first to try to verify the references given at the end, in which they will fail, and second to read 'Vivisection: a statement in behalf of Science,' published in the issue of this JOURNAL for March 20, 1896, and endorsed by President Eliot, of Harvard University, and the late Francis A. Walker, President of the Massachusetts Institute of Technology.—ED. SCIENCE.]

ASTRONOMICAL NOTES.

REPORTS OF OBSERVATORIES.

THE annual reports of three of the most active observatories of the world are at hand.

1. *Report of Her Majesty's Astronomer at the Cape of Good Hope for the year 1897.*—The astrophotographic telescope was used for chart plates, catalogue plates, variables, and with a 20-degree prism for a spectroscopic survey of stars to 3½ magnitude. The transit circle was used for stars needed for the measurement of plates to complete the Cape zones, —40° to —52°. 9,000 standard stars will be included in this area. The 7-inch equatorial has been chiefly used to look up discrepancies in the photographic plates and in checking missing stars. Among the results obtained was the confirmation of the large proper motion of 9″ in the star which Kapteyn had detected on the plates. The heliometer was used chiefly in triangulation of comparison stars for observations of planets at opposition. Preparations were making for the mounting of the new McLean telescope, constructed by Grubb, and the new transit circle by Troughton and Simms. The computations were chiefly upon the meridian observations of former years, and upon heliometer observations for parallax. Dr. Gill has eleven regular assistants and computers, with other computers occasionally employed. The observatory carries on an extensive system of time signals, and the geodetic survey of South Africa will be under the direction of the government astronomer.

2. *Report of the Superintendent of the U. S. Naval Observatory for the year ending June 30, 1898.*—The 26-inch equatorial has been used for micrometric observations of the faint comets, satellites, close doubles and the diameters of Venus and Mercury. The 12-inch telescope has been similarly used for astercids and comets. The 9-inch transit has been used for sun, moon, planets and certain stars. The new 6-inch steel transit is in process of erection. The 5-inch altazimuth has been used as a zenith telescope and as a vertical circle. The opinion is expressed that declinations can be obtained with greater accuracy by this instrument than by a meridian circle. The astronomical work has been materially lessened by the detachment of line officers for active service in the recent war, necessitating the care of nautical instruments, chronometers and time service by the astronomical staff. This report goes into minute detail regarding the work of the Observatory, even mentioning such minor matters as the mounting of a new thermometer, and the repairing of the wooden cases of clocks, the glue in which had deteriorated. The Nautical Almanac has been under the care of the Astro nomical Director, Professor Harkness. The chief publication has been the Catalogue of Stars from observations made from 1866–1891, prepared by Professor Eastman.

3. *Fifty-third annual report of the Director of the Astronomical Observatory of Harvard College, for year ending September 30, 1898.*—The 15-inch equatorial has been used for photometric observations chiefly of variables. The 6-inch equatorial has been used for observations of variables by the method of eye estimates. The meridian circle has been used to complete the observations for the southern zone—9°50′ to—14°10′. The meridian photometer has been devoted to the reobservation of the stars in the Harvard Photometry and other stars fainter than those in that catalogue. The 8-inch and 11-inch photographic telescope, working under the Henry Draper Memorial, have obtained more than 3,000 plates. Their study has resulted in various discoveries, such as twelve variables, stars of peculiar spectra, one spectroscopic binary, one spectrum of a meteor with five bright lines, one spectrum of the aurora with four bright lines. At Arequipa, Peru, more than 2,400 plates have been made with the 8-inch, 13-inch and 24-inch telescopes. Professor Bailey's study of variables in clusters has revealed 509 variables in 20 clusters; the light

curves of 125 variables in ω Centauri have been obtained.

Among other matters discussed by Professor Pickering in his report is the organization of the Observatory. The Harvard College Observatory is not, like many other observatories, divided into departments each under an astronomer of high grade. The Director himself is in immediate charge of all the departments, in many cases making a daily inspection and planning the work in detail. The assistants become skilful each in a particular work, and three or four times as many can be employed at a given expenditure as under the departmental system. The report mentions the advantages and disadvantages of each plan and advises that the plan in operation at Harvard should continue to be followed in one large observatory. The corps of assistants at Harvard and at the Southern Station, in Peru, includes forty persons.

THE PLANET DQ.

THIS planet has been named *Eros*. The *Astronomical Journal* and Circular 36 of the Harvard Observatory contain the gratifying announcement that numerous observations of the planet have been found on the Harvard plates in 1894 and 1896. In 1894 the planet was at its most favorable position for observation, and of the 7th magnitude when nearest. Observations have been found extending for more than four months, making it possible to determine an accurate orbit for that opposition alone. Dr. Chandler has undertaken the rigid discussion of all available data, and will bring the calculation down to the 1900 opposition, so that the observations then to be made will be under the best knowledge of the theory of the planet's motion.

This research has justified the policy of Professor Pickering in having the whole sky photographed at frequent intervals. That the plates thus accumulating contain a vast amount of material which the future needs of astronomy will utilize is quite evident. That many new facts can be obtained from their examination is shown by the discovery during the search for the planet Eros of two variables and two stars which are not in the Durchmusterung catalogue, besides observations of asteroids previously discovered.

WINSLOW UPTON.

BROWN UNIVERSITY, January 27, 1899.

NOTES ON PHYSICS.

SOME RECENT INVESTIGATIONS UPON THE BECQUEREL RAYS.

RUTHERFORD (*Phil. Mag.*, Jan., 1899), in an important and interesting paper, shows experimentally that in a mass of gas exposed to the radiation from uranium, thorium or their compounds the following statements hold good:

1. Charged carriers produced through the volume of gas.

2. Ionization proportional to the intensity of the radiation and the pressure.

3. Absorption of the radiation proportional to pressure.

4. Existence of a saturation current; *i. e.*, a current passing through the ionized gas, whose magnitude is such that all of the carriers produced by the radiation reach the electrodes.

5. Rate of combination of the ions proportional to the square of the number present.

6. Partial separation of positive and negative ions.

7. Disturbance of potential gradient under certain conditions between two plates exposed to the radiation.

It is also shown that the radiation given off by both uranium and thorium is complex, consisting of two varieties which the author calls α and β respectively; β being the one of greater penetrative power, whiie α is the one chiefly instrumental in causing ionization in gases. The intensity of the α radiation seems to depend chiefly upon the amount of surface of the uranium, while the β radiation depends upon the thickness of the layer.

In *Wied. Ann.*, No. 12, for 1898, Elster and Geitel give an account of a research undertaken by them to test the validity of two suppositions which have been made as to the cause of the Becquerel rays. Madame Curie (*Comptes Rendus*, CXVI., p. 1101) has suggested that the continuous radiation from uranium, thorium and their compounds may be explained by supposing all space to be filled with a sort of modified Röntgen radiation which possesses the power