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LXXXIII. On sounds of splashes

A.L. Narayan M.A.

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3. The 21·2 volts radiation ionizes abnormal helium produced by 20·4 volts electron impacts, and with a relatively high gas pressure the detected effects of ionization may swamp those of radiation. This result provides an explanation of the ionization of helium by electrons having less than the normal ionizing velocity, which is essentially different from that offered by Compton.
4. Both types of radiation can be absorbed and subsequently re-emitted by normal helium atoms, so that they are passed from atom to atom throughout a volume of the gas.
5. For velocities below the normal ionizing velocity, the amount of ionization produced as the result of electron impacts on abnormal helium atoms, under the experimental conditions used, is small in comparison with that resulting from the ionizing action of the 21·2 volts radiation.

The possibility of the presence of a small quantity of impurity in the helium facilitating the production of radiation at 20·4 volts has been investigated, but no evidence that the impurity acts in this way has been obtained.

It is concluded that the significance of the experimental results in connexion with theories of the arrangement of the two electrons in the normal helium atom lies in the fact that they indicate that the limitations of the selection principle are not applicable to the fundamental displacements of the outer electron of the helium atom.

LXXXIII. *On Sounds of Splashes.*

By A. L. Narayan, *M.A.**

[Plate XXIII.]

In a previous paper Prof. C. V. Raman and Ashutosh Dey investigated by a photographic method the "smooth" or sheath splash and the "rough" or basket splash, in so far as the splash depends on the condition of the surface of the impinging sphere.

In this connexion it may be noted that a smooth splash is

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a silent one taking down no air, while a rough or basket splash is noisy, taking down much air and throwing up a tall and very conspicuous jet, as can be very easily seen from the many beautiful instantaneous photographs taken by the late Professor Worthington and given in his interesting book 'A Study of Splashes,' pp. 97 and 103.

The transition from a smooth splash to the rough splash depends on :—

1. Condition of the surface of the falling sphere.
2. Velocity of entry of the falling sphere.
3. Nature of the liquid.
4. Temperature of falling sphere.

The present investigation is undertaken with a view to study photographically the transition from the "airless" to the "airy" splash in so far as it depends on the second condition, viz., velocity of entry of the falling sphere, *i. e.*, the height from which the sphere is dropped.

The method by which the photographic records of the splashes are obtained in this communication is almost exactly the same as was adopted by the authors of the previous paper (Phil. Mag. No. 229, Jan. 1920, pp. 146–147).

For the benefit of the readers, a brief description of the apparatus is given here. It consists of an ordinary gramophone horn at the end of which a thin mica disk is fixed. From the centre of this disk, a thin steel blade projects normally from the disk, and this projecting blade presses on a fine steel needle supported horizontally on two props. At one end of this steel needle a minute fragment of a galvanometer mirror is cemented. Thus when sound waves enter the horn, the thin mica disk and along with it the projecting steel spring vibrates, and thus the steel needle rolls on the supports and the mirror fragment rotates about a horizontal axis. It is interesting to note in this connexion that as experience showed there is a greater freedom of movement for the steel needle, the supporting blocks in this case are two small steel knife-edges, which are at the same time slightly curved so as to ensure that the needle always remains parallel to itself.

The sphere used in this investigation is mostly a highly-polished nickel-plated steel sphere, about ½ inch in diameter, as used for ball-bearings. In some experiments a polished brass sphere also is used. In all these cases, the height of fall is gradually increased each time, rubbing the sphere well on a clean handkerchief and then polishing it by

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a selvit cloth. Above a certain height of fall (146 cm.), it is found that the records are somewhat inconsistent although each time the ball is rubbed with equal care, thereby showing that a very small difference in the surface will influence the nature of the splash very near the critical height.

The paper is accompanied by eight photographic records of the sounds of splashes obtained in the above experiment (Pl. XXIII.) In all these the plate moves past the narrow rectangular vertical slit of the camera with a high speed, and I have used ordinary Empress plates to ensure the moving spot of light making a good impression on the photographic plate. The whole apparatus is mounted in the dark-room and a narrow beam of sunlight is projected into the dark-room through a hole in one of the shutters of the windows by means of a heliostat set in motion by clockwork. With this arrangement it is found that a good negative is obtained by developing the plate for about a minute in a normal solution of metol-hydroquinine.

These records clearly show that in one of a basket-splash there was a violent disturbance at a particular stage followed by another small disturbance, and that the first violent one was considerably damped while there was very little damping in the small one. A photograph of the apparatus *in toto* is also given (fig. 9).

