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"AT HOME" TO VISITING ASTRONOMERS OF THE BRITISH ASSOCIATION.

July 26, 1929, will long be remembered in the annals of the Astronomical Society of South Africa, for on the evening of that day it was "At Home" at the Oddfellows' Hall, Plein Street, Cape Town, to the visiting astronomers who were attending the meetings of the British Association.

The chair was taken by Mr. A. W. Long, President of the Society, who, in opening the proceedings, said: This gathering of the Astronomical Society of South Africa has been arranged to enable the members to greet the distinguished astronomers and other eminent scientists interested in astronomy who are visiting South Africa in connection with the meetings of the British Association. We have with us to-night Sir Frank Dyson, the Astronomer Royal; Professor Eddington, Director of the Cambridge University Observatory; Professor Fowler, Yarrow Research Professor of the Royal Society; Professor Chapman, of the Imperial College of Science; Professor De Sitter, Director of the Leiden Observatory; Dr. Guthnick, Director of the Berlin-Babelsberg Observatory; Dr. Knox-Shaw, Director of the Radcliffe Observatory; Mr. Greaves, of the Greenwich Observatory; Mr. Wrigley, of the Edinburgh Observatory; Dr. Aston, of Cambridge, and I am pleased to say that at a later stage Lord Rayleigh will also be here. In the name of the Society I extend to these gentlemen a very hearty welcome. We have been familiar with them for a very long time by name, and through their scientific attainments; now we are delighted to have the honour of meeting them in person. Such a meeting as this was

not possible when the British Association visited South Africa in 1905, for then there was no Astronomical Society. The original Society—the Cape Astronomical Association—was founded in 1912. Six years later, owing to the migration of one of its members to Johannesburg, an astronomical society was established on the Rand. The union of these two bodies into the Astronomical Society of South Africa was accomplished in 1922. The most remarkable feature of our Society is its vast area. Our membership is drawn from all parts of this great country, our most distant member residing at a place in Northern Rhodesia, which is 2,200 miles from Cape Town. Therefore, it is not possible for all our members to be present to-night. But those who are unable to be here, I am sure, are envying the Cape members their good fortune in being privileged to observe this great cluster of giant stars. Our visitors make this an eventful day in the history of our Society, and our council, at its last meeting, wishing to have a permanent memorial of this notable occasion, elected Sir Frank Dyson, Professor Eddington and Professor De Sitter, to the honorary membership of the Society. These gentlemen have graciously accepted this, the only and therefore the highest, honour we can pay them. I now ask these three gentlemen to come forward and sign our membership roll, and then to support me on the platform.

The Honorary Members, having signed the membership roll, took their seats on the platform.

The President: Ladies and gentlemen, you have not come here to listen to anyone from Cape Town talk, and we will begin the real business of the meeting by hearing an address from Sir Frank Dyson, the Astronomer Royal.

Sir Frank Dyson: First of all I should like to thank the members of the Astronomical Society of South Africa for the great honour they have paid me in electing me an Honorary Member, a distinction which I appreciate very much. When one comes to South Africa one does so with a great deal of pleasure. For one thing, one sees new stars, and finds a great many new astronomers, both amateur and professional—the professionals devote themselves to fundamental astronomy and astrophysics, while the amateurs find comets and new stars and so on. After all, there is not so much difference between the professional and amateur astronomer, for the professional astronomers are amateurs too, in the sense that they are all very fond of and thoroughly interested in their subject. In the Royal Astronomical Society of London the amateur astronomers think the professional astronomers have rather a dull time of it, and the

amateurs object when too much mathematics is put on the blackboard. Barring that little difference, however, the amateurs and the professionals get on very well together. I come from Greenwich, which is an observatory with a long and famous history. Dr. Spencer Jones' little son recently explained that Greenwich was the "mummy" of the observatory at Cape Town. I hope you will judge the Greenwich Observatory by what you have seen of her offspring at the Cape. We are told that "you cannot choose your parents too carefully," and if you look at the Cape Observatory you will realise that it has chosen its parents very well indeed.

If I were to tell you the history of Greenwich I should be repeating to you a great deal of what you know already. You all know what a famous list of astronomers it has had connected with it—Flamsteed, Halley, Bradley, Airy and others—all of whom have made very valuable contributions to astronomy. They began at the start by setting an example of continuous work, which is still one of the main features of the observations of the Cape and Greenwich Observatories. The mother observatory at Greenwich is 250 years old, and the daughter institution here at the Cape is 100 years old, and they have both kept constantly on one particular kind of work, which is very interesting to the professional astronomer and which, we think, is extremely important, though not particularly interesting to the amateur; I refer to the accurate determination of the position of the Sun, Moon, planets and stars. That is what Greenwich was founded to do, on account of its practical value to navigation. When the practical problem had been solved they continued with the same sort of studies, because they found there were so many points of interest in them—points which they wanted to solve. The Cape Observatory was established because it was necessary to take observations in the southern as well as the northern hemisphere, if the greatest accuracy was to be obtained. Greenwich Observatory has observed the Moon for all these 250 years, and the mathematicians have compared these observations with theory in order to see how the movements of the Moon could be explained. But there are still difficulties which we cannot fully explain, although we can make very reasonable hypotheses. It is not only the Moon and the planets that are so troublesome, but there is the problem of making an accurate map of the sky. For instance, it is difficult to say exactly where the celestial equator lies, just as it would be difficult for a geodesist to stake out exactly the position of the equator on the earth. Apart from

that we are in difficulties regarding a good many fundamental points concerning the movements of stars. These are some of the problems on which the professional astronomers at Greenwich, the Cape, and in Germany, Holland and Washington are all busily engaged. I do not want to talk much about the other work we do at Greenwich, but should like to point out that a great deal of the merit of it is that it is carried on continuously year after year. Gradually we are accumulating observations about the stars, and as they move slowly we have to take a long time in continuous observation of them.

The President: We will defer expressing our thanks to the speakers until a later stage. I will now call on Professor Chapman, Professor of Mathematics at the Imperial College of Science.

Professor Chapman: I should like to say a few words about the physical aspects of the Sun. Nearly twenty years ago Professor Hale observed at Mount Wilson that the Sun, like the Earth, is a great magnet. The axis of the magnet nearly coincides with the Sun's axis of rotation and the direction of magnetisation is in the same direction relative to the Sun's direction of rotation, as in the case of the Earth. Some years subsequent to Hale's first discovery of the Sun's magnetic field, it was found that it differed from that of the Earth in a striking way, being very closely confined to lower levels of the Sun's atmosphere. If we take a circle to represent the Earth, and draw the magnetic lines of force, we shall see that these lines of force spread far out into space and complete their circuit inside the Earth. In the case of the Sun's magnetic field, the lines of force instead of spreading out into space, are closely confined within the Sun's atmosphere. The direction of the magnetic field at any point outside the Sun is nearly horizontal, i.e., parallel to the Sun's surface. When you go a few hundred kilometres above the Sun's photosphere, there is no magnetic field to be detected. No detailed theory of the general magnetic field of the Sun has yet been found. Some progress, however, has been made in explaining this remarkable difference between the magnetic field of the Earth and that of the Sun. It can be shown that the rapid decrease of the Sun's field with height above the Sun's surface requires that in the Sun's atmosphere there must be electrical currents running in the direction from west to east. The problem is to find the reasons for the existence of such currents and to explain what keeps them in motion. The atmosphere of the Sun is so hot that the atoms are broken into positive and nega-

tive charges; the positive ions are much more massive than the negatively charged electrons. A free electrically charged particle cannot travel in a straight line in a magnetic field but will move with a corkscrew motion around the lines of force. The positive ions being much heavier than the electrons, the radius of the spiral motion of an ion will be much larger than that of an electron. On the other hand, the number of revolutions described in a second will be very much greater for the electron than for the positive ion; an electron will describe 150,000,000 revolutions in a second. An ion will not describe many spirals before it collides with another ion; but an electron will be spiralling most of the time. The force of gravity is exerted on the particles all the time in a downward direction, so that instead of their describing a simple corkscrew motion about the line of force, they drift in a horizontal direction. The negatively charged electrons will drift in a westerly direction whilst the positively charged ions will drift in the opposite direction. Owing to the effect of collisions with other ions, these ions will not take up the drift, but the electrons will; the westward drift of the negative electrons is equivalent to an electrical current running from west to east. These eastward currents of electrons confine the Sun's electric field within its atmosphere. An important part in these movements is played by gravitation, and the theory of the equilibrium of the Sun's atmosphere will have to be revised. The magnetic field bears part of the weight of the Sun's atmosphere.

The President: I will now call on Professor De Sitter, the Director of the Leiden Observatory, one of our Honorary Members.

Professor De Sitter: I am sorry that I have to repeat what Sir Frank Dyson has already said, but I must thank you for the very great honour you have conferred on me in making me an Honorary Member of the Astronomical Society of South Africa. In my case it is an especially great pleasure for me to have my connection with South Africa strengthened in this way, because it was at the Cape Observatory that I learned practically all that I know of astronomy. When I asked the present director of the Cape Observatory what kind of lecturette I should deliver to-night, he advised me to give something purely scientific and something difficult as well. So I will put before you a problem of which I do not know the solution. We all know that the stars have motions which we can measure by means of the spectroscope. The motions of all the stars are of the same degree of magnitude, but the spiral nebulae have motions away from us in the

neighbourhood of 300, 600, 1,000 and even 1,200 kilometres a second. Recently one was discovered which had a velocity of about four thousand kilometres per second. That is one problem—how to account for these huge velocities. The strangeness of it is that these spiral nebulae go out in different directions away from the Earth, as if they did not like us. How is that to be explained? That is the problem I put before you. I cannot give a definite solution, but there is one thing which makes the solution simpler. These velocities are not in every instance away from us—there are three spirals which are moving towards us with a velocity of about 300 kilometres per second. When you have a general rule, with one exception, you can say that the exception proves the rule, but when you have three exceptions then it is more difficult. In the last two years it has been discovered that our Sun, with all the neighbouring stars, has a rotational motion round the centre of the galactic system, amounting to about 300 kilometres per second; if you believe that, it means that these three exceptions disappear. Taking into account the rotation of the galaxy these velocities become positive, or away from us, so that then you have a rule without an exception. These three discrepancies then disappear. There is only one hypothesis in the field which makes any pretension to an explanation. The only probable explanation is to be found in Einstein's theory of relativity. There are three different forms of the theory which we can think of as the A, B and C varieties. Variety B has a special velocity in the gravitational potential. If you abstract the matter, in the systems A and C there is no potential, but in the system B the potential goes on diminishing until at infinity the potential becomes zero. This has two effects; one is that any body on which no force acts, in the systems A and C would remain at rest or have a uniform motion, but in the system B it would have a receding motion. The other effect is that the velocity of light and of vibrations goes on diminishing, which make the waves coming towards us so much slower that we interpret our observations of them as if these bodies were running away from us. According to the mathematical formula, the velocity equals $V = \pm R + \frac{1}{2} R^2$. There is another difficulty which I have not mentioned yet, and that is there is no reason why the first term, R, should always be positive. I might suggest that the answer may be that the approaching velocities have become receding velocities, by passing through the origin of measurement. The term in R^2 is not indicated by the observations or

rather the observations tend to give it the wrong sign. This might be due to our measures of distance being unreliable.

The President: I will now ask Professor Fowler, Yarrow Research Professor of the Royal Society, to address us.

Professor Fowler: My contact with astronomy at the present time comes through experimental or laboratory work which bears on the interpretation of the spectrum, and particularly in connection with the spectra of the hottest stars. It is appropriate that I should say a few words on this subject to-night, because some of the greatest contributions on this subject have emanated from the Royal Observatory at the Cape. About thirty years ago the late Sir David Gill came to the conclusion that some of the most characteristic lines in certain stars were to be attributed to the common gases, nitrogen and oxygen. I remember being a little sceptical about that explanation; I suppose I should not have been so sceptical, for it turned out that Sir David Gill was perfectly right. There was some difficulty at the time about the intensities of the lines, but these were cleared up through the work of one of Sir David's assistants, Dr. Lunt, whom I am pleased to see sitting among the audience to-night. Dr. Lunt investigated particularly the spectra of nitrogen and oxygen. He put these gases into vacuum tubes, and found that the intensities of the lines in their spectra varied according to the intensity of the discharge. That confirmed the identification of these lines in the stars. The question obtained a new interest when Bohr's theory of the atom was presented to us in 1913. Oxygen has an atomic number of eight, which means that it consists of a nucleus and eight surrounding electrons. So long as none of these electrons come out of the atom of oxygen we get a spectrum of oxygen which is known as the OI spectrum. Suppose we succeed in expelling one electron out of the atom, then the atom has only seven electrons left, and it gives an entirely different spectrum, which is known as the OII spectrum. The spectrum of oxygen generated in this manner appears in stars of the highest temperatures. The Sun is a comparatively cool star and does not show these lines. The work initiated by Dr. Lunt, following on Sir David Gill's identification of the spectral lines, and continued by myself in the light of Bohr's theory, ends in our being able to say how much energy is required to drive out one or more electrons from an atom. These data in regard to the energy have an important bearing on the investigations of the atmospheres of the stars. Professor Bowen of the California

Institute has shown that the most characteristic lines in certain nebulae are due to the OIII atom, i.e., to the atom from which two electrons have been expelled. These nebular lines are therefore due to the doubly ionised oxygen atom. Only this morning an important communication was made to the British Association by Mr. Horrocks, the Chief Assistant at the Cape Observatory, regarding Nova Pictoris. The spectrum of this new star shows the characteristic nebular lines, but there are, apparently, certain discrepancies in the relative intensities of the lines in this spectrum. We shall have to attempt to explain the discrepancies which he has brought to our notice, the problem being one for future investigation.

