conclusion that the life of a practising physician was not his true sphere. So early as 1835 he undertook, in conjunction with his friend De Koninck, an investigation of the root-bark of the apple-tree, and discovered phloridzine, an interesting crystalline body. However, at the outset he merely succeeded in obtaining this body in its pure state and in ascertaining its behaviour with reagents. He decided to go further, and to study the constitution and transformations of phloridzine. To this end he stood in need of further instruction. But the methods of organic investigation were at that time little advanced. The art of research was taught only by Liebig at Giessen, and by Dumas at Paris. Stas made choice of Dumas, and after overcoming endless difficulties, was admitted as a pupil in the laboratory of that distinguished Academician.

Here, he resumed the study of phloridzine, and soon succeeded in determining its formula, and those of its principal derivatives. He ascertained that in contact with acids, phloridzine was split into glucose and phloretin, thus belonging to the class of glucosides, bodies the prototype of which had been discovered by Liebig and Wöhler in amygdaline. Berzelius, a man by no means lavish of praise, declared that "from an investigator who has carried out such a research much may be expected."

Impressed with the ability of his pupil, Dumas requested him to undertake a series of investigations in concert with himself. The first of these researches was the examination of the action of potassa-lime on alcohols. They determined that, without exception, alcohols were transformed into corresponding acids. By their powers methylic alcohol yielded formic acid, and ethylic alcohol yielded acetic acid. Fusel-oil gave a valericianic acid exactly agreeing in its properties with the natural valericianic acid—a discovery of great importance considering the paucity of synthetic organic compounds then known. In conjunction with his master, he ascertained the molecular weight of valericianic acid by a determination of its vapour density and by its conversion into tri- and tetra-chlorvalericianic acid, thus justifying their joint belief