He reviews the more important results obtained since the publication of Zeeman's monograph upon the subject in 1912. Amongst the improvements in technique have been the introduction of the Wehnelt cathode lamp devised by Dr. Mohammad himself, the use of crossed spectra from two pieces of apparatus of high resolving power, and the construction of more powerful electromagnets. Nagaoka and Takamine have taken up the study of the Zeeman effect in the ultra-violet region, whilst Croze has extended his observations into the infra-red so far as the photographic methods allow. The effect of a magnetic field on the satellites of complex lines is likely to give a clue as to the mechanism of radiation and the production of spectrum lines. The study of the magnetic resolution of band spectra has attracted much attention. There is now no doubt of the fact that some band spectra show the Zeeman effect, but opinion is divided as to the existence of the effect in other cases. Certain dissymmetries have been observed both in the place and in the position of components, and several complicated types of magnetic resolution have been noticed. Anomalies of a different kind have been found in which the lines of a very close doublet or triplet series appear to influence each other in a peculiar manner. On the theoretical side Voigt has modified and extended the theory of Lorentz, introducing into the equations terms expressing a resistance, a quasi-elastic force, and allowing for the coupling of the electrons. It is to be noted that when the quantum hypothesis, as represented by Bohr's equations, is assumed, there is no place left for the quasi-elastic oscillating electrons which have been used in all theories for the explanation of the Zeeman effect from Lorentz to Voigt.

Now that our rations of food, particularly of meat and wheaten bread, have been so appreciably reduced the necessity of arranging our diet so as to ensure a sufficient supply of those elusive substances, the so-called "vitamines," is more important than ever. It is known that these substances exist in certain foods, and that an adequate supply of them is necessary to health, but they have not yet been isolated in a pure condition, although several workers claim to have done so successfully. As a result of some recent work, McCollum and Davis concluded that two distinct types of vitamine exist, the "fat-soluble A" and the "water-soluble B." In the *Biochemical Journal* for December Mr. J. C. Drummond describes yet another attempt to isolate the latter type of accessory substance. Unfortunately the attempt failed, but several interesting observations were made. In Mr. Drummond's experiments pure-bred rats were fed on a basal artificial diet containing all the necessary constituents except the water-soluble, growth-promoting accessory substance, and also on the same diet together with marmite which had been treated in various ways. From the variation of the live weight of the rats the presence or absence of the "water-soluble B" in the treated marmite is inferred. In this way it is established that the water-soluble accessory substance is (1) soluble in 70 per cent. alcohol, but insoluble in absolute alcohol; (2) dialysable through parchment paper; (3) injured by heating at 120°, but very little affected at 100°; (4) largely destroyed by prolonged boiling with 20 per cent. sulphuric acid, but not with 1 per cent. hydrochloric acid; and (5) much damaged by digestion with hot 5 per cent. sodium hydroxide, but very little affected by the same solution cold. Water solutions containing the active substance give voluminous precipitates with phosphotungstic acid, basic lead acetate, and silver nitrate, but the solutions recovered from these precipitates by the customary methods have little activity. The author attributes this fact to loss of the substance by adsorption rather than to its actual destruction. The results support the view that the so-called "antineuritic vitamine" is identical with the "water-soluble B."

MR. F. EDWARDS, 83 High Street, Marylebone, has just published a catalogue (No. 381) of books on British and foreign birds. It contains some 642 titles. Some of the books are scarce. Two sets of the *Ibis* (1859–1915) are offered for sale.

MESSRS. GAUTHIER-VILLARS ET CIE (Paris) announce the following science books:—Œuvres de Henri Poincaré publiées sous les auspices du Ministère de l'Instruction publique par G. Darboux, tome i.; Œuvres de G. H. Halphen publiées par les soins de C. Jordan, H. Poincaré, E. Picard, avec la collaboration de E. Vessiot, quatre vols., tomes ii., iii., et iv.; Cours de Géométrie pure et appliquée de l'Ecole Polytechnique, Prof. M. d'Ocagne, tome ii., Cinématique appliquée, Stéréotomie, Statique graphique, Calcul graphique, Calcul grapho-mécanique, Nomographie.

OUR ASTRONOMICAL COLUMN.

