Meteors.

The following showers occur in February. They are not very brilliant showers :—

	R. A.	Dec.	Character.
February 5th—10th	... 75°	+41°	Slow, bright.
,, *15th*	... 236°	+11°	Swift, streaks.
,, ,,	... 261°	+4°	,, ,,
,, *20th*	... 181°	+34°	Swift, bright.
,, ,,	... 263°	+36°	Swift, streaks.

Planets.

Venus—Is a morning star. On February 15th at 8 P.M. its position will be R. A. 19 hrs. 26 mts. 59 secs., Dec. 21° 20′ 20″ S. Time of its rising will be 4 hrs. 3 mts. A.M. on the 16th February.

Saturn.—The position of the planet on 15th February at 8 P.M. will be R. A. 2 hrs. 49 mts. 32 secs., Dec. 14° 1′ 15″ N. The time of its setting will be 11 hrs. 12 mts. P.M. on the 15th February.

Mars.—The position of the planet on 15th February at 8 P.M. will be R. A. 4 hrs. 13 mts. 44 secs., Dec. 23° 25′ 48″ N. The time of its setting will be 0 hr. 55 mts. A.M. on the 16th February.

Jupiter.—The position of the planet on 15th February at 8 P.M. will be R. A. 16 hrs. 43 mts. 39 secs., Dec. 21° 31′ 10″ S. The time of its rising will be 1 hr. 13 mts. A.M. on 16th February.

Extracts from Publications.

The Nebular Hypothesis assumes that long, long ago, perhaps hundreds of millions or thousands of billions of years ago, all suns were either simultaneously or successively in a nebulous state ; that the nebulous matter of which they were originally formed was widely and quite uniformly scattered throughout space, but later began to gravitate toward certain slightly denser centres. The particles or masses moving toward these centres not doing so with equal velocities and momentum, or in the same direction, a slight rotation on an axis would result in the nebulous mass ; and, if by radiation of heat, the partially con-

tracted nebula or primitive sun still further contracted, his rotary velocity would have to continue to increase by reason of a mechanical law which we shall hereafter elucidate; and as soon as the rotation had increased so much that the centrifugal force of the outer equatorial border overcame that of gravity, a ring or belt would be shed or left behind from the equatorial region of this rapidly rotating nebulous sun.

This revolving ring, in obedience to well-known mechanical laws, must form itself into a spherical planet, rotating on its axis with ever-increasing rotary velocity; so that eventually a ring would also be shed from this large, newly-born, highly-heated, gaseous planet from which, in like manner, a moon or satellite was formed. As the contraction and consequent increasing rotary velocity of the sun and planets thus continued, ring after ring was, at long intervals, shed from which all the planets and moons of our solar system slowly evolved themselves to their present form and function, and this same evolution is still as ever going on. The solar system is slightly different to-day than it was yesterday, and will be different to-morrow than it is to-day.

Briefly stated, these are the fundamental doctrines advanced by the Nebular Hypothesis in respect to the gradual evolution of our solar system; and it is highly probable that every fixed star is an enormous central sun rotating on its axis and evolving by the same mechanical laws a solar system similar to our own.

In the two last topics in this series of articles, the writer will enumerate some of the strongest proofs in favour of the Nebular Hypothesis, and will also answer the principal objections that have so far been urged against it. I will here say merely that I am in full accord with the late Professor S. Newcomb's announcement "that the Nebular Hypothesis is indicated by the general tendency of the law of nature, and that it has not been proved inconsistent with any fact."

[*Popular Astronomy, Vol. XIX, No. 10.*

Encke's Comet.—The following circumstances related by Dr. Backlund, in a recent number of the Ast. Nach. (4539), are mentioned here for reasons which will be obvious. There were two points about the appearance of Encke's Comet last summer, which were remarkable: First, the object was brighter than it was expected to be; and, secondly, the observed places differed from the computed ephemeris by comparatively large quantities. When a sufficient number of these residuals had accumulated from observations made at Algiers, Johannesburg, and the Cape, Mr. Crommelin, with

his usual acumen, inferred that they would not have existed if a different value of the eccentricity had been used in computing the ephemeris, and wrote to Dr. Backlund suggesting an error of 10′ in this element. Dr. Backlund, on examining his work, found that there was a misprint in a certain publication of the elements, and that he had used an incorrect value of the eccentricity. The ephemeris being corrected in this sense, the residuals are no larger than would be expected, and Dr. Backlund says that the observations support his previously expressed views as to the mass of Mercury, and that the acceleration of the mean motion suffered a diminution in 1904.