The President: I will now call on Mr. Greaves, Chief Assistant at the Royal Observatory, Greenwich.

Mr. Greaves: In the short time at my disposal I can not do better than give you an elementary account of the latest type of work we are doing at Greenwich regarding the experimental determination of the temperatures of the outer layers of the stars. The general principle is that the temperature in the outer layer of a star affects its colour. Some of the stars are red, corresponding to a comparatively low temperature, while the hottest stars are blue. The problem consists in obtaining some quantitative measure of colour and converting it into temperature. We obtain such a measure by comparing the relative amount of red and blue light coming from a star. If we can measure the amount of the light emitted at each of two wave-lengths, we can calculate the temperature by Planck's formula. Having photographed the spectrum, we can measure the amount of blackening on the photographic plate at the wave-lengths in question, but this amount will depend not only on the quantity of light received but also on the degree of sensitivity of the plate and the conditions of development. Suppose, however, we photograph the spectrum of another star, we have two spectra on the same plate. We can measure at each wave-length the ratio of the light coming from the two stars, and if we know the temperature of the second star we can then calculate the temperature of the first. Thus it would seem that one could go straight ahead with the investigation, but we encounter one great difficulty, the fact that we are observing the stars from the bottom of an ocean of air which absorbs light. At Greenwich we have selected as standards 24 stars mostly of type A, north of the equator, and we are now comparing them in pairs by a kind of triangulation process, in each case making a comparison

with two stars at the same altitude. Each comparison gives a relation between the temperatures of the stars concerned, and the whole scheme gives the temperatures of the 24 standards, apart from a constant which will have to be determined by comparisons with a terrestrial source, the necessary information regarding atmospheric absorption being obtained by comparing standard pairs at unequal altitudes. We have nearly finished this standard network of 24 stars and other stars will be compared with one or more of the standards. Coming to the stars of the early types, B0 to B2, we have found that they include a small group, characterised by temperatures lower than that of an average A0 star. Some of these stars are at nearly the temperature of the Sun. We found that if we selected stars which contain very strong calcium lines in their spectra, such stars would fall into this low temperature group. The result presents some interesting problems. A possible explanation is that these stars are giant stars, and at enormous distances from the earth.

The President: I will now call on Professor Eddington, Plumian Professor of Astronomy in the University of Cambridge and Director of the Cambridge University Observatory, who is one of our Honorary Members.

Professor Eddington: It is a great pleasure to be here to-night to address my fellow-members of the Astronomical Society of South Africa. When the British Association came to South Africa in 1905 the visit was a memorable one so far as astronomy was concerned, because Professor Kapteyn announced his great discovery of the Star Streams. Strictly speaking, I think he announced it at the St. Louis Exhibition a year before, but we have always associated it with our visit to the Cape. I do not think it is an exaggeration to say that we have now come to regard that announcement as marking an epoch in the development of stellar astronomy, partly by the direct stimulus it gave to its study, and partly that the time was ripe for new development. We date from that paper the great expansion and rapid progress which has since been made. Newcomb's book on "The Stars" was published just a year or two before, so it is easy to realise how much development has been made since then. Before this stellar astronomy was mainly confined to two broad problems—one the more accurate determination of the solar motion and the endeavour to reconcile its divergencies; the other was the work of counting the stars and obtaining a knowledge of the way in which the stars

are condensed towards the galactic plane. These seemed to be the two lines of investigation to follow. There was, however, a hint of something more interesting. It had been noticed that the stars of a later spectral type had bigger motions than the stars of an early spectral type. Professor Kapteyn had planned to make a study of the solar motion from stars distributed at random, and he got his brother to work out a mathematical theory of such a motion so that it could be compared with observation. The Groningen Publication No. 5 was devoted to this, and it was announced that the following number would show how the proper motions would compare with the theory, and it was anticipated that they would show a good agreement. Paper No. 6, however, never appeared, because Professor Kapteyn found that there were these two great Star Streams. The next interesting generalisation was the fact that stars of different spectral types had different average motions. Later it was found that there was a relation between proper motion and absolute magnitude —the bright stars moved slower than the others. But the problem has become complicated, and I do not think we have been able to unravel it, although we have discovered many facts about it without, however, arriving at a solution. Then came another great advance, the division of the stars into giant and dwarf stars by Hertzsprung and Russell. Keeping to proper motions and the structure of the stellar system, what have we learned since then? We have greatly extended the region through which the two Star Streams are found to prevail. Also there is a third stream investigated largely by Dr. Halm of the Cape Observatory. We have studied the proper motions, and found that the bright stars predominate in the first stream, but as we get down to fainter stars the numbers in the two streams more closely approximate one another. Recently at Cambridge my Chief Assistant, Dr. Smart, has been investigating the proper motions of faint stars determined by photographic observation. Early investigation dealt generally with stars of the sixth to eighth magnitudes, but now we are investigating stars of the eleventh and twelfth magnitudes. That helps to answer the question—how far off the star streams extend? Although the realm of the star streams has grown, the recognised size of the stellar system has extended enormously more. I might speak for a long time, showing how the problem of the system of the stars has grown since the last meeting of the British Association in Cape Town, and I may predict that the British Association will have made many more visits

to South Africa before all the problems opened up by Kapteyn's great discovery have finally been solved.

The President: I will now ask Dr. Aston, of Cambridge, to tell us something about the eclipse expedition in which he recently took part.

Dr. Aston: I feel that I am here under false pretences, as I started my career as a chemist and subsequently took to physics; but all the time I have been a very keen astronomical amateur, and as total eclipses happen in such interesting places I have been given a very good excuse for travelling. One of my colleagues used to say "When a total eclipse comes along Aston makes a noise like an astronomer." When the total eclipse of May 19th was growing near I was asked by Dr. Carroll, of the Solar Physics Observatory, Cambridge, to assist in photographing the sun in coronium light. I left England at the end of March for Bombay in the P. and O. liner "Viceroy of India." From Bombay I went on to Penang and Singapore. The day before the eclipse was practically perfect, and during that day most of the adjustments to the camera were made. Several American astronomers were present, and altogether a dozen experiments were being made. Unfortunately the morning of the eclipse was fairly hopeless, there being a large pall of motionless fog which, however, became slightly thinner as the time of the eclipse approached. The eclipse lasted five minutes, and the first plate was exposed for three minutes. It was estimated that only about one-tenth of the light came through the fog. So the observations were practically useless from a scientific point of view, although from a spectacular point of view the effects were good. There was very great excitement among the natives during the period of the eclipse. At the approach of totality there was enormous excitement, and Chinese crackers were let off and tin cans were beaten; this had the desired effect, the sun bursting from behind the clouds five minutes later. The Einstein experiments were a complete failure, as no stars could be photographed through the layer of clouds. The spectroscope experiments were also useless. My plates of the corona, however, showed that Dr. Carroll's estimates were correct, and he hopes to extract something of value from the plates, although they are not very clear. It was reported that a man went to the cable office during the period of totality and asked to have a cable sent at night rates. It is suggested that he was a Scotsman!

The President: Before calling on His Majesty's Astronomer, Dr. Spencer Jones, to express the thanks of

the Society to the speakers, I just wish to draw your attention to the fact that we have another distinguished scientist present to-night who does not come from overseas. I refer to General Smuts, who has been a member of the Astronomical Society for several years. We are very pleased to welcome him here to-night.

Dr. Spencer Jones: I would like to say that this is a unique occasion in the history of this Society. When the Council of the Astronomical Society of South Africa planned this meeting, they perhaps overlooked—fortunately, it may be—that our visitors have been heavily worked during the past week, and we owe a deep debt of gratitude to them for giving up an evening to us. I believe that I am correct in saying that every visiting astronomer is with us to-night. That is a very great honour to the Society. In addition to the names mentioned by the President, we are very pleased to have with us Sir Charles Parsons, and Professor McLennan from Toronto. I ask the members to show their appreciation of the great honour conferred on us by the presence of so many distinguished astronomers from England, Holland, Germany and elsewhere.

The meeting then terminated and was followed by music and refreshments.

The following is the list of the visiting members of the British Association who were present at the Conversazione:—

Dr. F. W. Aston, F.R.S., Trinity College, Cambridge.
Mr. J. G. Bower, Norwich, and Mrs. W. le Neve Bower.
Professor Sydney Chapman, F.R.S., Imperial College of Science.
Sir Frank Dyson, K.B.E., F.R.S., Sc.D., Royal Observatory, Greenwich; Lady Dyson and Miss Dyson.
Professor A. S. Eddington, F.R.S., D.Sc., Observatory, Cambridge.
Professor A. Fowler, F.R.S., London, and Mrs. Fowler.
Mr. R. H. Fowler, F.R.S., Trinity College, Cambridge.
Mr. W. M. H. Greaves, Royal Observatory, Greenwich, and Mrs. Greaves.
Professor Paul Guthnick, Berlin-Babelsberg Observatory, Germany.
Dr. H. Knox-Shaw, Radcliffe Observatory, Oxford.
Professor J. C. McLennan, F.R.S., D.Sc., Toronto University, Canada.
Hon. Sir Charles Parsons, O.M., K.C.B., F.R.S., London.
Rt. Hon. Lord Rayleigh, F.R.S., Terling, Essex.
Professor W. de Sitter, Leiden Observatory, Holland.
Mr. R. W. Wrigley, Royal Observatory, Edinburgh, and Mrs. Wrigley.

THE FOUNDATION AND DEVELOPMENT OF THE ASTRONOMICAL SOCIETY OF SOUTH AFRICA.

By A. W. Long, F.R.A.S.
(*Presidential Address, Session* 1928-9.)

It has been the custom in former years for the retiring President to preface his address with a short résumé of the activities and achievements of the Society during the year just concluded and afterwards to speak on a phase of astronomy with which he has been specially associated or of a sphere in which he is universally acknowledged to be an authority. Unfortunately the practical part of my astronomical work has been in the domain of variable stars, and as this subject was the theme of the previous President, who is an expert of international fame, that subject is denied me.

Thinking over the matter it occurred to me that it is time there should be a record in a convenient form of the history of the origin of our Society, and being one of the little coterie which met originally to talk over the possibility of the formation of such a body, and having served continuously on the Council since the beginning it is perhaps fitting that I should present the story to you on this occasion.

The members of our Society are very widely scattered, in fact the Society may be said to measure 2,200 miles long by 1,000 miles wide. The Cape Centre itself includes members at points so widely apart as Windhoek, Bwana M'Kubwa in Northern Rhodesia, Cape Town and Durban. Members who are perhaps greatly treasured by those who are at the hub of the Society are merely names to those on the frontiers and, on account of the self-effacing nature of the workers, perhaps even unfamiliar names. It is therefore my intention to make this sketch something in the nature of a Who's Who of all those who have contributed or who are contributing to the usefulness of the Society, with an indication of the nature of their activities.

Like many great men and world-wide organisations the Astronomical Society of South Africa had a very humble beginning. It may be traced back to the gift of a 3-inch telescope by a fond uncle to his dutiful nephew. Halley's comet had appeared in 1910 and had created a public interest in astronomy. This had been fostered by the late Mr. Clement J. Taylor, who published a chart showing the portion of the comet's orbit in the neighbourhood of perihelion, dated at appropriate intervals.

Interest was fanned by letters in the Press describing the appearance of the comet and especially the unique spectacle of Venus and the comet in the morning sky. When interest began to wane Mr. J. F. Skjellerup discovered a comet which we learned afterwards had been seen by Gale a few days earlier in Australia.

