increased attention and care. M. Wurtz having resumed his seat, M. Dumas presented a letter from Mr. Crookes, in which he summarises his theories of radiant matter, and submits them for discussion before the French Academy. After having explained the Crookesian view of the fourth state of matter, M. Dumas added that he felt confident these assumptions would be the occasion of discussions of the same character as that which the Academy had just witnessed.

PHYSICAL NOTES

HERR DORN of Breslau has published a fresh series of experiments on the propagation of electricity by current water in tubes, and allied phenomena (*Wied. Ann.*, Nos. 4 and 5). In agreement with Helmholtz's theory, he finds the electromotive force from current water in capillary tubes independent of the cross section and the length of these. The value of the "electric moment" of water and glass (3·936 Daniell) deduced from this electromotive force corresponds nearly to that deduced by Helmholtz from Quincke's observations on the propagation of water in glass tubes by the electric current. Observations of the electric current produced by water flowing in capillary tubes lead to a somewhat smaller value. For wider tubes (within pretty wide limits) the current strength, with a given mean velocity of the streaming water, proves empirically to be nearly proportional to the radius of the tube. Traces of a sliding of the water on the glass-wall may perhaps co-operate in producing the variations of electromotive force observed in course of time. Through motion of material particles in a liquid, therefore, an electric current arises.

THE diffusion of salts in aqueous solution has been investigated by Herr Long (*Wied. Ann.*, No. 4), by a method similar in principle to that of Schuhmeister (though different in detail), viz., making a continuous water-current flow over the salt solution and measuring the amount of diffusion by the quantities of salt that pass over in given times. Various interesting relations were found, *e.g.*, the chlorides, bromides, and iodides of the alkali metals form a series, in which NH_4 stands between K (the higher) and Na; and KCl, KBr, KI, and KCy have nearly the same velocity of diffusion. Such is the case also with the corresponding NH_4 and Na salts and with the chlorides of the bivalent metals Ba, Sr, Ca, and Mg, the nitrates, and the sulphates. It seems generally that those salts which diffuse most quickly also conduct best in aqueous solution. Salts with large molecular weight and volume seem to diffuse most easily, while among the waterless salts those which absorb most heat in dissolving or (the same thing) whose molecules, through the work done, finally reach the finest state of division, have the greatest velocity of diffusion. The chlorides of the alkalies stand in the same series with regard to molecular volumes, velocities of diffusion, conductivity, and absorption of heat. This is the case, too, with the corresponding bromides and iodides. Cyanide of potassium behaves as to diffusion and conductivity exactly like the chloride, bromide, and iodide of the metal. In the second group (nitrates) the order is the same as to conductivity and diffusion; but with regard to molecular volumes and heat-absorption the salts form a special series. In the group of sulphates the individual salts have the same order as to diffusion and conductivity, but the values for molecular volume and heat of solution are quite irregular; indeed as regards velocity of diffusion and absorption of heat the waterless salts seem to stand in inverse order. These results are fully discussed by Herr Long.

A CURIOUS physical phenomenon has been lately described by Dr. Grassi (*Reale Ist. Lomb. Rend.*, f. viii. and ix.). An apparatus is formed of three concentric vessels with an annular space of about two centimetres between the first and the second, and the second and the third. The outer space is filled with oil, the next with water. The oil is heated by a gas furnace to a little over 100°, and the water boils. Then hot oil, at *e.g.*, 150° is poured into the central space. This quickly cools to a temperature close on 100°. Dr. Grassi found that the central oil cooled more rapidly the higher the temperature of the outer oil; and with more delicate apparatus (in which the vaporised water was conducted and returned, and the outer oil kept at any required constant temperature) he arrived at definite numerical results, which he tabulates. With the outer oil at a mean temperature of 129°·9, *e.g.*, the time of cooling of the inner oil from 130° to 110° was 49s.; when the former was 105°·1, the latter was 57s. Alcohol and ether gave more decided results. The maximum difference was got with ether; the outer oil being at 57°·5°, the inner took 25s. to cool from 57° to 50° (7 degrees); whereas the former being 39°·3°, the latter became 39°·5s. In all the experiments the cooling of the inner oil commenced at a temperature little above the maximum of the external oil. When the outer oil is at a higher temperature, at a certain point the heat begins to prevail which is transmitted directly from the outer to the inner oil. An analogous phenomenon (to which Dr. Grassi refers) was that of some members of the Accademia del Cimento, who found that water in a vessel surrounded by ice cools more rapidly if the ice be heated to accelerate fusion.