The investigation is being continued with a view to study the phenomenon with spheres of different substances and also to ascertain how it depends on the nature of the liquid.

As even the ordinary ear observation shows that up to a certain height the splash was perfectly noiseless and the spot of light was at rest, the large number of the records obtained for the low heights are not given here. In all these cases the curve is only a straight line, showing thereby that the splash was noiseless.

The records show that the critical height of fall of the highly-polished steel sphere in the case of water is approximately 153 cm.

Department of Physics, Maharajah's College,
Vizianagaram, Madras, India.
2nd April, 1921.

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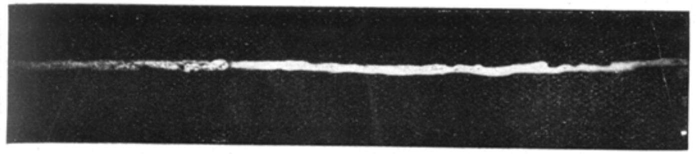
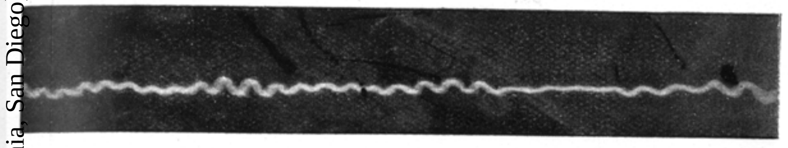
FIG. 1.



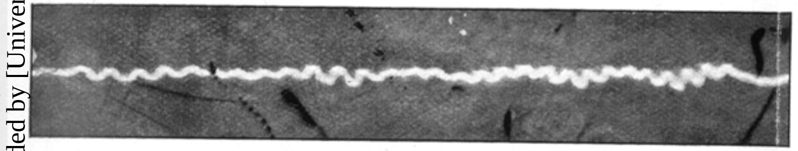
Height = 145 cm.

FIG. 2.



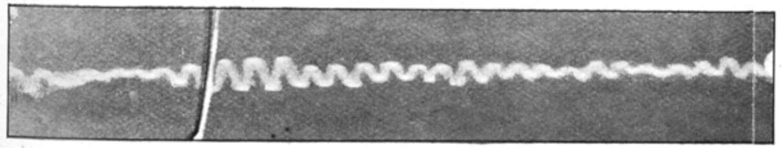
Ht. = 146 cm.

FIG. 3.



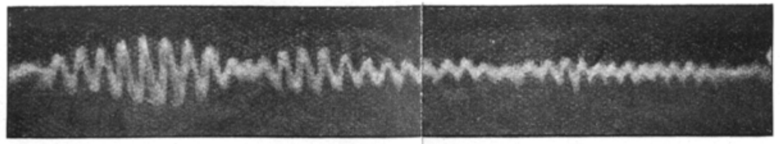
Ht. = 149 cm.

FIG. 4.



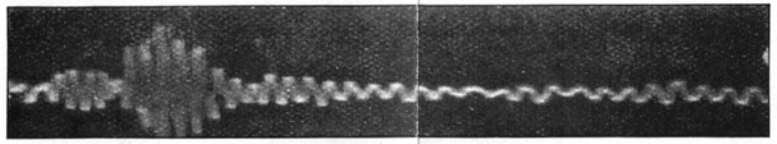
Ht. = 148 cm.

FIG. 5.



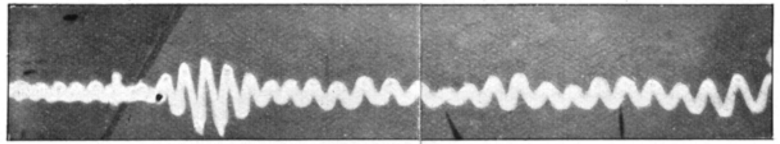
Ht. = 151 cm.

FIG. 6.



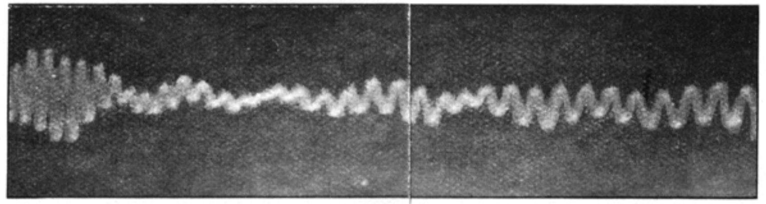
Ht. = 152·5 cm.

FIG. 7.



Ht. = 153·6 cm.

FIG. 8.



Ht. = 152·5 cm.

FIG. 9.