Key to the Universe; or, a New Theory of its Mechanism. Founded upon a (1) *Continuous Orbital Propulsion, arising from the Velocity of Gravity and its Consequent Aberrations;* (2) *Resisting Ethereal Medium of Variable Density, with Mathematical Demonstrations and Tables.* By Orson Pratt, Senior. Second Edition. (Salt Lake City, Utah Territory, 1879.)

MR. ORSON PRATT'S work is not a text-book for students, but an application of dynamical principles to the system of the Universe. "The aim of the author is to vindicate the UNIVERSALITY of the law (*i.e.*, of gravitation); to rescue it from the environed limits sought to be thrown around it, and to give it that unlimited freedom of action which the distinguished name 'UNIVERSAL' so appropriately and definitely imports." Mr. Pratt states that astronomical science needs a theory which will answer as far as possible nine questions, which he propounds; the second is, "Why do planetary bodies rotate upon their respective axes? Why do they rotate from west to east, instead of the contrary direction? Is there any law governing their diurnal periods?" The ninth, "Will cometary orbits ever be converted into those of a planetary form?" "Unaided and alone, he launches his humble barque upon this great unexplored ocean, with a compass of his own invention." The discussion occupies thirteen chapters, and his investigations result "in the development of the following beautiful law: *The cube roots of the densities of the planets are as the square roots of their periods of rotation.*" Without making any long comments of our own we can say that Mr. Pratt's book gives evidence of much hard work and, it may be, of ingenious speculation, and we quote as appropriate to the work before us the following remarks of Prof. Newcomb ("Popular Astronomy," p. 233): "It is true that many ingenious people employ themselves from time to time in working out numerical relations between the distances of the planets, their masses, their times of rotation, and so on, and will probably continue to do so; because the number of such relations which can be made to come somewhere near the exact numbers is very great. This, however, does not indicate any law of nature."

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

The Recent Gas Explosion

THE explosion of the gas main in the neighbourhood of the Tottenham Court Road appears to be an example on a large scale of the phenomenon which occurs on the bursting of a eudiometer.

It is known (although I do not speak from experience) that when such an accident happens the glass gives way at the surface of the mercury in the tube, for at this point the explosion is most violent, in consequence of the gas being compressed by the explosion of that above it. When no accident takes place the flash of light is more brilliant at the surface of the mercury than in the upper part of the tube. In order to see if this fact would throw any light on the explosion of the gas main I tried a few experiments about a fortnight ago, an account of which may possess some interest. A piece of combustion tube 1·93 m. long and 13·5 mm. in diameter was closed at one end, and at 100 mm. from the open end of the tube a pair of platinum wires was sealed into the glass. The tube was filled over water with a mixture of hydrogen and oxygen obtained by the electrolysis of dilute sulphuric acid, and the mouth of the tube closed with a plug of wet cotton wool. The tube was placed on the lawn and secured to a heavy weight by a piece of string tied near the open end; a spark from an induction-coil was then passed between the wires. The explosion of the gas blew out the plug of cotton wool and bent the platinum wires against the sides of the tube, but the glass was not broken. The tube was again filled with the mixed gases and closed with a cork, which was not forced tightly into the mouth of the tube. This time the tube burst in the middle, leaving ·78 m. of the closed end and ·59 m. of the open end without damage. The cork was projected some distance, but the wires were not bent by the rush of gas; the closed end of the tube was only slightly moved from its original position by the explosion.

Another piece of similar tube, but only about ·88 m. in length, was next filled with gas and exploded in the same manner. The closed end was burst, and ·475 m. of the open end remained. In this case the cork was also projected, but the wires were not bent. The experiment being made at night, it was noticed that the flash was much more brilliant at the closed than at the open end of the tube. A third tube of the same length as the first was next tried; the cork was blown out, but the tube did not burst. It was again filled and the cork forced in tightly, but it was again projected. The third time a block of stone was placed a few millimetres in front of the cork; this prevented its projection, but the tube did not burst, being apparently of thicker glass than the previous tubes. In the last three cases the flash was brilliant in the half of the tube towards the closed end.

The explanation of the experiments seems to be, that in the two tubes that burst the pressure produced by the explosion at a distance of about three quarters of a metre from the point at which the gas was fired was sufficient to overcome the resistance of the glass; and in the case of the long tube, which burst in the middle, the release of the pressure prevented the closed end from being destroyed. If the tube had been much longer there would probably have been another place where the violence of the explosion produced by the compression of the gas would have burst the tube.