DR. J. PULUJ lately communicated a paper to the Scientific Club of Vienna on "Radiant Electrode-matter," in which he traverses the researches of Crookes, Hittorf, Goldstein, and others upon the phenomena of electric discharges in high vacua. He maintains at the outset that the discharges of "radiant matter" observed by Crookes at the negative pole are not residual gas at all, but are particles of metal torn off from the surface of the pole. He thinks this proved by the mirror-like deposits of metal that are formed on objects interposed in the path of the discharge. That aluminium in this way forms no mirror is a difficulty in the way of this theory; but Dr. Puluj gets over this by remarking that the cause of this lies in the chemical constitution of the metal, and that the particles of an aluminium electrode fly round so far that they deposit themselves on the electrode! All the magnetic effects of these discharges Dr. Puluj regards as explainable by ordinary electro-magnetic laws, assuming that a stream of electrified matter acts as an electric current; but he apparently is not acquainted with the theory put forward by Maxwell on this point. Dr. Puluj has also constructed what he calls an *electrode-lamp*, which gives a bright light when worked by an induction-coil capable of affording a spark of 10 cm. length. In this lamp the radiant discharges of electrode-matter are concentrated upon a piece of carbon which glows with a white heat, but remains unchanged and unconsumed.

DR. CUSCO, ophthalmic surgeon in one of the hospitals of Paris, has invented a lens of variable focus, in which the pressure of a column of water or other transparent liquid is made to alter the curvature of the flat faces of a cylindrical cell of brass closed with thin glass disks. The pressure can be regulated by a manometer gauge to any required degree within the limits of working. It is said that the lens gives a sharp, well-defined focus. It is constructed for Dr. Cusco by M. Laurent.

M. HENRI BECQUEREL continues his researches on the magneto-optic properties of gases. He has recently examined the gases oxygen, nitrogen, carbonic dioxide, nitrous oxide, and olefiant gas, and finds that, except in the case of oxygen, the magnetic rotation of the plane of polarisation due to a field of given intensity varies inversely as the square of the wave-length of the ray, as is the case with solids and liquids. In an older research of Becquerel's it was shown that for non-magnetic solids and liquids the rotation R was proportional to a function of the refractive index n, very nearly represented by the expression $n^2(n^2-1)$; or, in other words, the quantity $\frac{R}{n^2(n^2-1)} = c$. For all non-magnetic solids and liquids the value of c lay between 0·26 and 0·59. In the case of gases in which the rotation is but a ten-thousandth part of that of most solids or liquids the same result holds good, and the values of c for gases fall between 0·26 and 0·59. The above law, that the magnetic rotation is *inversely* proportional to the square of the wave-length, implies that violet rays are more rotated than the red; or, in other words, that there is a positive dispersion. In the case of oxygen it is found that the red rays are rotated more than the green, affording an inverse or *negative* dispersion. This is the more curious as oxygen gives a positive rotation as if it were a diamagnetic body. In fact, Becquerel remarks, oxygen behaves as if it were a mixture of a magnetic and a diamagnetic body, the magnetic having small negative rotation and great negative dispersion, the diamagnetic having great positive rotation and small positive dispersion.

GEOGRAPHICAL NOTES

IN a private letter addressed to Herr von Hesse-Wartegg, the well-known explorer, Dr. Nachtigall, writes from Berlin:—"The German African Society (Deutsche Afrikanische Gesellschaft) has at the present moment not less than six different expeditions travelling through Central Africa. The large funds necessary for the outfitting of these numerous travellers are raised partly