The time seemed to be ripe for making an effort to get all those interested together with the object of forming an association. Mr. D. Gordon Mills, the fortunate nephew referred to, called together those with whom he had got into touch and others whose names had appeared in the Press. The first meeting was held in the Old Town House, Greenmarket Square, now the Michaelis Gallery, on October 3, 1912. There were present Miss A. Glossop, Miss Ellen Smith, Messrs. J. W. Copenhagen, S. A. Davis, R. T. King, A. W. Long, Andrew Milne, D. G. Mills, William Reid, H. W. Schonegevel, J. F. Skjellerup, E. J. Steer and John Williams. It was decided at that meeting that it was desirable to form an Astronomical Society, and Messrs. Davis, Long, Mills, Skjellerup and Steer were appointed a preliminary committee to draw up a scheme. It was decided to ask the staff of the Royal Observatory to join.

The Cape Astronomical Association.

The committee reported at a meeting called on November 8, at which Dr. J. K. E. Halm presided. Some of those present were already members of the British Astronomical Association, and it was suggested that we establish a branch of that Association. It was felt, however, that it would be preferable to start as an independent organisation, so that we might develop along lines most suited to South Africa. It was unanimously resolved to form a Society, which, seeing that our membership would most likely consist of residents in the Cape, should be called "The Cape Astronomical Association." The following additional names were added to the list of those given at the last meeting, which together composed the roll of foundation members, Miss Hilda Long, Dr. J. K. E. Halm, Dr. J. Lunt, W. Smith, S. Sangster, W. H. Cox and A. Pilling. Of the foundation members there remain only the following:—Cox, Halm, Long, Pilling, Schonegevel, Skjellerup, Steer and Williams.

Mr. S. S. Hough, His Majesty's Astronomer, was elected Honorary President; Dr. J. K. E. Halm, President; Dr. J. Lunt and Dr. A. W. Roberts, Vice-Presidents; Mr. J. F. Skjellerup, Secretary and Treasurer, and Messrs. S. A. Davis, A. W. Long, D. G. Mills and W. Reid, as Committee.

The avowed objects of the Association as set forth in Rules 1 and 2 were to encourage the study of the science of astronomy and to disseminate current astronomical information among its members; the holding of monthly and other periodic meetings and the reading of papers at such meetings; the promotion and organisation of lectures; the formation of observing sections; and to afford members not possessing telescopes the opportunity of practical observation.

The Association was inaugurated on the 13th of December, when the Hon. President presided and Dr. J. K. E. Halm delivered an inaugural address, followed by a lecture on Spectroscopy, which was illustrated by lantern slides. The attendance at the meeting numbered forty-two.

The first move towards the development of the practical side of astronomy was made at the third committee meeting, when Mr. Reid was appointed to take charge of a meteor section. Further sections were to be formed when members had had a little more experience in observing. A stimulus was given to this project by a visit paid to the Association by Mr. John Warren, who had for years been making extensive observations at Robben Island.

Owing to the transformation of the Old Town House into the Michaelis Gallery the Association had to find temporary accommodation in an annexe to the Training College in Queen Victoria Street, where the April and May meetings were held. Correspondence had been entered into with Dr. A. W. Roberts, of Lovedale, and Mr. A. W. Goatcher, late of the Royal Observatory, and then residing in Ceres, with reference to Variable Star work which the Association was anxious to undertake. Mr. Goatcher had supplied the Secretary with specimen charts of variable star fields and at the May meeting some members undertook to try their skill at this work so that a Variable Star Section might be established.

It was while the meetings were being held in the Huguenot Hall that Mr. Clement J. Taylor, who had hitherto held aloof, joined the Association and immediately became an enthusiastic member. His first paper on Herschel's work at the Cape was read at the meeting prior to the one on which he was proposed for membership.

It was resolved at a Committee meeting held in June, 1913, to publish Monthly Notes of such astronomical information as would be helpful to members. The first of these Notes accompanied by a map showing the aspect of the sky at 10 p.m. on the first of the month

appeared in the "Cape Times" dated June 28, 1913. Such Notes and a corresponding map have been continued each month without cessation until the present time. They have been largely responsible for keeping up the interest of members and have been instrumental in adding new members to the Association, among whom may be mentioned Mr. Theodore MacKenzie, now Secretary of the Computing and Director of the Meteor Sections; Mr. W. H. Smith, now Treasurer of the Society; and Mr. G. E. Ensor, now Director of the Variable Star Section. Expressions of appreciation of the help received from the Notes have been received from all classes, ranging from a Judge on the Bench to a coloured labourer on the Claremont Flats.

The following extract from a letter shows how the Notes were of service to one living in the "Back of Beyond."

"Somewhere about 1919/20 I was stationed in a factory on the West Coast in the middle of a howling desert. I was 18 miles from a telephone, a telegraph or a post office. I had no telescope, and wireless was still undeveloped. Now, I had to get accurate time somehow, and I found that the only source of information accessible was the "Cape Times" Astronomical Notes. At that time the Astronomical Notes included culminations of stars. I erected a 2-inch galvanised pipe on trestles to make a sort of transit instrument without lenses. I knew my latitude and longitude within a few seconds of arc, but as the variation of the compass was, at that time, about 25 deg. 15 min., I had to get my north and south by repeated trial and error. Anyway, the crude contraption worked, and I derived my time by observing the culmination of one of the stars specified in the Astronomical Notes. Doubtless there were many others who benefited by the publication of these culminations. In bringing this fact home to you I hope you will see that all seed does not fall on stony ground and also that one of your chickens has come home to roost."

On coming to live at Cape Town at a later date, the writer of this letter, Mr. D. C. Burrell, immediately sought out the Society and joined it. He is now Librarian of the Cape Centre and acts as alternate for one of the members of the Council of the Society.

Queen Victoria Street was considered to be inconvenient for our members and a room in the South African Mutual Assurance Building was engaged for our meetings. The building in Queen Victoria Street where we met was demolished soon afterwards and on its site was erected the New Huguenot Hall of the Dutch Reformed Church.

Mr. Connell, of Messrs. Cooke & Sons, who had joined the Association in December, contributed a paper at the July meeting of 1913 entitled "Reminiscences of an Amateur Astronomer in India." Mr. Connell supplied members and friends with printed copies of his paper suitably illustrated. This may be regarded as the first publication of the Association. At the same meeting Mr. J. F. Skjellerup read a paper on Variable Stars, but it was not until March, 1914, that a Variable Star Section was formed under the Directorship of Mr. William Reid.

A new departure was made in July, 1914, when the meeting took the form of an observational meeting. The members gathered at the Rhodes Recreation Grounds, Mowbray, where several telescopes were provided for the use of members and their friends. Before the next meeting was due, war was declared, and for a considerable time the monthly meetings were discontinued.

After a lapse of two years a meeting of Committee was called, when it was decided to resume the monthly meetings and other activities. At this meeting two new members were elected, Mr. Theodore MacKenzie, who was to give us excellent service as Secretary, until his removal to Johannesburg, and Mr. Alfred Bull, who acted as Librarian with much acceptance for several years.

The first meeting of the new Session was held in the Y.M.C.A. Hall in Long Street, now the offices of the Eastern Telegraph Company. The following officers were elected:—

Hon. President: Mr. S. S. Hough, His Majesty's Astronomer.

Hon. Vice-Presidents: Dr. J. K. E. Halm, Dr. J. Lunt, Dr. A. W. Roberts and Mr. R. T. A. Innes, Union Astronomer.

President: Mr. Clement J. Taylor.

Vice-Presidents: Mr. W. Reid and Mr. A. W. Long.

Secretary: Mr. Theodore MacKenzie.

Treasurer: Mr. E. J. Steer.

Committee: Messrs. Davis, Schonegevel, Skjellerup and J. Williams.

By this time it was known that Mr. W. Reid was an assiduous searcher for comets, and that Mr. J. F. Skjellerup was interested in variable stars, so these two members were appointed Directors of these Sections. From this time both Sections became thoroughly alive. There were nevertheless only two members in each for a considerable time. Dr. A. W. Roberts had announced that he was unable to continue his work of observing Southern Variables, and it was suggested that Mr. Skjellerup and his co-observer should endeavour to carry

on the work which Dr. Roberts had maintained so successfully for many years single-handed. For this purpose His Majesty's Astronomer kindly granted these two members the use of a 6-inch Refractor at the Royal Observatory to enable them to continue the observation of variables when these passed beyond the limit of their small telescopes.

At the second meeting of the new session the Association gained considerable strength in the accession to its membership of Mr. R. Watson, who was to bring it fame in the discovery of two new stars, Mr. C. L. O'Brien Dutton, who was to become the efficient Secretary of the Astronomical Society of South Africa, and Mr. D. G. McIntyre, who afterwards became Chairman of the Cape Centre and a popular lecturer. The two latter were associated with Mr. W. Reid in the historical observation of the visible passage of a star behind all the rings of Saturn. It was about this time that the Association acquired a lantern for use at the meetings. Mr. H. W. Schonegevel was appointed to take charge of the lantern and he has continued to fill this duty until the present time.

At the meeting held in September one of our country members, the late Mr. Izak Meiring, of Worcester, attended and exhibited and explained a drawing of an equatorial mount for stellar photography.

At a Special General Meeting held in August, 1916, it was decided that the Annual General Meeting should be held in June of each year, which continued to be the practice until the formation of the Astronomical Society of South Africa. This Special Meeting was held in the Cape Town Gallery Club's Room, Burmester's Buildings, Adderley Street, which was the place of meeting until June, 1917.

In the beginning of 1917 the Association had under consideration the purchase of a 6-inch Refractor Telescope. It was proposed to ask the City Council for a grant of a plot on the Camp Ground, Mowbray, for the erection of an observatory to house the telescope. The money to purchase the telescope was guaranteed by the members. An offer made by the Association for the telescope was not accepted. It was subsequently purchased by Mr. Reid, who offered the hospitality of his observatory to any member wishing to do practical work. This suggestion was not taken advantage of, but his offer to keep an evening each week for members and their friends was freely made use of for many years.

The attendance during the period of the tenancy of the Cape Town Gallery Club's Room varied from 30

to 50. As this room was unsuitable owing to the noise of traffic, arrangements were made to hold the meetings from July, 1917, in the rooms of the Owl Club, Burg Street.

On application by a Scoutmaster, the Committee undertook to provide lecturers to teach Boy Scouts to qualify for their Starman's Badge. Several troops of Boy Scouts and subsequently companies of Girl Guides took advantage of this offer. Messrs. Cox, Long, MacKenzie, Reid, Skjellerup and McIntyre acted as lecturers and examiners and fostered in the minds of these young people the desire to acquire knowledge beyond that which was required in their curriculum. We are pleased to number among our members some of the boys who benefited by that series of instructions, one of whom is now attached to the staff of the Royal Observatory and may aspire to attain fame in the realms of astronomical research.

A Fête des Nations was arranged by the Fairhaven Work Party in the City Hall on July 4, 1917, for the purpose of raising money to augment the Governor-General's War Fund. A total eclipse of the Moon was to take place that evening at a time when the Fête would be in progress. The opportunity of providing a unique sideshow was seized and the Association was asked to provide telescopes and demonstrators. Several of our members attended and, from the roof of the portico of the Corporation Street entrance to the City Hall, exhibited the eclipsed Moon and other interesting celestial objects and gave a running commentary on the exhibits.

At the meeting of September 12, 1917, it was announced that the Hon. Secretary, Mr. T. MacKenzie, had removed to Johannesburg. Mr. H. W. Schonegevel was appointed to fill his place until the Annual Meeting, when he was elected Secretary, an office he has since held continuously in the Cape Astronomical Society and afterwards in the Cape Centre of the Astronomical Society of South Africa.

The first of a series of Circulars of the Cape Astronomical Association appeared in 1918. It was composed of a paper read by Rev. Andrew Graham, afterwards a Vice-President, at a meeting held on April 10. The title of the paper was " An Evening in a Private Observatory." Copies of this Circular were sent to the "English Mechanic" and to the British Astronomical Association. These two Circulars had a most exciting adventure, the cause of which can be easily guessed from the state in which they arrived at their destination. The "English Mechanic" published the Circular in their issue of July 12, 1918, but with the last page and the greater part of the previous

page missing. The following footnote was added, which explains the mutilation: " We may add that this communication with several others received by the same mail has suffered by immersion in the sea, doubtless the result of some of Fritz's deviltries, and has suffered somewhat as regards legibility." The review of the Circular in the British Astronomical Journal contains these lines: " Mr. Graham discusses the various planets he observed in Mr. Reynecke's refractor, and under Mars, he refers to H. J. Klein's statement that ' We are forced to assume that Mars possesses a most highly civilised people, and that their culture is of older date than ours,' and he adds the comment that this is ' a graceful concession one expects will be revised. If Shakespeare is German, these Martians must have some discoverable relationship, and absorbed their ' Kultur ' on some telepathic principle.' Mr. Graham's paper on its passage to England itself absorbed some of the kultured under-sea processes. It was still damp and distinctly sodden on arrival."