THE PLANET MARS.—This planet came to opposition with the sun on the morning of March 15. On that date Mars was about sixty-one million miles distant from the earth, and had an apparent diameter of a little more than fourteen seconds of arc. The planet is now situated in Leo, on the eastern border, and moving to the W.N.W.

The present opposition of the planet is by no means a favourable one for the study of his surface markings. It is curious, however, that some excellent views of the markings have been obtained on occasions when the disc was comparatively small, and when little success in this direction was expected. The fact is that certain lineaments on Mars, such as the Syrtis Major, the Mare Sirenum, Cimmerium, and Acidalium, are so conspicuously dark and large that a very small telescope is sufficient to show them, and they may be viewed even when the conditions are not altogether favourable.

Perhaps the features on Mars are, however, scarcely so easily discerned as those on Jupiter, owing to the expansive disc of the latter object. But the study of Martian markings is more interesting from the fact that they represent objects existing on its actual surface, while Jovian details are merely temporary, outside formations of atmospheric character.

The double canals on Mars are now justly regarded as one of the observational romances of astronomy. The single canals have even been assailed as non-existent, but there is no question whatever that a series of linear formations is scattered over the equatorial and south-equatorial regions of the disc. Scepticism was aroused by the hard, dark, and straight lines by which some observers erroneously represented the delicate streaks of shading which really diversify the planet's surface, and certainly look nothing like water channels to an unimaginative observer.

It is to be hoped that the renewed study of the topography of Mars will be successfully made at this opposition, and the revised rotation period of 24h. 37m. 22·57s. tested by fresh data.

WOLF'S NOVA.—Besides the interesting planet found in January, Prof. Wolf also discovered a Nova in Monoceros. The Harvard plates have enabled its previous history to be traced. It was fainter than 9·8 mag. on December 22, rising to 5·4 by January 1 (being thus the brightest Nova since 1912). It declined rapidly, reaching mag. 8·9 on February 4, 9·0 on February 17, 9·1 on February 22. It is 10° north and 2° west of Sirius, and, like most Novæ, lies within the Galactic Zone.

Dr. Mundler gives the position for 1918·0 as R.A. 7h. 22m. 47·00s., S. declination 6° 30′ 34·7″.

A Potsdam spectrograph taken on February 18 shows the typical Nova-spectrum in the stage of decline; broad bright hydrogen bands on a somewhat faint continuous background that could be traced far into the ultra-violet; groups of lines were seen at λ 464, and a trace of the green nebula line.

THE MINOR PLANETS.—In 1866, when only eighty-eight asteroids were known, Prof. Kirkwood detected gaps in their distribution, at points corresponding with commensurability with Jupiter's motion. Prof. Hiravama (in Proc. Tokyo Math.-Phys. Soc., 2nd series, vol. ix., 11) re-examines the question with nearly 900 orbits available. The gaps at the ratios 2/1, 7/3, 5/2, 8/3, 3/1 are still very striking, and some others are probably indicated. Prof. Hirayama makes the interesting remark that for values of the daily motion smaller than 500″ the asteroids seek, instead of avoiding, the points of commensurability; thus the four Trojan planets have the ratio 1/1, one planet has 4/3, and six have 3/2. These cases are shown to correspond with librations of a stable character, while the gaps mentioned above correspond with unstable motion. It would probably have been better to omit all asteroids observed at one opposition only, as the elements of their orbits are subject to considerable uncertainty. The new planet DB (daily motion 881″) lies fairly close to the 3/1 point, so its perturbations by Jupiter will be interesting.

As the war has severed relations with the Berlin Rechen-Institut, formerly the centre for discussion and distribution of minor planet information, an independent bureau has been opened at Marseilles Observatory, whence numerous circulars relating to orbits and observations have been sent to us. One of the ephemerides is that of Deianira, which has been observed at only three oppositions since its discovery. Its position on March 22 is R.A. 12h. 19·3m., N. declination 18° 26′, magnitude 13·1.

THE ROTATION OF THE EARTH.