[*The Observatory.*

Revd. A. L. Cortie (being called upon to give an account of his mission to observe the solar eclipse). The Vavan group of the Tonga Islands consists of one larger island, Vavan, some 9½ miles long in the east and west direction and 6¾ miles broad from north to south, and numerous smaller islands extending in the north-north-east and opposite direction over some 18 miles, with an extreme breadth of 19 miles. Vavan, the principal island of the group, is situated in latitude 18° 37′ S. and longitude 174° E., and was the station selected by the Joint Permanent Eclipse Committee for the Government Eclipse Expedition to view the total solar eclipse of April 28 last. The Admiralty detailed H. M. S. *Encounter* to assist in the eclipse operations, and every possible help was rendered to the expedition by Captain Colomb, his officers and crew. Accompanied by my assistant, Mr. McKeon, I left Stonyhurst on January 30, and sailed from Tilbury by the R. M. S. *Otway* on February 3, arriving at Sydney on March 16; Dr. Lockyer and Mr. McClean sailed in the steamer. The two Government expeditions left Sydney on the *Encounter* on March 25, and arrived at Vavan on Sunday, April 2. Although it is preferable that different parties of observers should separate as far apart as possible, in the present instance, the force of circumstances compelled the two parties to coalesce and to erect their instruments on the same site. The site chosen was the Admiralty coaling ground at the extreme south end of the Vavan harbour, latitude 18° 41′ S. and longitude 173° 59′ E. The harbour runs approximately north and south, and M. Stefanik occupied a position about one mile removed from our site in a northerly direction, at the Catholic Mission Reserve, the Australian Government party, under Mr. Baracchi, a position some half-mile yet further north on the recreation-ground of the chief village Neiafu, and Mr. Worthington's party a position some quarter of a mile still further north. On the day of the eclipse the weather condi-

tions, which were bad at our station, became better and better at these places in the order named, while the S. S. *Boverie* lying in the harbour not two miles away, had an almost perfect view of the eclipse. A clearing of the dense brushwood on the selected site, and of half a dozen cocoanut trees, was effected and the instruments were landed during the first few days after our arrival. Luckily the weather remained fine until the evening of April 10, and by that date the concrete foundations, made of cement, old coral, and dry sand had been built, the cœlostats erected in position, and the instruments placed under shelter. We were greatly indebted to Mr. Brooks, of Dr. Lockyer's party, for marking out the meridians and azimuths of the instruments. My instrumental equipment consisted of a 20-foot coronagraph, with a lens of 4-inch aperture, kindly lent by the Royal Irish Academy, and with the tube made of zinc sections, carrying an 8 × 10 camera at the end. This was set up horizontally in the azimuth of sunset. This instrument was under the charge of Mr. W. McKeon; side by side with it was set up the " Abney " 4-inch lens, fitted with a new camera-tube 33 inches long, the camera carrying quarter-plates. This instrument was under the charge of Lieutenant Elmsley.

The direct photography of the corona on a large scale for detail, and a smaller scale for extension, was thus provided for. A 16-inch cœlostat solidly mounted on a heavy box filled with stones, and this again on a concrete base, supplied light to these two cameras. Our spectroscopic outfit consisted of a prismatic camera and a quartz spectroscope. The former instrument was in the charge of Father E. Pigot, S.J., Director of the Riverview College Observatory, Sydney, who had joined me there. He was ably assisted by Engineer Lieutenant McEwan.

The prismatic camera was built up of a Grubb prism, refracting angle 40°, and transmitting a 7-inch beam of light, placed in front of a Dallmeyer 6-inch portrait lens of 30 inches focal length. This spectroscope, together with a one prism (60°) visual spectroscope for eye-observations of the times of the " flash," and a camera fitted with a Thorp replica grating, was rigidly fixed to the top of a table, the legs of which were embedded in the ground. In order to obtain the spectral arcs concentric with the disappearing and reappearing chromospheric crescent, the top of the table was lifted through 55° by means of two stout iron rods with screw adjustment. The deviation at He was thus reduced to 16° 28′. Wratten and Wainwright's panchromatic plates were taken out with us, and the spectrum was focussed for the red to green region.