The second Circular contained the Annual Report for the year 1917-18, and included the congratulations of the Association expressed by the President, Dr. J. Lunt, on the discovery of a new star in Aquila by Mr. R. Watson, of Beaufort West. The Circular also contained the first annual report of the Variable Star Section and the first report of the Comet Section. The Comet Report had for a dramatic conclusion an apology by the Director, Mr. William Reid, for being late, on account of having stayed at his observatory to verify his discovery of a new comet on the previous evening. This was Mr. Reid's first discovery and came at the last moment of his third year of searching.

Although this was the first fruits of the Comet Section it was not the first of the Association's discoveries. Dr. J. Lunt discovered a comet in Dorado on September 18, 1914. This comet was a naked eye object when first seen and remained so for several weeks. It appeared as a round nebulous object without a tail, somewhat similar in appearance to the star cluster Omega Centauri. The comet was discovered independently by Campbell at Arequipa and by Westland in New Zealand. Campbell's time was about 7 hours earlier than that of Westland, and the latter's about 9 hours ahead of Dr. Lunt's. A photograph taken at the Royal Observatory, Cape, shows a remarkable double nucleus.

The second cometary discovery of the Association was made by Mr. Clement J. Taylor at Claremont on December 2, 1915. This was a telescopic discovery. The

comet was in the constellation Orion and its magnitude was about 9½. Our Association was so little known in England then that it was reported that the comet was discovered by Mr. Taylor at the Royal Observatory. It was evidently thought that only at the Royal Observatory could there be any one so interested in the denizens of the heavens as to notice a new arrival. We have since had so much success in this field of discovery that the Cape is known throughout the world as the resort of comet hunters. There being no other claim for the discovery of this comet Mr. Taylor was awarded the Donohoe medal. Although searched for diligently the comet has not been seen at any subsequent return. Its period was computed to be about six years.

The third discovery was made without optical aid. Mr. John Warren, at Robben Island on April 14, 1917, was admiring the Zodiacal Light, when he observed a suspicious object near the eastern horizon in the morning sky. The sky was clouded in the direction of the comet, but there was no doubt about the nature of the object on the following morning. The comet was then very conspicuous with a tail extending for about ten degrees. Although this was not a new comet it amounted to a discovery. Mr. Warren was, as far as is known, the first in the Southern Hemisphere to see it. It had been discovered by Mr. Mellish on March 20 in the Northern Hemisphere when on the other side of the Sun. For some reason or other the discovery was not cabled to the Southern Hemisphere, so it was left to Mr. Warren to discover it for us. Independent discoveries in the south were made in Australia a few days later.

The third Circular of the Association was in the form of a paper on Saturn, read by Mr. A. W. Long at a meeting held on August 14, 1918. This Circular was reprinted in the "English Mechanic" of November 1, 1918.

The fourth Circular contained the Annual Reports for the Session 1918-19. The Comet Report included the discovery of Mr. Reid's second comet.

The fifth Circular was an account by the President, Dr. J. Lunt, of the Equatorial Sundial designed by him and erected at the Castle, Cape Town. This sundial, which is an attractive feature of the Castle grounds, is graduated in two-minute intervals and the time can be read accurately within half a minute. A table at the side gives the corrections to be applied for the equation of time. The dial figures are advanced 46 minutes, so that there is no correction for standard time apart from the equation of time. The sundial is in marked contrast

to the two ancient sundials on the walls of the Castle, which are divided into half-hour intervals. Dr. Lunt's designs were carried out by Mr. T. R. Miller, Mechanician to the Royal Observatory. The entire cost of the sundial was borne by the Rhodes Trustees.

The sixth Circular contained the Annual Reports for 1919-20 and an account of the occultation of Star No. 1460 (Cape Catalogue) by Saturn on the 14th of March, 1920. This was the only time a star had been observed to pass behind all the rings of Saturn, and being visible throughout the passage added an ocular demonstration to the theory of Clerk Maxwell that the rings are composed of an innumerable host of tiny satellites. Some doubt was cast on the accuracy of this observation when the news was first received in England. It was not, however, the observation of a casual observer, but was made by three skilled observers in conjunction, Messrs. W. Reid, C. L. O'Brien Dutton and D. G. McIntyre whose evidence is beyond dispute. It will not be out of place to quote Mr. Reid's own account of the observation:—

"The night was the finest we have experienced during the whole summer. The planet looked almost like a copper plate engraving. The ring could be seen crossing the planet as a thread of light, edged with a thin dark line on the outer side, and on the inner side by the Crape Ring, the jagged edge of which could be easily seen. The bands on the planet were plainly visible. Cassini's Division was distinctly seen and even conspicuous. When first seen the star was about equi-distant from the limb of the planet and the tip of the ring, and slightly above the ring. The contrast between the colour of star and planet was very marked, the star being a bright orange. This contrast in colour helped us greatly to determine the actual time of immersion. As nearly as we could judge, the first contact with the ring took place at 8.46 p.m., S.A. Standard Time. It was, however, difficult to make this observation owing to the acute angle between the path of the star and the ring, and the fact that the star seemed to shine with very little diminution of light even when behind the ring. While the planet was approaching the star, we thought the star would pass into the dark space between the ring and the planet, but this did not happen. The star disappeared from view behind the planet at 8.54 p.m. S.A. Standard Time; the point of disappearance was at the inner part of the bright ring or the outer edge of the Crape Ring. While the star was behind the ring its light fluctuated considerably and once gave a momentary flicker. When

disappearing, its light seemed to die out gradually until only a slight orange speck could be seen, the speck going out very suddenly. As the time of reappearance was uncertain a constant watch had to be kept. At 10.37 p.m. the small orange speck was detected at the spot where we expected it to emerge, but inside the limb. It gradually brightened up until it emerged. We watched it for nearly an hour afterwards. It seemed to be going straight towards Titan, but clouds came up and the whole sky became overcast, and we are unable to say whether the star was occulted by Titan as predicted."

The sixth Circular contained also the report of a new comet discovered by Mr. J. F. Skjellerup.

The seventh Circular consisted of a paper by Mr. T. MacKenzie on " Seventeenth Century Astronomy at the Cape," read at a meeting held on April 14, 1920.

The eighth Circular presents the Reports for the year 1920-1. The Comet Report gives the particulars of two new discoveries, Mr. Skjellerup's second discovery and Mr. Reid's third. This Circular contains a full list of the members of the Association at the date of the report, with an asterisk to denote the foundation members. Rules of the Association are printed for the first time in this number. This concludes the publications of Circulars by the Association.

During the year 1920-1 members began to feel that the title of the Association was a misnomer. When the Association was formed it was supposed that the membership would be comprised solely of those who were able to attend the monthly meetings held in Cape Town. Although the membership was still comparatively small, it was drawn from all parts of the country, including places as far distant as Rhodesia. Seeing that these distant members were recruited to the Association without any special effort on our part it was considered that the time had come when we might drop the local title and adopt one that would be more representative of the comprehensive nature of our Association and which would attract to it all those who were interested in astronomy throughout the length and breadth of the country. A change of name to one of a national character with alterations in the rules to make it possible for country members to receive benefit from their connection with the Association might well be expected to result in increased numbers and greater usefulness.

A proposal to change the name from the Cape Astronomical Association to the Astronomical Society of South Africa was made and a special general meeting was called to consider the proposal.

At a preliminary discussion in committee Mr. R. T. A. Innes, Union Astronomer and an Honorary Vice-President of the Association, who was present by invitation, drew attention to the fact that there was a Johannesburg Astronomical Association and suggested that negotiations should be entered into with them to amalgamate with the the Cape Astronomical Association under the title The Astronomical Society of South Africa. This was readily agreed to, Mr. Innes being informed that the reason this was not included in our proposal was that we had been under the impression that the Johannesburg meetings had been discontinued. This alone showed the necessity for bringing all the astronomical talent of the country into conjunction.

JOHANNESBURG ASTRONOMICAL ASSOCIATION.

It will be necessary now to trace the history of the Johannesburg Association, which may be looked upon as the offspring of the Cape Association. We find it recorded in the minute book of the latter that at a committee held on December 12, 1917, a communication was read from Mr. Theodore MacKenzie, who had removed to Johannesburg, resigning his position as Secretary and informing us that he had been asked to inaugurate an Association at Johannesburg. A resolution was passed at that meeting welcoming the project and wishing it success.

The first meeting in connection with the formation of the Johannesburg Association was held in the Unionist Party Club on February 26, 1918. Thirty-five were present. Mr. R. T. A. Innes was voted to the chair. It was resolved to form an astronomical association, and until rules were drafted and adopted the rules of the Cape Astronomical Association should be its rules. Mr. T. MacKenzie was appointed Secretary, and a committee consisting of Mrs. Moir, Messrs. Smyth, Green, Simpkins, Wood and Jackson was appointed to draw up rules and arrange for the first regular meeting. This took place on March 21, 1918, in the Unionist Party Club, when over a hundred were present.

Mr. R. T. A. Innes was elected President, Dr. Theodore Reunert and Mr. R. N. Kotzé, Vice-Presidents, Mr. T. MacKenzie, Secretary, Mr. F. Hall, Treasurer, and the following as members of committee:—Major J. P. Edwards, Mrs. Moir, Messrs. W. B. Jackson, H. C. Green, R. Simpkins and James Thom. Mr. Innes delivered a lecture at this inaugural meeting with blackboard sketches on "Points for Beginners."

From this time until September Mr. H. E. Wood delivered a course of lectures for beginners, which was

greatly appreciated and did good service in quickening the interest of those who were attracted to the meetings of the Association. Regular meetings of the Association were held in April, May, June, September and December, at which Messrs. Wood, Jackson, Worssell, Green and Dr. J. Moir lectured on subjects calculated to incite the members to prosecute the study of astronomy assiduously.

No meetings were held for some months afterwards owing to the illness of the Secretary, but on September 19, 1919, the Association was reorganised at a meeting held in the Committee Room of the Public Library. The President and Vice-Presidents were re-elected. Mrs. Moir was elected Secretary, Mr. Hall Treasurer, and Mesdames Moir and Wood, Messrs. Eaton, Green and Dr. Moir as committee. Regular meetings have been held since then, mainly in the Committee Room of the Public Library, but at times at the School of Mines.

After the annual meeting in April, 1919, the members adjourned to the Union Observatory at the invitation of the Union Astronomer, Mr. R. T. A. Innes, and spent a very instructive evening in the several departments of the Observatory. This visit was found to be so helpful to the Association that in the next year a quarterly visit was arranged through the kindness of the Union Astronomer. These visits were continued until 1926, when owing to the pressure of work at the Observatory they were reduced to two per year. These visits have done much to keep the members attached to the Association and have been of great educational value.

The Johannesburg Association sustained a severe loss in the death of Mrs. J. Moir in 1921. Mrs. Moir had been an active member of the Association since its inception, having served on the committee for three years.

At a meeting of committee held on Friday, July 22, 1921, a letter was read from the Cape Astronomical Association suggesting the amalgamation of the Cape and Johannesburg Associations. The proposal was favourably received and the Cape Association was asked to submit a scheme for their consideration. The committee suggested that whatever form the scheme took it should aim at the publication of an annual report or, preferably, a quarterly Journal, and that the local centres should be self-governing and elect members to the governing body of the Society.

THE CAPE ASTRONOMICAL ASSOCIATION (*Continued*).

Meanwhile the Cape Association had been revising their rules. The proposal to change the name of the

Association to the Astronomical Society of South Africa was withdrawn until it could be ascertained whether the Johannesburg Association would unite with the Cape under the suggested national title.

Circular No. 8, the last of those published, contained the amended rules. Bye-laws were now made for the first time. These were needed to arrange the procedure regarding the announcement of the discovery of a comet and for the regulation of loans from the Library and Lantern Slide Collection.

In order to have more funds in hand for publication the subscription was raised to one guinea, and lest this might prove a hardship to those who could not pay the increased fee the Association was to consist of members and associates, the subscription for the latter being at the old rate, half a guinea. The only disability under which the associates would suffer would be that they could not vote on proposals to alter the rules. In order to attract students and other young folk a clause was inserted to make them associates with an annual subscription of five shillings.

Realising that the Association could not be so helpful to country members as to those who were able to attend the monthly meetings, another clause was added to the effect that members and associates residing more than twenty-five miles from headquarters should pay half the ordinary subscriptions.

On receipt of Johannesburg's favourable reply to the proposal to unite with the Cape Association, the Council of the latter proceeded to the work of drafting a constitution for the new body. The Council of the Cape Astronomical Association consisted then of:—

President: Mr. A. W. Long.

Vice-Presidents: Mr. D. G. McIntyre and Mr. J. F. Skjellerup, the latter being also Director of the Variable Star Section.

Hon. Secretary: Mr. H. W. Schonegevel.

