humidity, and wind in his discussion. He finds that the change in the loss by evaporation under different conditions is proportional to the product of the absolute temperature and the absolute dryness or saturation deficit, and he makes the interesting suggestion that sufficient observational results should be obtained to give normal values for the constants for different sexes, races, &c. Incidentally the paper emphasises the importance of the wet-bulb temperatures as a climatic factor, especially in tropical or semi-tropical regions. It may be noted that experiments on the effect of different meteorological conditions on the human body are being conducted by Dr. J. R. Milne at Edinburgh, a preliminary account being given in the recently issued Journal of the Scottish Meteorological Society.

THE Meteorological Institute of the Netherlands has issued copies of thirteen of the principal magnetic disturbances of the year 1911, as recorded at de Bilt, and the director of the institute, Prof. van Everdingen, intimates that in future it is intended to publish each year copies of the chief disturbances, as indicated on the international lists compiled under his auspices. The time scale adopted is 15 mm. to the hour, and the curves—declination, horizontal force, and vertical force—are very clearly reproduced.

WE have received a copy of an address delivered by Dr. Wolfgang Ostwald before the eighty-fourth Versammlung Deutscher Naturforscher on "Die neuere Entwicklung der Kolloidchemie" (pp. 23, T. Steinkopf, Dresden, price 1 mark). Colloid-chemistry is a branch of science which has made striking progress during the past few years, and has now not only a distinct terminology of its own, but a journal, the *Kolloid-Zeitschrift*, to chronicle its advances. The brief review given by Dr. Ostwald of recent development of the science should prove of interest to many workers in the numerous fields of science and industry in which a knowledge of colloids is of importance.

WE have received a copy of the *Compte Rendu* of the Geneva Physical and Natural History Society for the year 1912. The society has sixty-eight ordinary and forty-two honorary members, and admits twenty-eight associates free. The *Compte Rendu* extends to more than eighty pages, and contains articles on physics, chemistry, botany, geology, and zoology of considerable interest. Amongst the most important of these articles are Prof. Guye's on the internal friction of metals at high and at low temperatures, and M. Tommasina's surveys of Ritz's theories of the æther and of gravitation.

THE June number of *Terrestrial Magnetism and Atmospheric Electricity* contains a list of the determinations of declination made on the magnetic survey ship *Carnegie* during its voyage across the Pacific from Tahiti, Society Islands, to Chile, and thence *viâ* Cape Horn to the Falkland Islands. Comparisons are made between the values obtained and those given on the United States, the German, and the British charts. So far as the latter is concerned, the corrections to be applied to the charted values are in most cases less than one degree, but exceed that amount at nine points off the coast of Chile and Patagonia, where the chart shows the easterly declination too small.

IN a paper recently published in the Bulletin of the Imperial Academy of Sciences of St. Petersburg, Prof. P. Walden brings forward additional evidence in favour of the view that the degree of dissociation of a given solute is independent of the nature of the solvent if each solution is at the saturation point. This was demonstrated previously for tetramethylammonium iodide, $N(C_2H_5)_4I$, in fourteen solvents, but is now shown to be true for tetramethylammonium iodide, $N(CH_3)_4I$, in ten solvents ($\alpha=0{\cdot}666$), for tetrapropylammonium iodide, $N(C_3H_7)_4I$, in five solvents ($\alpha=0{\cdot}26$), and, finally, for potassium iodide, KI, in three solvents ($\alpha=0{\cdot}423$).