THE *Revue générale des Sciences* of January 30 contains a full abstract of a very interesting paper by D. Korda in *Archives des Sc. Phys. et Nat.* (Geneva) of November 15 last. It appears that Baron Eötvös, in examining the records of gravitation made at sea, found certain anomalies which he traced to the speed and course of the ship. The weight of a thing on the surface of the earth is less than that due to the attraction of the earth by an amount equal to the centrifugal force, which at the equator amounts to $g/288$, and which, resolved in a vertical direction, varies as the square of the cosine of the latitude. Any variation in the centrifugal force therefore affects the weight to this reduced extent. The velocity at the surface of the earth may be 46,500 cm./sec., while that of a ship in the water may be 1000 cm./sec., so that the motion of the ship round the axis of the earth may vary between 47,500 and 45,500 cm./sec. at the equator. Centrifugal force varies as the square of the velocity, so, calling V and v the velocities of the earth's surface and of the ship in the water, the centrifugal force on a body in the ship may vary between $(V-v)^2$ and $(V+v)^2$ —that is, through a range of $4Vv$ depending on the course. While v may be relatively small, the large factor V may, and does, at times make the product so great as to introduce an error in the apparent gravity as determined on board ship. For example, in the case supposed, which corresponds with a speed of 19·4 knots and at the equator, the difference in weight as shown by a spring balance going east with the earth and west against the earth would be as much as 1/3355, or more than two grains per pound—quite a serious amount in a gravitational survey.

But it is here that the ingenuity, daring, and experimental skill so typical of Eötvös comes in. Not content with finding serious disturbances in weight resulting from velocities of 1000 cm./sec., he conceived the idea of setting up in the laboratory a small delicate balance on a rotating vertical axis with the accurately balanced masses moving at a speed of about 1 cm./sec., with the view of observing the disturbance of the balance. At the equator with such a speed the two masses would alternately seem the heavier by 1/3,355,000 of themselves, whereas at his laboratory at Budapest, which is very nearly at latitude 45°, the difference would be one-half of this—not a very large amount to play with—but Eötvös was able to make manifest the minute change by employing synchronism and the principle of resonance, and so obtaining the large magnification which is possible with a very small degree of damping.

Unfortunately, the published account is most tantalising; for beyond saying that the period employed was about a minute, that the maximum oscillation could be read in an hour, and that the balance was small, not one of the details which would assist in repeating the experiment is given—length of beam, load at each end, decrement, and stability are alike left undefined. The mode of observation, however, is described. A horizontal mirror is carried by the beam so that a vertical ray of light may be reflected up by it. When an experiment is to be made the beam is arrested and the reflected ray of light traces a small circle upon a screen. When the beam is liberated the two ends, alternately becoming the heavier, set up an increasing oscillation made evident by the departure from the original circle, which settles down to an amount determined by the equation:

$$\text{Maximum amplitude} = 2\Omega \cos \phi \frac{K}{k},$$

where Ω is the angular speed of the earth, ϕ the latitude, K the moment of inertia of the balance, and k its coefficient of damping. This formula quoted by the author is remarkable in that almost every feature of the apparatus and of the earth is eliminated.

The present writer, desiring to verify the formula, obtained a different result, and then, testing both formulæ dimensionally, found the formula at which he had arrived dimensionally correct, while that given above is not. He thinks, therefore, that it is desirable to state very shortly the facts as he understands them. The balance is supposed to be rotated accurately at the speed of true synchronism, taking into account the effect of centrifugal stability discussed in the next two paragraphs. In these conditions, treating the vibrations as the projection of a logarithmic spiral, and using the hodograph as given by Tait and explained more clearly in Clerk Maxwell's "Electricity and Magnetism," vol. ii. [731], the radius A of the spiral grows until the resistance proportional to the velocity is equal to the maximum deflecting moment due to the action of $4Vv$. The value of A, then, is the maximum value, and the spiral has become a circle. When this is reached the actual resistance couple will be found to be $\frac{8\pi A k K}{T^2}$, and this must be equal to the couple $\frac{8\pi K \Omega}{T} \cos^2 \phi$, due to the $4Vv$ action described. From this it follows that

$$A = \Omega \cos^2 \phi \frac{T}{k},$$

where T is the time of a complete rotation of the balance and k is the logarithmic decrement. This A is the angular deviation from the mean position, so if by A is meant the complete amplitude, the expression must be multiplied by 2. It will be noticed