Hon. Treasurer: Mr. H. Stanton.

Director of Comet Section: Mr. William Reid.

Members of Council: Messrs. C. L. O'Brien Dutton, A. F. I. Forbes, A. Humphries and T. MacKenzie.

In all five Council meetings were held for this purpose, each lasting until about midnight. Messrs. Dutton and MacKenzie acted as a sub-committee to arrange the decisions of the Council and prepare draft rules for consideration.

It is perhaps sufficient comment on the result of the Council's deliberations to say that when the proposed constitution was submitted to the Johannesburg Asso-

ciation it was accepted without any amendment. A suggestion, however, was made and accepted by the Cape that the last bye-law relating to the discovery of a comet should be made to include any strange object. It was rather strange that the Cape Council should have overlooked the necessity for this, seeing that one of their members had already discovered a nova. The Constitution has stood the test of time as no alteration has been required during the seven years that have passed except a very minor one. The conditions in Clause iii of Article VII. were amended to enable Dr. Halm, who had removed to Stellenbosch, to be represented on the Council by an alternate. Dr. Halm's services to the old Cape Association and to the Society were so great that we could not allow him to get out of active association with us. The amendment was made unanimously.

Hitherto the Cape Association had as Honorary Officers the chiefs of the Royal and Union Observatories and their chief assistants, also Dr. A. W. Roberts, the leading non-professional astronomer in South Africa. One of the first decisions arrived at by the Cape Council was that no one residing in South Africa should be made an honorary member of the Society. It should be the duty and privilege of astronomers in South Africa to become active members of the Society and honorary membership should be reserved only for those distinguished astronomers in other countries whose interest in our Society was sufficient to warrant us in electing them. This proposal was put before the honorary members of the Cape Association, who readily approved it and signified their willingness to become active members of the new National Society.

The question of finance was settled by adopting the membership fees recently established by the Cape Association. The publications of the Society were to be the work of the Society's Council, and for this purpose and to defray the expenses incidental to the work at headquarters each centre is required to remit to headquarters one-half of the subscriptions received, the remaining half being retained for the local expenses of the centre.

The headquarters of the Society were fixed to be in Cape Town as the greater part of the membership is in the Cape, but provision was made for officers and members of Council in other parts of the country to be represented at the Council meetings by alternates.

The Astronomical Society of South Africa.

As it was considered inadvisable further to delay the amalgamation, now that there was complete agree-

ment between the two Associations, it was declared* that the Astronomical Society of South Africa had been established on the first day of July, 1922, by the union of the Cape and Johannesburg Astronomical Associations, which Associations ceased to exist as such, but are henceforth known as the Cape Centre and the Johannesburg Centre of the Astronomical Society of South Africa. It was also resolved† that "until the election of the first Council is completed the governing body of the Cape Astronomical Association shall act and have power as if it were the Council of the Society and as if the Constitution had come into force, and its officers shall act as if they were officers of the Society."

The fourth Wednesday of July was considered to be the best date for the annual meetings of the Society, and it was so decided‡, but as the constitutional formalities could not be completed in time it was agreed as a matter of urgency to accept the fourth Wednesday of August, 1922, as the date of the first annual meeting of the Society to elect officers and Council for the year ending June 30, 1923, and that, for the purpose of the first meeting only, the date in Article XIV. dealing with voting rights should read as if it were the 30th day of June.

The following officers and Council were elected at the first annual meeting:—

President: Mr. S. S. Hough, M.A., F.R.S., H.M. Astronomer.

Vice-Presidents: Dr. J. K. E. Halm, F.R.A.S.; Mr. W. B. Jackson, M.Sc.; Dr. A. W. Roberts, F.R.A.S.

Secretary: Mr. Theodore MacKenzie.

Treasurer: Mr. J. F. Skjellerup.

Members of Council: Messrs. W. Eaton, A. W. Long, F.R.A.S.; W. Reid, H. W. Schonegevel, H. E. Wood, M.Sc., F.R.A.S.; W. M. Worssell, F.R.A.S.

The two observing sections which had done such good work under the Cape Astronomical Association were continued. The Comet Section remained under the direction of Mr. Reid until his death in 1928. The work accomplished by it is too well known to require comment here. The lion's share was done by Mr. Reid, who for his work in this field of astronomy was awarded the Jackson-Gwilt medal and gift of the Royal Astronomical Society early in 1928. The discoveries of the section since its inception number fourteen. Six of these were made by Mr. Reid, five by Mr. Skjellerup, two by Mr.

*See Articles I. and II. of the Constitution.

†Article VI.

‡Article XIII.

Blathwayt and one by Mr. Ensor. An award of the Donohoe medal of the Astronomical Society of the Pacific was made for each of these discoveries.

To these may be added the re-discovery by Mr. Reid of D'Arrest's comet, when it was about to be placed on the list of lost comets, and the re-discovery of Pons-Coggia-Winnecke comet by Mr. A. F. I. Forbes, for which Mr. Forbes received the Donohoe medal.

The Variable Star Section continued under Mr. Skjellerup, but only for a few months, as he removed to Australia in May, 1923. Mr. Skjellerup has retained his membership in the Society and he discovered his last comet from his residence near Melbourne. A large amount of valuable work is credited to our Variable Star Section, although the members have never numbered more than three. The total number of observations made since the foundation of the section is over 25,000, 3,100 of these were made during the past year by the three observers, G. E. Ensor, H. E. Houghton and W. H. Smith. Mr. Skjellerup was succeeded by Mr. W. M. Worssell, of the Union Observatory, who was followed by Mr. W. H. Smith, of Plumstead. The present Director is Mr. G. E. Ensor, of Pretoria.

Three new sections were formed by the first Council of the Society. A Lunar Section, under Mr. W. B. Jackson, which failed for lack of observers. A Meteor Section, under Mr. D. G. McIntyre, which was abandoned for the same reason, but has during the past year been revived under the directorship of Mr. T. MacKenzie, whose first report will appear in the next issue of the Journal.

A Mars Section was formed under the control of Dr. J. Moir, of Johannesburg, which has done excellent work, particularly around the close opposition of 1924. Reports of this section, with drawings, by members are published in Journals Vol. I., Nos. 4 and 6, and Vol. II., No. 2. The members contributing to these reports greatly exceed in number those who have been attracted to the older sections and are scattered throughout the country as follows:—CAPE, Captain D. Cameron-Swan, Mr. M. Deas, Major Fox, and Mr. Bertram F. Jearey; NATAL, Mr. D. L. Forbes and Mr. C. F. Wickes; TRANSVAAL, Miss H. L. Troughton, Mr. T. Blathwayt, Mr. F. C. S. Haden, Dr. J. Moir and Mr. J. Werner. It may be mentioned that Mr. Jearey made in all more than a hundred drawings at the 1924 opposition, from which he made a composite map of the planet which appears as a frontispiece in Journal Vol. II., No. 2.

Dr. J. Moir was very energetic in directing this work and the excellent results are mainly due to his infectious enthusiasm. The Society mourns his death during the past year. He was a foundation member of the Johannesburg Association and one of its most active members, being a frequent lecturer at the monthly meetings. He was one of the Society's representatives on the South African National Committee. An obituary will appear in the next issue of the Journal.

A Computing Section was formed in March, 1928, under the directorship of Dr. R. T. A. Innes, with Mr. Theodore MacKenzie as Secretary. The aim of this section is to provide predictions of phenomena for observers at places for which such predictions are not otherwise furnished, to compute the orbits and ephemerides of comets and to instruct members in the use of astronomical formulae. The members of this section number fourteen, and predictions for the local circumstances of such occurrences as occultations of stars by the Moon, and eclipses of the Sun and Moon, have been supplied to observers as required. It is hoped that the Comet Section will give the Computing Section plenty of work by the discovery of new comets and the latter undertakes to keep the former supplied with information as to the return of cometary visitors.

It was hoped that the Society would be able eventually to publish a quarterly Journal, but this ambition has not been achieved. In order to enable the Society to have a fair start financially the Cape Association donated a sum of £8 towards the cost of printing the Constitution. Two numbers of the Journal were printed in the years 1923-5, but it was found impossible to continue this, and only one number, but of increased size, has been published in each succeeding year. In addition to the contributions from the two centres, according to the Constitution, donations towards the printing of the Journal have been received from each Centre, from several anonymous donors and from Dr. J. Moir, Captain D. Cameron-Swan, Messrs. Bert F. Jearey, H. C. Mason, and H. Sausenthaler. Another constant source of income has been an annual donation from the Natal Astronomical Association, to which the Society in return presents copies of the Journal for distribution among its members. The question of joining our Society as a Durban Centre has been under consideration by the Natal Association, but up till now it has not been possible to overcome some difficulties. Several of the members of the Natal Association have joined the Cape Centre, among whom are the Martian observers, D. L. Forbes

and C. F. Wickes, and we hope the time is not far distant when the whole of the Association will be absorbed by us to our mutual advantage and profit. It has also been suggested, now that Bloemfontein is favoured by the establishment there of two large observatories, that sufficient interest may have been awakened among the residents of that city to call for a Bloemfontein Centre of the Astronomical Society of South Africa.

Other publications of the Society include a Star Atlas for the use of beginners in the Southern Hemisphere with useful notes. This is the first and only Atlas to be produced altogether in the Southern Hemisphere. The Atlas was published at a popular price, just sufficient to cover the cost of production and to bring it within the reach of everyone. The financial risk involved was undertaken by the author. A small profit made on the sales of this book through the Cape Centre was devoted to the purchase of lantern slides and library additions. The first edition was quickly sold out and a second edition has since been published by Juta & Co.

Another very useful and popular publication of the Society is " A Universal Sundial," by Dr. J. K. E. Halm. This is a description of the universal sundial invented by the Author, with full instructions regarding its construction. " It is intended to provide farmers and communities in distant and isolated parts of this and other countries with a simple instrument, constructed on strictly astronomical principles, which can be manufactured and manipulated by any person unacquainted with astronomy, and which, from the position of the Sun in the sky at any moment of the day will show the time with only a small and practically negligible error not exceeding one minute." The sundial is of very simple construction, consisting of two pieces of wood at right angles, on which are pasted two diagrams marked with hour lines. The diagrams are supplied with the pamphlet. The style which casts the shadow consists of a thread, on which are two beads, whose shadow enables the observer to erect the sundial to suit any latitude. The book is in constant demand, and the Society benefits to the extent of half the profits made on its sale.

Presidents of the Society.

It was fitting that the first President of the Society should be Mr. S. S. Hough, His Majesty's Astronomer, who had been the Honorary President of the Cape Astronomical Association since its inception, and had been an unfailing source of strength to it. His inaugural address on " The Tides " will be found in the first number

of the Journal published in 1923. Unfortunately the second number of the Journal, published in September of the same year, was to contain Mr. Hough's obituary, for he passed away after great suffering borne with " patient cheerfulness and fortitude," on the 8th of July.

Dr. R. T. A. Innes, Union Astronomer, was our second President. Dr. Innes had been in sympathetic touch with the Cape Association from the very beginning. He was one of its Honorary Vice-Presidents, and had in many ways been of great assistance, especially in connection with the Variable Star Section, whose results be published in the Union Observatory Circulars. Dr. Innes was also the first President of the Johannesburg Association. He is still an active member of the Society, having recently undertaken the directorship of the Computing Section. His presidential address, "South Africa's place in the Advancement of Astronomy," is published in No. 4 of the first volume of the Journal. In it he referred to the International Astronomical Union, and regretted that there did not exist in connection with it a South African National Committee. This defect has since been remedied. The South African National Committee in Astronomy, although nominated by various scientific bodies, is composed almost exclusively of members of this Society. There are at present only two exceptions. The direct representatives of the Society are Mr. D. G. McIntyre and Mr. A. W. Long. To these will be added another to fill the vacancy caused by the death of Dr. Moir. Other members of the Society on the committee are:— Dr. H. Spencer Jones (Chairman), Dr. R. T. A. Innes, Dr. A. W. Roberts, Dr. J. K. E. Halm, Dr. H. L. Alden, Mr. H. E. Wood and Mr. W. H. Cox.

Our third President was Dr. J. K. E. Halm. The Cape Astronomical Association owed much of its success to the unselfish work of its first President, Dr. Halm. His numerous lectures and constant active assistance in all the details of the working of the Society made his removal to Stellenbosch in 1927 a severe loss to the Society. Dr. Halm still remains a member, but owing to his distance from the Cape Centre is unable to render the valuable assistance the Centre was accustomed to rely upon. One of his self-sacrificing labours for the advancement of the Cape Association was a class he carried on for a considerable time in his home for those of the members who wished to learn something of the mathematical side of astronomy. Dr. Halm's presidential address, " Present-day Problems of Astronomy," is published in Journal Vol. I., No. 6.