IN the May issue of the Chemical Society's Journal Dr. Scott describes some new methods for the preparation of pure bromine. The first method depends on getting rid of iodate and iodide by boiling potassium bromide with a little potassium metabisulphite and sulphuric acid, then twice adding saturated bromine water and distilling off the bromine, and finally neutralising with potassium carbonate and evaporating to dryness. The bromide was then fused with potassium dichromate in quantity insufficient to decompose any chloride that might be present; the fused mass was decomposed by sulphuric acid with the addition of a little permanganate to decompose organic matter. A quantity of 3250 grams of pure bromine was prepared in this way, together with an additional 185 grams, which should contain all the chlorine, but this was found to amount only to 4 or 5 milligrams. The halogen impurities were separated by extracting the bromine with caustic soda; this appears to provide a very simple and a most effective way of purifying bromine, the chlorine being removed as chloride, and the iodine as iodate. By this method the whole of these halogens can be removed from 10 c.c. of bromine by extracting once with 5 c.c. of normal sodium hydroxide.

OUR ASTRONOMICAL COLUMN.

OBSERVATORIES AND CITIES.—Modern astronomical research work, which necessitates the long exposure of photographic plates and the observation of faint stars, is gradually separating old observatories from their historic surroundings and creating new buildings in more favourable situations. The Hamburg Observatory is now settled in its new site in Bergedorf, some distance away from the city, and the new ground is bristling with domes of the latest construction. Berlin Observatory is now on the move, taking up its new position in Neu Babelsberg, not very far from its astrophysical *confrère* at Potsdam. At the present time the question is being considered as to the removal or part removal of the Paris Observatory, as the conditions on the site now occupied are not conducive to the best observational work. Those unfamiliar with the present locality can obtain a good idea of it in relation to Paris from the excellent reproduction of a photograph by M. Baillaud which is given in the current number of *The Observatory* (June, No. 462).

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NEPTUNE'S FAINT EQUATORIAL BELTS.—Dr. T. J. J. See publishes in the *Astronomische Nachrichten*, No. 4656, a paper describing some observations he made on the planet Neptune in 1899 and 1900, with the 26-in. refractor of the Naval Observatory at Washington. On some days in those years the air was particularly steady and the mottled appearance of the disc of the planet accidentally attracted his attention. This led him more closely to scrutinise the disc, and he noticed that beaded bands or belts were faintly visible against the brighter body of the planet. The seeing on these occasions was such that 95 Ceti, the most difficult of known double stars, was resolved, and other difficult pairs, such as 85 Pegasi and T Cygni, measured. The bands, he says, were found to be extremely faint, but on a few occasions they came out with more distinctness, and he attaches drawings from which their general character can be inferred. Dr. See refers to Prof. Asaph Hall's observations with the same instrument, which gave the suggestion of suspected mottlings on the planet's surface, and to Prof. S. J. Brown, who noticed an unsymmetrical appearance on the disc. As Dr. See points out, the chief interest attaching to the discovery of these equatorial belts arises from the circumstance that phenomena depending on planetary rotation first noticed on Jupiter, and then on Saturn, and finally on Uranus, are now seen to be common to the most remote member of the solar system. The paper concludes with a brief notice of the discovery of belts on the other major planets.

VARIABLE STARS.—Numerous recent papers deal with the subject of variable stars. Prof. A. A. Nijland, of Utrecht, sends a pamphlet on the light curves of twenty-three Algol stars, and the classification of variables. Two papers in the *Astronomische Nachrichten* (No. 4653, vol. cxciv.) deal respectively with the ellipsoidal variables SI Tauri and S Antliæ, by Harlow Shapley, and the variability of the pole star by Ant. Pannekoek.

Photometric observations of variables is the subject of Padova's communication to the *Mem. della Soc. dei Spettroscopisti Italiani* (April, disp 4*a*, vol. ii., ser. 2*a*), and he deals with two Algol variables, U Ophiuchi and RZ Cassiopeiæ; two variables of short period, Y Ophiuchi and β Lyræ; five long-period variables, and two irregular variables, RS Cygni and R Scuti. Light curves accompany the observations in most cases. Harlow Shapley contributes a paper on the visual and photographic ranges and the provisional orbits of Y Piscium and RR Draconis to the April number of *The Astrophysical Journal*, while the same journal also contains a second paper by Frederick H. Seares on the Algol variable RR Draconis. Prof. E. C. Pickering refers in Circular 177 of the Harvard College Observatory to the maximum brightness of Algol variables.