It is in good focus as far as the K line. Father Pigot manipulated the instrument with great skill, and on the day of the eclipse, in spite of the cloudiness of the sky, a photograph taken of the upper chromosphere at the second " flash " shows the hydrogen series from Hd to Hi, as also some other lines. Though not adding much to our former scientific knowledge, I believe that this is the first time the red end of the spectrum has been photographed during a total solar eclipse. A 12-inch cœlostat supplied these instruments with light. The quartz spectroscope, which originally belonged to Major Hills, was kindly lent me by Prof. Newall, of Cambridge. This instrument was under my own particular charge, and I was ably assisted by the warrant officer Mr. Bright, torpedo-gunner. The 12-inch siderostat supplied it with light.

The fine weather broke on the evening of April 10, and from that date until the eclipse, we experienced very heavy torrentail rains and much cloud. The evening of April 28, for we kept Sydney time, and the morning of the 29th, were very overcast. The weather was clear during the partial phase, but near second contact the drop in temperature caused the formation in the humid atmosphere of dense cirro-cumulus clouds which were quite local. We lost fully two minutes of the 217 seconds of totality entirely, and during the remainder of the time the eclipsed Sun was obscured by a thick curtain of filmy clouds. To the naked eye, the corona was quite typically of the minimum character, with long equatorial extensions and open polar regions. The polar rays were just glimpsed. On the east the equatorial streamer was traced as far as one lunar diameter. In spite of the clouds a fairly good photograph of the corona was obtained with the Abney lens with 15 seconds exposure towards the end of totality. The negative shows some of the polar rays besides the equatorial streamers. With the long-focus coronagraph, with 20 seconds exposure, only the prominences and the fringe of the lower corona are visible. To the naked eye there seems to be a ring of brightness all round the Moon. Very little, if anything, was got with the quartz spectroscope, although I have not yet had time to examine the plates very carefully. The corona was not seen on the slit of the spectroscope until 20 seconds before the end of totality.

The Australian party is to be congratulated on having had much better, though not perfect, weather-conditions, and that they made good use of their opportunities is evidenced by the fine series of transparencies entrusted to my care by Mr. Baracchi, and now on exhibition in the library. I will put a few slides of the Australian results through the lantern, also a drawing by Captain Holfort, of the S. S. *Tofua*,

made under Mr. Baracchi's direction at the island of the same name, and an enlargement of a picture taken with an ordinary camera by one of my party of assistant sailors, seaman Smith. An examination of all the available material leads to the conclusion that the corona of April 1911 was markedly of the minimum type, and that, beyond the polar rays, there was no marked structural detail in the lower corona.

Mr. Baracchi used a Dallmeyer photopeliograph of 4-inch aperture in combination with an enlarging lens giving an equivalent focal length of 40 feet. The instrument was mounted equatorially. Mr. Merfield had charge of a pair of twin photographic lenses, also equatorially mounted, one a Dallmeyer Rapid Rectilinear of 4-inch aperture and 34-inch focal length, and the other a 4-inch Ross stopped down to $1\frac{1}{10}$ inch with focal length 21 inches. Mr. Dodwell used a combination of a pair of 12-inch parabolic mirrors fed with light by a 16-inch cœlostat, and Mr. Beattie a coronagraph consisting of an $8\frac{1}{2}$-inch calver mirror fed by a 12-inch cœlostat, which gave very bright images of about $\frac{3}{4}$ inch diameter.

Father Cortie illustrated his discourse by pictures, thrown on the screen, of the camp, of his instruments and of the corona taken during the eclipse. Dr. Lockyer followed with other pictures of the island and of the instruments used by the expedition of which he had charge, and of results obtained with them. Some photographs of the corona taken by Mr. Worthington were then thrown on the screen, and about these Prof. Turner said a few words. Mr. Frank McClean said a few words as to his share of the work in Dr. Lockyer's expedition.