Dr. H. Spencer Jones succeeded Mr. S. S. Hough as His Majesty's Astronomer at the Cape in 1923, and soon after arrival joined the Society. He has since been a very active member and a tower of strength to the Society. The Council wished to nominate him to succeed Dr. Halm in the Presidency, but he very considerately suggested that the honour should be given to Mr. Reid in consideration of his valuable work in the cometary field, which had brought the Society into international prominence. He also suggested that an amateur and a professional should as far as possible be elected alternately.

Mr. William Reid therefore became our fourth President, and for his year of office Dr. H. Spencer Jones accepted the humbler position of Chairman of the Cape Centre. Mr. Reid's election was undoubtedly a popular one. He was one of the small inner band which was responsible for the growth of the Society from the beginning. He had served in many capacities during the progress of the Society. He had charge of the Meteor Section, then the Variable Star Section, and from its beginning he was Director of the Comet Section, which under his care prospered exceedingly. He frequently complained about the lack of observers, but he was a host in himself, and he was greatly delighted that assistance began to come when he became incapacitated for work. Mr. Reid's death in 1928 was a great blow to the Society, those who came into personal touch with him mourning his loss as that of a friend. His presidential address, "Amateur Observations with a 6-inch Telescope," is published in Journal Vol. II., No. 2. His obituary is published in the next number of the same volume.

The fifth President was Dr. H. Spencer Jones, His Majesty's Astronomer. To detail the services of Dr. Spencer Jones to the Society would occupy more time and space than we have at our disposal. From the moment of his arrival in this country he has been a powerful factor in the life of the Society. He has served continuously on the Council and his presence at its meetings has inspired the members with confidence in the future usefulness of the Society. The Cape Centre is highly favoured in having so distinguished an astronomer as an active member, and his lectures on the deeper mysteries of astronomy are followed with the keenest interest and profit. Dr. Spencer Jones has been the editor of the Journal since 1925 and from that time all the reviews with one exception are from his pen. Besides his work in and through the Society he has by his numerous articles in the Daily Press and by popular lectures

awakened a general interest in astronomy by placing before the public in language easily understood the wonderful achievements of astronomical research. His presidential address on "Stellar Evolution" is published in Journal Vol. II., No. 2.

Senator Dr. A. W. Roberts was the sixth President. Dr. Roberts is undoubtedly the most distinguished non-professional astronomer in South Africa. His pioneer work on southern variables is of world-wide repute. He was elected an Honorary Vice-President at the first meeting of the Cape Astronomical Association, which position he retained until the formation of the Society, when he was elected a Vice-President and remained in this office until his election to the Presidency. Distance at first and afterwards his Parliamentary duties prevented him from attending many of our meetings, but he always evinced a keen interest in the welfare of the Society. When the Variable Star Section was formed he met the two observers by appointment at the Royal Observatory and gave them valuable instruction in the work. His own herculean efforts in this field have been a constant inspiration to our members. Dr. Roberts's presidential address on "Variable Stars" is published in Journal Vol. II., No. 3.

The seventh President is he who now presents this short sketch of the Society's history to you.

The President-elect is Mr. H. E. Wood, Union Astronomer. Mr. Wood was an Honorary Vice-President of the Cape Association and was ever ready with his valuable aid when service was required of him, particularly with regard to the Comet Section. He computed orbits for all the comets discovered by the Section and kept the Director supplied with ephemerides, himself keeping the comets under observation when they had passed beyond the limits of small telescopes. The funds of the Cape Association benefited considerably in 1919 from the proceeds of a public lecture given by Mr. Wood on "The Depths of Space" in the Y.M.C.A. Hall, Cape Town. Mr. Wood was a foundation member of the Johannesburg Association and has been of inestimable value to it as a lecturer at its meetings and in numerous other ways. He was Editor of the Society's Journal from 1922 to 1925, during which period he contributed the Book Reviews and several valuable articles.

Secretaries, Treasurers and Honorary Members.

The hardest worked official of the Society is, of course, the Secretary. We have been fortunate in having had in that office those who spared not themselves, but

gave of their best for the welfare of the Society. The first Secretary was Mr. Theodore MacKenzie, on whom fell the heavy work in connection with the launching of the Society. Mr. MacKenzie removed to Grahamstown at the end of the first year. Since that time Mr. MacKenzie has contributed monthly notes and other astronomical articles in Afrikaans to "Die Burger" and these have been instrumental in adding to our membership. The secretarial work was carried on effectively in the following year by Mr. C. L. O'Brien Dutton. He too removed from Cape Town, and our present Secretary, Mr. H. E. Houghton, was elected to succeed him. Mr. Houghton has occupied the position with marked ability for five years. He not only finds time for the numerous secretarial duties, but is a frequent lecturer at the monthly meetings of the Cape Centre and a diligent observer of variable stars. His observations for some years have exceeded a thousand per annum.

The first Treasurer of the Society was Mr. J. F. Skjellerup, but he removed to Australia after a few months of office. His place was taken for the remainder of the year by Mr. A. F. I. Forbes. Mr. W. H. Smith was appointed Treasurer in 1923, and has continued in that office until the present time. During the years 1924-6 he directed the Variable Star Section and is one of the three present members of that section, each of whom contribute over a thousand observations each year.

The number of Honorary Members of the Society is limited to ten. Until recently only one election had been made, that of Dr. L. J. Comrie, whose services to the Society were considered by the Council to entitle him to the honour of being our first Honorary Member. At their last meeting the Council, wishing to celebrate the visit of the British Association to South Africa this year, elected as Honorary Members Sir Frank Dyson, Professor Eddington and Professor De Sitter. Our new Honorary Members and other eminent astronomers from overseas were the guests of the Society at a Conversazione held in the Oddfellows' Hall, Cape Town, on July 26.

The Cape Centre.

When the Society was formed in 1922 the Cape Centre was fortunate in securing Dr. J. K. E. Halm as their Chairman. Dr. Halm was President of the Cape Astronomical Association for the first two years of its existence and for an equal period he controlled the Cape Centre. On his removal to Stellenbosch the members of the Cape Centre and of the Council of the Society

THE JOHANNESBURG CENTRE.

The first Chairman of the Johannesburg Centre was Mr. W. B. Jackson, a foundation member of the Johannesburg Association, and a frequent lecturer at the meetings. Observational meetings have been held at the residence of Mr. Jackson from time to time. Mr. Jackson occupied the chair again in 1925-6.

The Chairman of the Johannesburg Centre in 1923-4 was Mr. J. D. Stevens. Mr. Stevens was an enthusiastic member of the Johannesburg Association, contributing liberally to the syllabus. He is now the very efficient Secretary of the Centre.

Mr. W. M. Worssell was Chairman of the Johannesburg Centre during the year 1924-5. Since the foundation of the Johannesburg Association Mr. Worssell has done much to forward the interests of the Association and of the Centre. He is frequently called upon to lecture at the meetings. Mr. Worssell was the Director of the Variable Star Section of the Society from 1922 to 1925.

The Chairman of the Johannesburg Centre for 1926-7 was Mr. Alex. Forrest, a loyal member of the Centre and one who on occasion has placed his residence at the disposal of the members for an observational meeting.

Miss H. L. Troughton was Chairman of the Johannesburg Centre in 1927-8. Miss Troughton was formerly (when she resided in Natal) a member of the Cape Centre. On taking up her residence in Johannesburg she transferred to that Centre and immediately became an exceedingly active member. She was Secretary of the Centre for the year 1926-7, succeeding Mr. W. Eaton, who occupied that position for the preceding four years.

The Treasurer of the Johannesburg Centre from 1922 to 1925 was Mr. F. B. Hall, and since 1925 Mr. W. Geddes has occupied that office.

MEMBERSHIP.

The numerical strength of the Society when formed was 61; of these 43 were members of the Cape Centre and 18 members of the Johannesburg Centre. The Cape membership has grown to 95 (86 members and 9 associates) and that of Johannesburg to 33 (28 members and 5 associates). It is very gratifying to record this steady growth, but it is most desirable that all members should be on the look-out for new recruits. We require a larger membership to extend our activities and, as stated in the Council's report, to put our finances on a sounder basis.

Although we would wish to see the Society increase numerically, which no doubt will happen, we need not wait for an increase in numbers to extend our usefulness. At present the activities of the Society are carried out by fewer than 25 per cent. of our membership. An increase in this percentage of workers is all that is required to make our Society a greater factor in astronomy. What we want is perhaps not so much more members as more workers among the members we already have. If all our members would attach themselves to one or other of the working sections what a great amount of valuable work could be done. The novice is very timid at undertaking observational work, but it is wonderful how soon a working knowledge may be obtained by anyone who will seriously apply himself. I remember how shy Mr. Ensor was about starting variable star work, and yet we find him in the short space of three years undertaking the Directorship of the Variable Star Section.

There is plenty of choice for all in the Sections already formed. Those who do not mind hard grinding work, if there is the prospect of a delightful thrill somewhere ahead, should join the Comet Section. What can equal the sensation which is the result of the discovery of a new comet? To see something that no other mortal has gazed upon is surely worth some plodding work, not to speak of the satisfaction of having added to the world's knowledge of celestial things. A wonderful knowledge of the heavens is the inevitable result of comet searching.

Those who prefer immediate results will find much interest and fascination in the observation of the light changes of variable stars. They will also acquire a good knowledge of the constellations and perhaps, like Mr. Ensor, pick up a comet by the way.

Members who are mathematically inclined will find scope for their talents in the Computing Section, while the artist will have great delight in depicting the features of the planets which come within the range of his telescope.

It is not necessary to have a telescope to do important work. A member who is so placed can be extremely useful in making observations of meteors, of the Zodiacal Light and of the early visibility of the new Moon. He will acquire an accurate knowledge of the constellations and of the movements of the planets across them, and will be in a position to recognise and herald the appearance of a new star.

There is interesting work for every member according to his taste, and if all will apply themselves diligently in their chosen spheres the continued prosperity of the Society is assured.

[Any account of the Society's activities would be incomplete if mention of Mr. Long's own services was not made. Mr. Long was a foundation member of both the late Cape Association and the present Society of South Africa. He has served continuously on the Council, first of the Association and then of the Society, from the inception of the Association to the present day. During the war the revival of the Association was due to his efforts. Most of the Committee meetings of the Association, including the protracted series during which the Constitution of the Society was framed, were held at his home, which has always been the meeting place of the Cape Centre's Committee as well. He has been an indefatigable contributor to the Press: his Monthly Notes in the "Cape Times" have a circulation throughout the Union, and are often quoted by journals overseas. His Star Atlas for southern latitudes is a standard work which has reached a second edition; and from the proceeds of the sale of this Atlas the late Association received material benefits. Mr. Long's star maps are also to be found in Philips' New Large Print Atlas for South Africa. Mr. Long is virtually the founder of the Variable Star Section and has contributed over 4,000 of his observations to its records. He obtained for this section the use of a 6in. refractor at the Royal Observatory. Throughout the whole existence of the Association and the Society Mr. Long has occupied an unique position in that he has been the intermediary between the Observatory and amateur observers in South Africa. South African amateurs are beholden to him, too, in that his time has always been at their service. Mr. Long has been associated with the first and present editors of this Journal, on the Committee of which he has served continuously, and to which he has contributed on more than one occasion.—Editor.]

LUNAR CRATERS AND THE VOLCANIC EXPLOSION THEORY.

By H. C. Mason.

(Read at the Meeting of the British Association for the Advancement of Science, Cape Town, July 25th, 1929.)

The origin of the lunar craters is one of the few admitted enigmas of astronomy which have not yet attracted the attention of mathematical experts. But the neglect of one unsolved problem sometimes means that the key to others is missing also. The moon, for instance, is a sort of experimental station supplied by

nature for the control of geophysical theory, in which certain of the most familiar terrestrial conditions are altered. The theory which follows shows (if accepted) that our satellite is probably not far removed from the margin of stability for the smaller planetary bodies, that between it and the minor planets there is a gap in size which is probably no accident,* and that the moon may in past times have contributed a substantial portion of its bulk to the meteoritic population of the inner portion of the solar system.

The volcanic explanation of the lunar craters suffers from the disadvantage of being too obvious. Moreover, it has to explain the astounding difference in scale and appearance between the largest lunar craters and the largest terrestrial volcanoes. It is a far cry from Etna and Kilauea to Clavius, with a diameter of 140 miles, and Maurolycus, with its 150. It seems absurd to suggest that forces of similar origin and intensity could have produced such divergent results on two bodies so near of kin and so closely associated. Not only does it seem absurd, but eminent authorities have even assured their readers that it really is absurd.

