DISCUSSION AND CORRESPONDENCE.

DIFFRACTION OF X-RAYS OBTAINED BY A NEW FORM OF CATHODE DISCHARGE.

TO THE EDITOR OF SCIENCE: Will you allow me to publish a very brief statement concerning some work which is now in progress on the diffraction of X-rays. The trouble has been in obtaining a sufficiently intense source to give diffraction bands with the very narrow slits that must be used. After considerable experimenting I have found a new method of producing the rays, by which the intensity of radiation per unit of area of radiating surface is from ten to twenty times as powerful as in the best focus tubes. A 'total radiation' equal to the large focus tubes has not yet been obtained. The rays are produced by an arc-like discharge between two very small beads of platinum in a high vacuum. The discharge bulb is only about an inch in diameter, while the radiation (which comes from an area about the size of a pinhead) is strong enough to show the bones in the forearm. The 'arc' appears to be a new form of cathode discharge and can only be produced under peculiar conditions. I am now using a tube with a platinum slit 1 mm. wide, mounted within the bulb at a distance of 2 mm. from the radiating bead. The second slit of variable width is placed at a distance of 10 cm. from the first and the photographic plate at distances varying from 10 to 30 cm. from this.

The images of the slit on the plate show a distinct dark line on each edge, which I can only explain on the supposition that interference occurs. The plate is at too great a distance from the slit for such an effect to be produced by reflection of the rays from the edges. Images of fine wires show similar phenomena.

As yet I have not succeeded in getting a maximum of the second order, possibly because of under exposure of the plates. The details of the work will appear shortly in *Wiedemann's Annalen* and *The Physical Review*. I am under great obligation to Professor Cross for his kindness in placing at my disposal the facilities of the physical laboratory of the Massachusetts Institute of Technology.

R. W. WOOD.

JAMAICA PLAINS, MASS., March 31st.

THE HEIGHT AND THE VELOCITY OF THE FLIGHT OF A FLOCK OF GEESE MIGRATING NORTHWARD.

DURING the three days ending March 22d numerous flocks of geese were seen migrating northward, or rather northeastward, since they were following the general trend of the coast line, which, in New England, is nearly northeastward north of Cape Cod. On the morning of March 22d, while Mr. A. E. Sweetland and I were measuring clouds, at the ends of a base line 1178.4 meters in length, extending from the Blue Hill Meteorological Observatory to the base of Blue Hill, we succeeded in measuring, with our cloud theodolites, the height and the velocity of flight of one of these flocks of geese. So rapid is the velocity of flight that the flock was visible to the observers only about two minutes, but during that time two sets of measurements, were taken with the theodolites on the leader of the flock. The first measurements, at 8.49 a. m., were accurately taken at the Observatory station, but were only approximate at the other station. The second measurements, at 8.50 a. m., were accurate and simultaneous at both stations. Using the second set of observations at both stations for the height and the two sets of observations at the observatory station for the velocity, the calculations gave the height as 905 feet above the Neponset River valley, or 960 feet above sea level, and the velocity of flight as 44.3 miles an hour. The direction of flight was from southwest to northeast.

The self-recording instruments at Blue Hill Observatory, 615 feet above the river valley, showed that the wind at the time of the measurements was from the west-northwest with a velocity of eight miles an hour.

The height calculated from the first set of observations at the two stations was 928 feet above the river valley. This result, though not considered strictly accurate, serves as a good check on the adopted value which is given above.

On a previous occasion as described in SCIENCE of January 1st, p. 26, we found a flock of ducks flying from the northeast at a height of 958 feet with a velocity of 47.8 miles an hour. The close agreement between the two results is sug-

gestive, though it may have been accidental.

H. Helm Clayton.

Blue Hill Meteorological Observatory,
Readville, Mass., March 25, 1897.

ARCHÆOLOGICAL DISCOVERIES MADE IN THE GRAVELS AT TRENTON.

To the Editor of Science: In Dr. Brinton's reference in your issue of March 12th to Professor Putnam's report to the Peabody Institute, he scarcely does justice to the recent archæological discoveries made by Mr. Ernest Volk in the gravels at Trenton. Dr. Brinton says, referring to Professor Putnam's description of chipped stones "found in the glacial deposits of the Delaware Valley," that "it is fair to say that geologists are not agreed about the age of these deposits." It cannot be that Dr. Brinton has Professor Putnam's recent facts clearly in mind or he would not make this remark.

For Mr. Volk's investigations have been carried on on the Lalor farm, which is clearly within the range of the 'Trenton gravels' ascribed to glacial floods by every recent geologist who has visited them, including Professors Cook, Shaler, Chamberlin and Salisbury. This farm lies fifty feet above the level of the Delaware river, and abuts directly upon it. Boulders two or three feet in diameter are lying about loose upon the surface in the immediate vicinity. Mr. Volk, under Professor Putnam's direction, has systematically dug over acres of this farm and has found hundreds of chipped pieces of argillite in the undisturbed layers of sand which are everywhere found from two to three feet below the present surface. In the upper twelve inches of the soil, where there are evidences of disturbance, great numbers of jasper and flint implements have been found, together with some argillite implements; but in the lower two feet excavated no jasper and flint implements have been found, but only argillite; thus demonstrating the correctness of Dr. C. C. Abbott's previous observations, and excluding the various extravagant theories propounded to account for their burial by natural causes; such as overturning of trees, the burrowing of animals and the cracking of the soil.

I would say that I have had the privilege of accompanying Mr. Volk during some of these excavations, and can add my testimony to his as to the genuineness and importance of these very significant discoveries. In this case there is no chance to claim that they have been buried in the talus; for in the cases which I saw with my own eyes the implements were dug up from the undisturbed strata of the sand more than one hundred feet back from the edge of the bluff.

I trust that the Philadelphia geologists and archæologists will give more personal attention to the work which Professor Putnam, through Mr. Volk, is so successfully carrying on in that disputed district. G. Frederick Wright.

[When Mr. Volk's specimens were exhibited at Buffalo Professor McGee stated in the Section that he did not consider that the age of the deposit in which they were found is positively ascertained. The sand layers overlie the gravels, and have usually been supposed to be considerably later. Mr. Volk has not found the specimens referred to in the true, undisturbed gravels.—D. G. Brinton.]

AN IMAGINARY FLEET.

To the Editor of Science: Permit me to congratulate you for the extremely just and advanced view you take of what a university should be. In your issue of March 19, p. 471, I find, to my great satisfaction, "Research is not only the primary object of the university; it is the university itself." So dominant is this sentiment in my mind that I have attempted the establishment of a department where all work, however elementary, shall be carried on after the manner of original research.

Would that the statement found on p. 473 of the above-mentioned date were true, viz., that the trustees of Cornell University are going to build me a naptha launch for the transportation of my students in paleontology; would also that the launch were forthcoming that a prominent firm writes me about, viz., one they understand the 'Cornell students' are making for me. These, with the one I *am personally* having built by Lintz & Co., Grand Rapids, Michigan, would certainly form an enviable fleet for the prosecution of paleontologic research.

G. D. Harris.

Cornell University.