[*The Observatory.*

The Latest Photograph of the Planet Mars.—(By Mary Proctor) Dr. Percival Lowell, of the Lowell Observatory, at Flagstaff, Ariz, has been finally successful in obtaining photographs of Mars, which establish beyond a doubt the reality of the canals of Mars. Heretofore, the value of the photos obtained by him in 1907 was questioned, on account of their minuteness being compared in size to the head of an ordinary pin. Doubts were expressed as to the amount of detail which could be seen on so small a scale, and magnification, it was said, only increased the difficulty by enlarging the silver particles upon the plate, wherever its sensitive surface had been exposed to the light.

With regard to photographs of Mars obtained October 11, 1911, with the Lowell refractor, 24-inch aperture, the images

made at one-minute intervals of exposure, each of three seconds, Dr. Lowell writes as follows, in a letter dated November 9, 1911:—

"The following, therefore, will interest you and the public generally. The magnification used for the photographs is now 178 diameters. This, on a disc of twenty-four seconds of arc which Mars presented at the last opposition, gives for the photographic images a diameter 2·3 times that of the Moon to the naked eye, and a superficies of over five times that presented by our satellite to naked eye vision—rather a surprising revelation this as to the size of our photographs.

Believe me, yours very truly,

(Sd.) PERCIVAL LOWELL."

The diameter of Mars at the last opposition was 24 seconds of arc less than now. Superficies, in the above letter, means surface of original photographic images, which then covered an area over five times that presented by the full Moon to the naked eye, the telescope magnifying one hundred and seventy-eight diameters. While the canals are plainly visible on the photographic plate, they will not bear printing processes. On examining the enlarged image through a screen by a stereopticon an immense amount of elaborate detail appeared, several of the canals being plainly in evidence. As these photographs were taken a month or so before Mars had reached its nearest to our planet, we may look forward with interest to those which will be obtained on the date of nearest approach.

[*English Mechanic*.

Schaumasse's Comet will pass its nearest point to the Sun on February 5 at 8 P.M. It is now approaching both Earth and Sun, and it brightness is therefore increasing, and will continue to do so till nearly the end of January, when it will be at least as bright as the tenth magnitude, and, therefore, discernible with moderate telescopes. There is no prospect of its becoming visible to the naked eye.

It will remain a morning star throughout its period of visibility. Its positions on the days named will be—

	R. A.			Dec.
	H.	M.	S.	
Dec. 16	14	11	16	2° 8′ N.
,, 20	14	27	16	1° 9′ N.
,, 24	14	43	42	10′ N.
,, 28	15	0	34	49′ S.
Jan. 1	15	17	52	1° 47′ S.

The motion of the Comet in the sky is nearly parallel to that of Venus which is now a bright morning star. The Comet is about 4° west of Venus and 14° north of it, these figures remaining nearly constant throughout the month.

[*English Mechanic.*

Several of the papers read at the Astronomical Society's December meeting were on techincal points connected with the measurement of star photographs, but an address by Mr. Hope-Jones, who exhibited and described a Synchronome Astronomical Regulator, was distinctly practical. This is an electric clock, not new as to its elementary principle, for it consists of a pendulum kept swinging by the fall of a small weight which is raised after its fall by the armature of an electro-magnet ; but the novelty and improvement lie mainly in the way that the falling weight gives the impulse. On the tail of the pendulum, below the bob, there is mounted a small, delicately poised wheel, with its plane in the plane of swing of the pendulum and the impulse-weight, or rather a round steel rod projecting from it, falls on this wheel every second, immediately after the pendulum has passed the middle point of its swing in either direction. The weight pressing on the periphery of the wheel sets it rotating and exerts a small force in direction of the swing until the pendulum has swung clear of the weight. The latter then continues its fall on to a contact piece, and thus completes a circuit which passes through an electro-magnet whose armature replaces the impulse-weight in its original position, and through the electro magnet which actuates the dial-work, and also, Mr. Hope-Jones says, through any number of subsidiary dials and chronographs. It should be added that the weight, when replaced by the armature, is held up by a catch, which the pendulum releases by a touch at its return swing, and the process is repeated, so that the contact is made, and the signal sent every second.