Perhaps the most celebrated advocate of the volcanic explanation of the lunar craters was Nasmyth, the engineer and inventor, who contented himself, however, with a qualitative exposition of his theory. He pointed out that the moon has no appreciable atmosphere to resist the motion of ejected volcanic materials, and only one-sixth of the force of terrestrial gravity to bring a projectile to the ground, but seems to have overlooked the possibility that this important relative constant, six, might turn up, not once, but many times, when the corresponding phases of typical lunar and terrestrial eruptions are followed up, entering in the resulting equations not to the first power only, but to much higher powers.

A simple mathematical treatment of the subject shows that all three dimensions of space, as well as the dimension of time, enter the calculation. A more graphical and illustrative exposition of the theory was published recently in the Journal of the Astronomical Society of South Africa (Vol. 2, No. 3, 1928); but there has been some advance in the author's views since that date.

The crux of the whole question is an obvious consideration, namely, that on a planet with less attractive power than that possessed by the earth, the superficial

*Exceptions beyond the orbit of Jupiter may be due to a fundamental difference in constitution.

strata, if composed of similar materials, would weigh proportionately less. Hence a like intensity of eruptive force would be capable of breaking through from a proportionately greater depth. This would be still more the case if the smaller planet were composed of less dense materials. But at this greater depth, the radius of the quasi-circular area broken through would have to be correspondingly greater also, because the resistances to be overcome would act along the vertical wall of an imaginary cylinder (extending from the base of the explosion to the planet's surface), whereas the lifting force would act upon its base.

Let y be the depth of the eruption, and r the radius of the cylinder. Then the relation $\pi r^2/2\pi ry$, *i.e.*, $r/2y$ must be constant and therefore r must vary as y.

In the case of either planet the radius of the eruption will be limited by the principle of least work, but the limit set by that principle will be proportionately greater on the smaller and lighter planet. Hence the relative constants of superficial gravity and superficial density, as between the earth and the contrasted planet, will enter into all three dimensions of space, and therefore to the third power, in comparing the size of two volcanic pipes, or tubes of eruption, formed by the escape of analogous forces of equal intensity.

This consideration taken alone would give to the scale of a lunar eruption, compared with a parallel terrestrial eruption, the dimensions of a cannon compared with those of a musket. But if the assumption of equivalent intensities of force (as contrasted with the quantities of energy brought into play in a given time) is carried throughout the whole operation, it can be shown that the dimension of time is also involved in the work of distributing the ejected materials, which is accomplished by an eruption prolonged in the critical phases in a similar proportion to the spatial dimensions. Finally the frictional resistance to the movement of bodies over the surface of the moon, or the lesser planet, would be reduced in a corresponding proportion to their reduced weight.

Thus the relative constant of superficial weight, due to the reduced force of gravity and probably in the case of the moon to reduced density of material also, enters the argument no less than five times. All other conditions being assumed to be similar, and calling this combined relative constant K, we can thus account for the formation on the moon, or lesser planet, of a crater of eruption containing in its encompassing wall K^3 times the amount of ejected material compared with that formed on the earth, or larger planet. This ejected material, moreover,

will have been forced over the surface to a relative distance from the centre of the orifice of the order K^2 times.

The relative constant of superficial gravity, comparing the earth with the moon, is about 6.07. For very deep-seated eruptions this figure would require to be modified, but would still be of the same order. The mean density of the moon is only three-fifths of that of the earth, and although this probably does not apply to the superficial strata, it is a fair assumption that over portions of the moon's surface, at any rate, the rocks are less dense than ordinary terrestrial rocks. Hence, for the major craters on the moon, the value of K cannot be less than 6, and may be considerably more.

These figures are of the order required to account for the largest lunar formations, commonly known as craters, as being due to volcanic forces. And not only are their huge dimensions accounted for, but also their characteristically greater width in relation to the height of the encompassing wall.

It is well known among geologists that only the most recently formed volcanic cones survive the processes of denudation on the earth, whereas on an airless planet nothing could be expected to obliterate a crater, once formed, except fresh convulsions from below. Hence the vast accumulation of crater-forms on the moon may be simply the long result of time, proving little or nothing as to the frequency with which they were formed. One new crater per millenium would account for a million formed in 1,000 million years, thus affording an ample allowance for casualties to earlier craters.

The same relative constant of superficial weight would act in the opposite way in comparing that other great mountain-building agency found on the earth, compressional folding, with a like force supposed to act on the moon. The moon's feeble gravity, and the greater arch-strength of its superficial curvature, account for the apparent success of its strata in resisting the formation of mountain ranges by this process. Whatever the origin of the lunar mountain ranges, they do not clearly resemble folded mountains. Perhaps the principle of Isostasy may hereafter throw some light upon them.

The above considerations may be used to account for the lunar craters to a considerable degree of detail. Just as on the earth there is a natural gradation of volcanic, or quasi-volcanic, forms: from the eruptions on the surface of cooling slag or lava, through fumaroles and parasitic cones to giant volcanoes; so on the moon there is a similar gradation on a larger scale. And just as the largest volcanoes are the fewest in number, and

so on downwards, likewise on the moon there is a remarkably regular gradation, with steady increase in numbers as the sizes grow less, from the giant walled plains down to the smallest visible craters. As Philip Fauth, a strenuous opponent of all plutonic theories of the lunar craters, has remarked, this regular gradation must be accounted for by any acceptable theory.

On the present view this gradation is readily accounted for, because crater-forming explosions from the limiting depth (whatever that may be) are inevitably rare. If in accordance with some natural law the superheated magma has at various times occupied all depths between the surface and this maximum limit, we should expect just such a steady increase in the numbers of the craters as the dimensions grow less.

The cones and lava-fields surrounding the orifice of a terrestrial volcano are usually the fruit of a long period of intermittent activity, ending perhaps in the final choking of the pipe and diversion of the volcanic activities into a new direction. This protracted activity seems to follow naturally from the relative smallness of the orifice compared with the dimensions of the subterranean mass of magma. Assuming a similar mass of magma on the moon, the initial eruption would provide a much ampler avenue of escape for the lava, first into the huge pipe or throat, then into the widened aperture or crater of explosion, and finally over the ring-plain surrounded by its distant rampart. Hence the formation would be clearly defined by the initial blowing-out of the rampart and by the materials cast upon it in the course of the first eruption. In the subsequent period of protracted quiescence, the original orifice would close, entailing the formation by later paroxysms of new craters at the nearest points of weakness.

The distinction made by selenologists between "walled-plains" (usually the largest formations after the "maria" or "seas") and "ring-plains" may be accounted for by the magnitude of the eruptive effort in the former case. The supply of eruptive gases may be supposed to have failed before the ejected materials could be swept away completely into a neat and regular ring, and the outflowing lava, after melting down the central portion of the ejected matter, would be brought to a stop against a rugged and irregular wall.

Probably the central mountain, which forms so common a feature of the lunar craters, is not a volcanic cone in most cases, but the remnant of that portion of the core of the pipe which was thrown up vertically, and owing partly to the expansion in volume of all frag-

mentary materials and partly to the rapid rise of the lava, has been unable to return.

The shallower type of crater-formations, or "ring-plains," would be accounted for as follows. An essential part of the present explanation is the lateral explosion-wind at the surface of the planet, caused by the relative ease of escape of the exploding gases in a horizontal direction, compared with the effort of lifting still higher the mountainous mass of material expelled from the volcanic pipe below. The pressure of this lateral surface-explosion may blow out a deep cup-like aperture at the mouth, or a shallow saucer-like aperture, according to circumstances. In the latter case, the explosion-wind does its work in driving a smaller quantity of material to a greater distance from the aperture; in the former we get a typical crater, with deep aperture, high walls, reduced diameter, and frequently a large central mountain.

It will be seen from the above suggestions that the proper terrestrial analogy on the present theory with the lunar craters, and that on a greatly reduced scale, is the first formation of a volcanic mountain, not its subsequent ordinary eruptions. The fact that there is no mathematical perfection in the circularity of the lunar formations is only to be expected, and the peculiar appearance of the edges of many circumvallations (such as Copernicus, for instance), resembling upturned planetary skin or folds, supports the view here put forward. The lightness of the strata and magnitude of the lifting force account for a degree of overturning not commonly observed in terrestrial craters.

Radial or concentric cracks associated with the craters are readily explained, and the frequent disposition of the craters in chains, as if following a line of weakness in the crust,, or in parasitic groups around an earlier orifice, are typical volcanic phenomena.

Space forbids speculation further as to the reason why encroaching craters are nearly always smaller than those encroached upon, though interesting possibilities are suggested by this question; and although the white rays are perhaps more suggestive of explosive violence than any other conspicuous lunar phenomena, it is necessary to conclude without taking up that much disputed subject.

The present theory at least provides an answer to the usual objections to a volcanic explanation of the craters. After all, no other hypothesis is in need of less assumptions than this, while some of the suggested alternatives require new laws of nature to be discovered.

THE GREAT SOUTH AFRICAN METEOR of July 27, 1928.

By A. King, F.R.A.S.

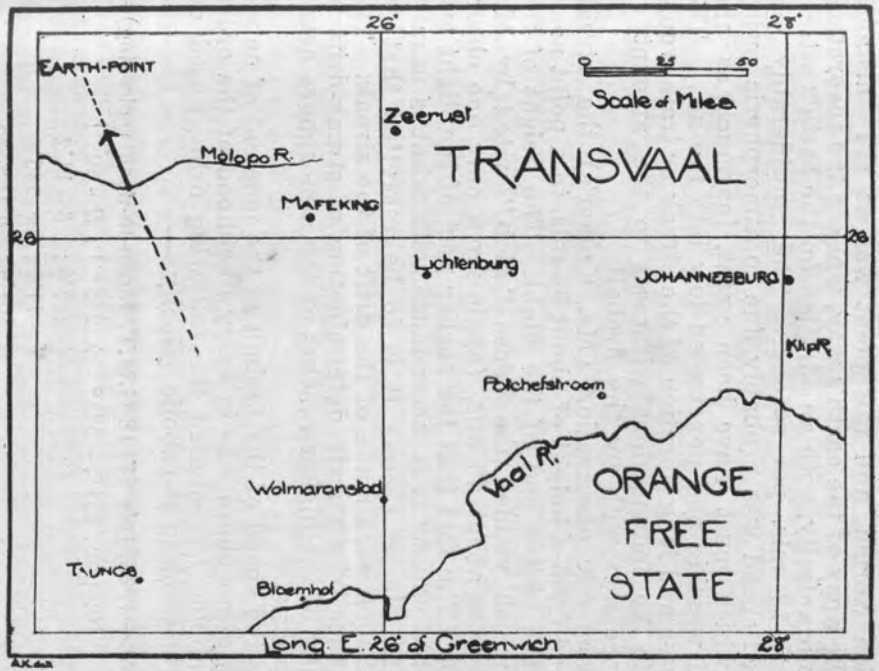
1. *The Observations.*—These were 8 in number, and were distributed in places over the S.W. corner of Transvaal, from Johannesburg down to the border. Some of them were of little or no use, except as confirmatory of the other observations.

The time of the meteor's fall is given variously, but the mean works out near that noted by Mr. L. Parker, at Johannesburg, from a public clock. This time—6h. 23m. p.m., S.A.T.—was therefore adopted.

No definite estimation of the fireball's brightness appears to have been made, but the object was undoubtedly very brilliant. It left a dense streak along its path. This streak was variously estimated to last from 4mins. to 20mins., and it quickly took on a very crooked form, due doubtless to cross-currents at different heights in the atmosphere. Mr. and Mrs. J. Keet, at Potchefstroom, noted the colour of the streak as white. These same two observers saw the fireball burst at least twice, and where it burst the streak was broader and denser. Mr. J. J. Kruger, at Elandsputte, near Lichtenburg, drew a diagram of the streak, and his sketch shows one of these denser patches at about half-way. Mr. L. Parker, at Johannesburg, noted the apparent path accurately with regard to Tattersall's building, and the bearing of the building from the observer's station was afterwards determined by a representative of the Johannesburg Observatory. We owe a debt of gratitude for this kindly act, for it enabled the azimuth-lines of the observation to be laid down with great precision, and thus contributed in no small measure to the pretty exact result obtained for the fireball's real path. Mr. L. P. Nigrini, of Zeerust, also sent a very useful diagram. Mr. D. J. Strydom, near Bloemhof, saw the meteor descending vertically due N.N.W. On plotting these three observations on a celestial globe, the radiant-point was found to come out very definitely, the backward prolongation of the apparent tracks meeting nearly in a point. This definite fixing of the radiant brought about, in conjunction with the observations, the determination of the real path with an accuracy very rarely encountered in such cases.

2. *Real Path.*—Radiant, 231°—50°, in azimuth 22½° E. of S., altitude 63° (from middle point of base).

For the luminous part of the flight: Meteor began 74 mls. high nearly over the Molopo R., 55 mls. 7° N.