The press of work at the end of the term has prevented my carrying the experiments farther, but I intend to try the effect of an explosion in a long lead or composition pipe, when I expect to find several swellings or burstings of the metal at the points where the pressure is greatest. When the experiments have been made I hope to be allowed to communicate them to you. HERBERT MCLEOD

Cooper's Hill, July 24

The Freshwater Medusa

IN NATURE, vol. xxii. p. 241, Prof. Lankester asserts that I had in a previous number (vol. xxii. p. 218) incorrectly represented him as holding that in Limnocodium the radial canals terminate blindly, and as denying the presence of a marginal canal. In proof of my inaccuracy he makes the following statement:—

"A reference to NATURE, vol. xxii. p. 147, will show that in my first publication on the subject I gave as a character of the new genus, 'Radiating canals 4, opening into the marginal canal. Marginal or ring canal voluminous.' I made the same statement in my communication to the Royal Society on June 17, and have not since deviated from it."

I have read the article to which Prof. Lankester here refers, and which was published on the date of the reading of his paper at the Royal Society. The only allusions in it to this subject are the following:—

"RADIATING CANALS 4, terminating blindly at the margin of the disk."

"MARGINAL or RING CANAL obliterated (or, if present, of very minute size)." GEO. J. ALLMAN

Storm Effects

THE storms about this part of Surrey have been lately local and violent, and the effects produced in some instances curious. Visiting a neighbour's farm on Wednesday evening (21st), we found a field of standing wheat considerably knocked about, not as an entirety, but in patches forming, as viewed from a distance, circular spots.

Examined more closely, these all presented much the same character, viz., a few standing stalks as a centre, some prostrate stalks with their heads arranged pretty evenly in a direction forming a circle round the centre, and outside these a circular wall of stalks which had not suffered.

I send a sketch made on the spot, giving an idea of the most

perfect of these patches. The soil is a sandy loam upon the greensand, and the crop is vigorous, with strong stems, and I could not trace locally any circumstances accounting for the peculiar forms of the patches in the field, nor indicating whether it was wind or rain, or both combined, which had caused them, beyond the general evidence everywhere of heavy rainfall. They were to me suggestive of some cyclonic wind action, and may perhaps have been noticed elsewhere by some of your readers.

Guildown, Guildford, July 23 J. RAND CAPRON

The Inevitable Test for Aurora

I HAVE not long returned from abroad, and have only recently had the opportunity of perusing in NATURE (vol. xxii. pp. 76, 96, 145) the correspondence of Messrs. De La Rue and Müller, Prof. Piazzi Smyth, and Mr. Backhouse on this subject.

I do not understand Messrs. De La Rue and Müller as claiming their electric discharges to be in the nature of an actual auroral discharge, but rather that their experiments inform us inductively at what heights auroræ are to be found. This, however, doubtless assumes that the discharges in question and auroræ must have something very much in common; and Prof. Piazzi Smyth is quite to the point in remarking that unless the citron line (and, I would add, the red line) are present in the spectrum, the identity of the discharges with the aurora has not even a foundation.

The fact is, that many of the electric discharges in air and the air gases, and the circumstances attending them—we may instance the ordinary tube glow, its change from rose-tint to violet under magnetic influence, the aura-arc accompanying the spark discharge under similar conditions, the dark space between the terminal and the glow, the change of colours in a hydrogen tube, and other appearances which I have not time to capitulate—so closely resemble auroral incidents, that one is quite disappointed to find on examination no concordance in the spectra. At the most, in a vague and unsatisfactory way one or two of the blue and violet lines in the aurora spectrum have been assigned to one or other of the atmospheric gases; but as Prof. Smyth points out, the red and green giant lines of the spectrum have up to the present time found no terrestrial analogues. I have examined the air spectrum and the spectra of the component gases of air under many various conditions, but always without success so far as these lines are concerned.

I have not, however, had the opportunity of doing this in the case of direct discharges from large secondary batteries; and it would undoubtedly be a valuable addition to our knowledge of facts relating to auroræ if Messrs. De La Rue and Müller would undertake this examination, and clear up matters in that respect. With regard to the heights at which auroræ obtain, the evidence is very conflicting. Certainly they have been seen very near the earth ("Auroræ, their Characters and Spectra," pp. 37 to 40. Height of the Aurora). It is unfortunate that simultaneous observations of the auroral corona are almost entirely wanting. I think I once saw one in print, but missed it subsequently, and would be glad if any particulars could now be furnished me. Prof. Newton, by calculations based on observations of auroral arches in 28 auroræ, has assigned a height of from 33 to 281 miles, with a mean of 130 miles.