KODAIKANAL SOLAR PROMINENCES DURING 1912.—Bulletins Nos. 29 and 30 of the Kodaikanal Observatory contain a summary of prominence observations made at that observatory during the past year. Previously it was customary to publish detailed lists of prominences, such as those which appeared in the series of bulletins ending with No. 28, but these will now be discontinued and replaced by a *résumé* of the observations issued half-yearly. This *résumé* will include full descriptions of any remarkable phenomena observed or photographed, and, in addition to the summary of the observations at the sun's limb, there will be given the results of a study of the prominences projected on the disc as hydrogen absorption markings. The present two bulletins are written on these lines, and they contain the summarised material for 1912.

THE ALLOTROPY OF IRON.

TWO papers read before the recent meeting of the Iron and Steel Institute, one by Dr. Carpenter on the critical ranges of pure iron, and the other by Dr. Rosenhain and Mr. Humfrey on the tenacity, deformation, and fracture of soft steel at high temperatures, were responsible for a renewal of the discussion upon the allotropic modifications of iron. The present discussion may be regarded as a further contribution to an old controversy, and in order to appreciate its true significance it is necessary to review, somewhat in the manner of a serial story, the incidents of the preceding chapters.

In 1890 Osmond showed that when a piece of steel was allowed to cool from a bright red heat the rate of cooling was not uniform, but that at three points there was an evolution of heat in the steel itself which had the effect of retarding the fall in temperature of the mass. These three arrests Osmond designated as A1, A2, and A3, A1 representing the change taking place at the lowest temperature. In order to distinguish between the evolutions of heat during cooling and the corresponding absorptions of heat during heating, the letters *r* (*refroidissement*) and *c* (*chauffage*) were added, and this nomenclature has been retained, the irregularities in the cooling curve being described as Ar1, Ar2, and Ar3, and those in the heating curve Ac1, Ac2, and Ac3.

It was clearly shown by Osmond that the A1 change was dependent upon the carbon in the steel, whereas the points A2 and A3 were independent of the carbon and equally prominent in the purest steel obtainable. Osmond therefore argued that the thermal changes at A2 and A3 must be due to molecular rearrangement or allotropy in the iron. Iron above the A3 point he described as γ iron, that between the A3 and A2 points β iron, and below the A2 point α iron.

Roberts Austen repeated and confirmed Osmond's experimental work, and accepted his theory of allotropy as being the most probable explanation of the facts. Prof. Arnold, on the other hand, rejected the allotropic theory on the ground that "steel research was, in his opinion, a field of too national an importance to be used lightly as a cantering ground for the hobbies of periodicity and allotropy." After repeating and confirming the work of Osmond and Roberts Austen, Prof. Arnold suggested that the A3 point was due to the influence of hydrogen, and the A2 point to a change from a plastic to a crystalline condition. He contended that these changes had little connection with the phenomena underlying the hardening of steel, but that these were due solely to the carbon, and at a later date he developed a subcarbide theory to explain the changes brought about by hardening, &c. Further investigations, however, by independent metallurgists, tended to confirm Osmond's original views, and within the last few years little has been heard of the controversy between the "carbonists" and the "allotropists."

The two papers which have been responsible for the reopening of the discussion may be briefly summarised as follows:—Prof. Carpenter, following a hypothesis of Benedicks, endeavours to prove that the change at Ar2 is not an independent change, but merely the tail end, or limit of supercooling due to impurities, of Ar3. It may be mentioned that this was Osmond's original explanation, which he abandoned when it was proved that the appearance of magnetism coincided exactly with the point Ar2. Prof. Carpenter argues that if Benedicks's theory is correct pure iron should show the Ar2 change but not the Ac2 change, and he gives a number of heating and cooling curves of the purest iron obtainable in

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