[*English Mechanic.*

At the B. A. A. meeting in November, Mr. G. F. Chambers occupied sometime in giving a very nicely illustrated discourse on the rather remarkable solar eclipse that is going to happen next April. He treated the matter rather from the point of view of Baldeker, instructing his hearers how they could reach the line of central eclipse in the easiest and cheapest way, but some remarks that followed were in a more astronomical vein. To set down in what way this phenomenon is of especial interest, I must ask to be allowed to refer to elementary principles of eclipses ; but first I would say, referring to a diagram and explanation in my letter of October 20 last, that the line

of central eclipse runs very obliquely from south to north (it begins its course in Venezuela and ends in Russian Asia), because it happens in the spring, when the Earth's axis as seen by a hypothetical observer on the Sun, inclines to his right, and, secondly, because the Moon is at its ascending node. But, leaving this and turning to another point, if we look at the diagram about eclipses in any text-book, we shall see that if the Moon is near the Earth—that is, at perigee or nearly so—when she eclipses the Sun, the eclipse will be total, and if the eclipse happens quite at perigee the Moon's shadow on the Earth will be large. On the other hand, if the Moon be comparatively far from the Earth, the eclipse will be annular. Next April the Moon will be in apogee on April 9 and in perigee on April 22, and the eclipse will happen on April 16, about midway between these dates, which seems to define approximately between totality and annularity. (The distance of Sun from Earth, of course, makes a difference; but in this case the Earth happens to be very nearly at mean distance from Sun.) Further, the Moon is always nearer to the observer when on the meridian than when on the horizon, assuming—which is very nearly the case—that her distance from the centre of the Earth remains the same. This will be understood when it is remembered that when the Moon is on the meridian her actual distance from the observer will be her distance from Earth's centre diminished by the radius of the Earth; but when on the horizon, or in any other position, her distance from the observer is her distance from the Earth's centre diminished by less than the Earth's radius. A small diagram of a triangle right angled when the Moon is on the horizon will make this clear. This well known circumstance gives rise to a correction called "augmentation of Moon's diameter." This being so, on April 16 next, when the Moon rises in Venezuela, her distance from Venezuela being large comparatively, the people there see an annular eclipse of the Sun; but as the eclipse track crosses the Atlantic, the altitude of Sun and Moon increases; the Moon get nearer to the observer for the reason above mentioned, and the eclipse becomes total. After this total phase, as central eclipse passes eastward, the eclipsed Sun will be lower down, and the phenomenon will be again only annular. This is, in the main, the reason of this somewhat unusual phenomenon, though it is complicated by other circumstances which need not be considered now. Naturally, the prediction of the places where the eclipse will be total depends on the value of the Moon's diameter adopted in the computation, and the N. A. predicts totality only in Spain, and that for not a second, whilst the French ephemeris says it will be total for six seconds in Spain

and for two seconds near Paris ; but as the duration of recent eclipses has generally been shorter than predicted, it is probable that the British N. A. will be found to be more correct, and, in fact, there may be no totality at all.

[*English Mechanci.*

Notices of the Society.

Election of Members.

The attention of members is invited to Bye-Law No. 14, regulating the election of persons who desire to join the Society. It is hoped that those who are already members will induce others to join. Forms of application can be had from the Secretary, Mr. P. N. Mukherji.

The Library.

A subscription list exists and several members in Calcutta have subscribed and enabled the Council to make a beginning with the Library. Other members outside Calcutta, however, have not, except in one or two cases, yet come forward, and as the Library will be one of the most important adjuncts of the Society, and will be available to members both in and out of Calcutta, those who have not yet done so are invited to help the Society in making progress with this important branch of the work. Suggestions as to useful books for the Library will also be welcomed by the Librarian.

A number of books have already been received and can be borrowed by members in accordance with the Bye-Laws.

The books available can be ascertained from the Assistant Librarian and a catalogue will be issued shortly. The reading room of the Society in the Imperial Secretariat is now opened for the use of members daily from 5 to 7 P.M. except on Wednesdays and holidays and from 3 to 5 P.M. on Saturdays unless that day is a holiday.

Subscriptions.

Subscriptions for the current session fell due on 1st October 1911. Those who have not paid in their subscriptions are requested to remit them to the Treasurer at their convenience.

Papers for Meetings.

It is requested that drawings which accompany papers for reproduction in the JOURNAL may be made with Indian ink on white paper. This will insure a clear reproduction.