Messrs. De la Rue and Müller, I notice, deduce experimentally that at 124 miles no discharge could occur. As to whether the red or the white aurora is the nearest to the earth, my impression certainly is that the apparently low-lying auroræ have generally been the *white*. I may instance the aurora seen by Mr. Ladd a Margate, "a white ray," and that seen by me in the Isle of Skye in September, 1874. In Lapland, too, the auroræ seem almost universally yellow, but it can hardly be assumed that they are all thirty-seven miles high. The apparently lower position of the red tint is by no means universal, and can hardly be relied upon as evidence on the point, especially when so many auroræ are seen in which it is wanting. I have great hopes, with a spectroscope specially prepared for the purpose, of getting the photographed spectrum of an aurora.

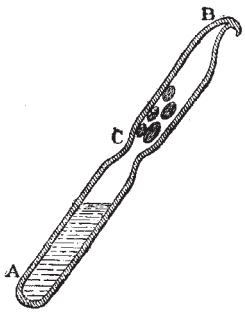
The red line is of course out of the question, but judging from experiments on gas tubes I think the green might be got, and the blue and violet I make in anticipation pretty sure of in the event of an aurora lasting some hours. The principle of the instrument is a long collimator, a single fluid prism, and a short focus-projecting lens, used with rapid dry plates.

Guildown, Guildford, July 23 J. RAND CAPRON

Experiment with Glass Tubes

I HAVE just been repeating a very beautiful experiment of Prof. Quincke's which he showed me some weeks ago in his laboratory at Heidelberg. The experiment was, I believe, described in *Poggendorff* about two years ago, but I have not seen it noticed in English papers, and a few words about it may interest your readers.

Prof. Quincke, with a view to test the porosity of glass for gases, sealed up tubes in which hydrogen and carbonic acid were generated in great quantity, and weighed them from time to time. Up to the present time, as I learned from him, no loss of weight has been detected. He obtained, however, a very curious result. As I do not know precisely how Prof. Quincke filled his tubes, let me describe what I did myself three weeks ago, remarking that I have done nothing but attempt to repeat what he showed me in Heidelberg.



I took a glass tube, A B, about 5 inches long and ¾ inch in external diameter, with good stout walls. I closed the end A, and let the glass fall in at C, keeping it still very strong, and annealing very carefully at A and C. I introduced some sulphuric acid into the part C A, carefully keeping the neck C dry, and dropped into the part B C some fragments of marble, previously washed, in order that no little particles should tumble down through the neck, C, and commence effervescing before I was ready. I then drew out the tube at B, making a small hook, by which the tube can be suspended if necessary, closed it very strongly, and annealed the extremity carefully, wrapped the tube in cotton wool, and inverted it. The sulphuric acid attacked the marble, and carbonic acid was given off no doubt in great quantity.

For the first few days there was nothing particular to be noticed. The tube was filled with a bubbling mass of liquid and white mud. Latterly, however, it has begun to show the phenomena which Prof. Quincke observed. The liquid now no longer wets the glass as it did at first, but creeps away from it, giving very much the appearance of the "tears of strong wine." Day by day this is getting more marked, and I expect that soon, as was the case in the Heidelberg tubes, the acid will roll about in the tube like so much quicksilver. Meantime it is most interesting to watch.

I believe Prof. Quincke considers that a thick layer of gas is condensed over the surface of the glass, and that it is this which gives rise to the very peculiar capillary phenomena that present themselves.

I feel bound to remark that the experiment is one that ought not to be attempted without great care and caution.

J. T. BOTTOMLEY

Physical Laboratory, University of Glasgow, July 15

On the Colours of Double Stars

IF any light whatever has its intensity increased the effect on the eye is to add to the sensation a certain yellow element which I have accurately defined by experiment (*Am. Jour. Sci.*, April, 1877, vol. xiii. p. 247). A red light brightened becomes yellower, a green light yellower, a yellowish white less white, a blue or violet light whiter. The phenomena are described at length in Prof. Rood's "Modern Chromatics." The fact that an incandescent body becomes less red and more yellow when it is heated is probably due to this physiological principle. That the incandescent body ultimately becomes white is probably owing to some not understood modification of the principle for excessively bright lights.

It follows that if two stars are of unequal brightness they will appear of different colours unless the qualities of the two lights have a peculiar relation to one another; and the brighter star will usually be the yellower. Accordingly, if we refer to Mr. Burnham's lists of binaries recently published by Prof. Holden (*Am. Jour. Sci.*, June, 1880, vol. xix. p. 467) we find that although differences of colour are so little distinguished that three-quarters of all the pairs are considered to be of the same colour, yet of the twenty-four pairs which differ in brightness by two magnitudes