The map only shows places where observations were made, except in the case of Mateking and Taungs which were added to indicate the position of the fireball.

of W. from Mafeking (or 121 mls. due N. of Taungs). Meteor ended 33 mls. high, 67 mls. W.N.W. of Mafeking (or 90 mls. due W. of Zeerust). Length of path, 46 mls., velocity 8 (or 8½) mls. per second. Earth-point, 17 mls. ahead of end-point of base, or 79 mls., 31° N. of W. of Mafeking.

The observed radiant-point, 231°—50°, corrected for zenith-attraction, becomes 234°—52½°, in the constellation Norma, and this point was at 137° distance from the apex of the earth's way, whence the theoretical parabolic velocity, with an addition for the earth's attraction, is 11¾ mls. per second. The considerably less observed speed was probably due to atmospheric resistance, which must have been great, inasmuch as the fireball was big and penetrated low into the air. The denseness and long duration of the streak or train would seem to be independent witnesses to the amount of resistance met with by the fireball.

From one observation (Mr. Kruger's) the streak extended from a height of about 64 mls. to a point near, or at, the visible end of the flight. The height of the burst which yielded the dense "blob" noted by Mr. Kruger was about 50 mls. (again from only one observation). The fact that the earlier part of the flight left no visible vapour is in accordance with what is usually noted in similar cases. It is to be regretted that no observations were made of the drift of the streak. The importance of accurate determination of streak-drift in the study of the higher reaches of the atmosphere needs no emphasis.

As the speed of the fireball at the moment of entering our atmosphere was in every likelihood of the order of parabolic, I computed the following orbit, based on the assumption of parabolic velocity:—

Date.—1928, July 27, 18 G.M.T. (noon-to-noon reckoning)—

Radiant, 234°, −52½° λ 245°·1; β −32°·1
l 223°·8; δ −11°·2
i 11°·4; π 323°·0
Ω 304°·4; q 0·9888

where L = longitude of apex of earth's way
λ, β, = longitude and latitude of corrected observed radiant
l, δ = ,, ,, ,, ,, true radiant

and i, π, Ω and q have their usual meaning, namely, inclination of orbit, longitude of perihelion, longitude of ascending node and perihelion distance (earth = 1) respectively.

The radiant-point is especially important, as our knowledge of southern meteoric centres is so meagre.

Astronomical Society of South Africa.

SESSION 1928-1929.

Annual Report of the Council.

The Council in presenting its report for the Session 1928-29 is again able to record a successful year in the history of the Society. The membership at the 30th June, 1929, stands at 118 members and 14 associates.

The retiring President, Mr. Arthur W. Long, F.R.A.S., will take as the subject of his Presidential Address the foundation and development of the Society. The Council would like to take this opportunity of expressing its very great appreciation of Mr. Long's services to the Society, both as President and as Member of Council and also of his untiring activity in promoting the work of amateur astronomers in South Africa and in sustaining the interest of a wide circle by means of notes and articles in the Press.

During the year under review the Council has met four times, those members residing away from Cape Town being represented by their alternates. Mr. D. G. McIntyre was nominated to represent the Society on the South African National Committee in Astronomy in place of the late Mr. W. Reid. Friendly relations have been maintained with the Natal Astronomical Association.

As in previous years, one number of the Journal (Vol. 2, No. 3) was issued. The regular issue of a Journal is one of the main objects of the Society. The other objects mentioned in the Constitution are the encouragement and stimulation of the study of astronomy, the association and organisation of observers, and the dissemination of current astronomical information. The Council is seeking to further all these objects, but the first-named, the publication of a Journal, is perhaps the most concrete of them and is proving the most expensive. Our present resources (as will be seen from the current financial statement) are almost entirely devoted to this end, and it is felt that unless more funds are available some curtailment of the size of the Journal will be necessary. This course would be taken with great reluctance. The other solution of the difficulty would be an appreciable increase in the Society's membership, thus providing a greater margin between revenue and expenditure which could be used to promote the other objects of the Society.

The Council desires to express the Society's thanks to the authorities at the Royal and Union Observatories for their continued courtesy. During the Session, Dr. H. Spencer Jones, H.M. Astronomer, and Dr. R. T. A.

Innes, late Union Astronomer, attended the meetings of the International Astronomical Union at Leiden and the Astronomische Gesellschaft at Heidelberg. The large gatherings on these occasions demonstrated the very wide interest in Astronomy which exists and the contributions to its advance which are being made in all parts of the world. The increase in the number of professional astronomers in South Africa in recent years has been notable, and this feature, so far from diminishing the value of amateur observation, has shown the excellence of our climate and the existence of a fine atmosphere, both physical and scientific, in this country. The forthcoming meeting of the British Association should give an impetus to scientific thought and work in South Africa. We extend a hearty welcome to the several distinguished astronomers who are visiting this country.

The Council records, with much regret, the death on the 30th April, 1929, of Dr. James Moir, M.A., D.Sc., F.C.S., a distinguished chemist in the Mines Department. Dr. Moir was a foundation member of the Society and had served since its inception as Director of the Mars Section. His study and knowledge of the features of Mars were extensive, and his able reports, contributed with commendable promptness after each recent opposition, have added much to the interest of the Journal. Dr. Moir had also served on the Committee of the Johannesburg Centre and was one of the Society's representatives on the South African National Committee in Astronomy. His place the Society will find it difficult to fill.

The Observing Sections have continued their work during the Session. The Council appointed Mr. A. F. I. Forbes as Director of the Comet Section in place of the late Mr. Reid, and Mr. Forbes has already shown that the work of the Section will be well sustained and that South Africa will retain its lead in comet discovery. The comet discovered by Mr. Forbes in 1928 had escaped the observation of astronomers in Europe and North America, for whom it had been very well placed earlier in its path. The Variable Star and Computing Sections have also shown good activity; the Meteor Section has been revived under the Directorship of Mr. T. Mackenzie. The Council would urge that an increasing number of members and associates should join one or more of the Sections and thus undertake definite work for the Society.

A cordial invitation is given to all persons in South Africa who are interested in Astronomy to apply for particulars of membership to the Honorary Secretary of the Cape Centre (P.O. Box 2061, Cape Town) or to the Honorary Secretary of the Johannesburg Centre (P.O. Box 2402, Johannesburg), who will be pleased to supply the necessary information.

REPORTS

FOR THE YEAR ENDED 30TH JUNE, 1929.

COMET SECTION.

Owing to the sickness and death of Mr. William Reid, the late Director of the Comet Section, no report was published last year. This report therefore covers the period from the 30th June, 1927.

We very much regret the loss of Mr. W. Reid. His example and enthusiasm were an inspiration to all workers in the Section. In the difficult art of comet finding he had no equal in his generation. Now that his hand and telescope are still, we feel it is our duty to endeavour to carry on his work and try and maintain, though in a small way, the reputation he brought to the Society and to South Africa.

The two years under review have been remarkable for the small number of new comets reported from any part of the world, only five discoveries having been made. Three of them were found on photographic plates exposed by those engaged in the work of searching for minor planets. Being faint they were beyond the reach of small telescopes. The other two were discovered by members of this Society.

The Southern sky has been well watched by members of the Section, and it is fitting we should mention the work done by members. That indefatigable worker, Mr. T. B. Blathwayt, of Johannesburg, reports that, since the beginning of January, 1928, he has spent 180 hours in systematic searching. It is hoped that his efforts will soon be rewarded and encouraged by more discoveries. It is evident by results that Mr. J. F. Skjellerup keeps a watchful eye on the sky. During the last eighteen months your Director has endeavoured, though sometimes not very thoroughly, to cover what he can reach of the Southern sky once a month.

We are indebted to our Computing Section for giving us much help through search ephemerides for expected comets, and for keeping us in touch with new comets. We thank all who have helped and we have especially to thank the Directors and Staffs of the Royal and Union Observatories for their cordial encouragement and assistance.

The following particulars are given of comets for the period under review. Acknowledgment is made of information taken from the Monthly Notices of the R.A.S. and from the B.A.A. Journal.

Comet 1927 h (Encke's Periodical).—This comet returned to perihelion on 19th February, 1928. It was detected by Professor G. van Biesbroeck on 13th November, 1927, when it was magnitude 16. An ephemeris was published locally, but no report of its having been seen by any one of our Section has been received.

Comet 1927 j (Schwassmann-Wachmann).—A new comet of the 14th Magnitude was discovered by Professor A. Schwassmann and Dr. A. Wachmann on 15th November at Bergedorf. Its position was then given as R.A. 1 hour 32 minutes, Declination 20° 43′ North. There is no record of its having been seen by any of the members of this Section.

Comet 1927 k. (Skjellerup).—A new comet of the 3rd Magnitude was discovered on 3rd December by Mr. J. F. Skjellerup, one of our members, residing at Melbourne, Australia. At discovery it was not many degrees away from the Sun, but was easily visible to the naked eye. In the telescope it showed a tail about 3 degrees long. Being a bright comet, there were many confirmations of Mr. Skjellerup's discovery. Captain Cameron-Swan, who observed it on 8th December, writes: "The comet was clearly visible to the naked eye. . . . Seen through the telescope (3in. refractor x 40) it presented a beautiful appearance with a bright and clearly defined nucleus and a long, straight tail which more than filled the field of view." Later it increased greatly in brightness and was seen by several observers in full daylight with the naked eye. Spectroscopic and radiometric measures were secured in full daylight on 16th December.

The following elements by Dr. Crommelin are given:

$$T = 1927 \text{ Dec. } 18{\cdot}008 \text{ U.T.}$$
$$\left.\begin{aligned} \omega &= 46^\circ\ 9'{\cdot}7 \\ \Omega &= 76\ \ 25{\cdot}2 \\ i &= 85\ \ 27{\cdot}2 \end{aligned}\right\} 1927{\cdot}0$$
$$\log q = 9{\cdot}23651$$

Comet 1928 a. (Reinmuth).—A new comet was discovered photographically by Herr K. Reinmuth on 22nd February at Königstuhl Observatory, Heidelberg. It was magnitude 12.5. Dr. Crommelin has computed elliptical elements for the comet which give a perihelion date of 1st February and a period of over seven years.

Comet 1916 I. (Taylor's Periodical).—This comet, discovered by the late C. J. Taylor at Claremont, Cape, was due to make its second return to perihelion about 21st to 29th October. Ephemerides for both the above dates by Dr. Crommelin were published, but no report of its having been seen anywhere has been received.

Comet 1928 b. (Pons-Coggia-Winnecke-Forbes).—A new comet was discovered on 19th November by Mr. A. F. I. Forbes at Rosebank, Cape Town, and verified the succeeding morning by Mr. A. W. Long. It was about the 9th magnitude at discovery, but it rapidly got fainter. Mr. H. E. Wood computed an orbit for it and found it had come down from Northern Declinations. The comet was found to have already passed perihelion, but it was kept under observation for nearly a month before it got too faint, which enabled its period to be deduced as about 27½ years. Its resemblance to comets 1818 I. (Pons) and 1873 VII. (Coggia-Winnecke) was suspected by Mr. H. E. Wood, Dr. Crommelin and others. Its identity with these comets has now been fully established. The comet has been twice round in the 55 years since 1873.

Dr. Crommelin gives the following approximate elements at three apparitions which for convenience he has reduced to the equinox of 1873. He also gives the elements of comet 1457 I. observed by Toscanelli, and also observed in China, deduced by Celoria. This is also quoted for comparison. In regard to it he says: "The only discordance is in the inclination, and the comet was too near the ecliptic for this to be very accurately deduced from such rough observations." The elements for 1928 b. are by Mr. H. E. Wood.

Comet	1818 I. (Pons)	1873 VII. (Coggia-Winnecke)	1928 *b.* (Forbes)	1457 I. (Toscanelli)
T.	Feb. 4·56	Dec. 1·93273	Nov. 4·493	Jan. 18
ω	195° 18′	196° 7′·6	195° 53′·9	194·9
Ω	250° 29′	249° 48′·7	249° 22′·5	249·7
i	25° 39′	28° 48′	28° 54′·8	13·3
log q	9·87592	9·87330	9·87216	9·847
Period y	9·375	27·910	28·635	

This is the only comet, except Halley's, outside the Jupiter and Saturn groups, that has been observed at three apparitions. Pons considered it to be the faintest of the comets he had found.

Comet 1929 a. (Schwassmann-Wachmann).—This comet was discovered by Professor A. Schwassmann and Dr. A. Wachmann with the Lippert Astrograph at Bergedorf Observatory on 17th January, with plates exposed for the photography of minor planets. Images of the comet were subsequently found on numerous plates exposed before that date at Harvard, Yerkes, Heidelberg and Uccle. Dr. Crommelin says: "Its total light is more than that of a 12th magnitude star, but as this light is spread over a greater area it is more difficult to see than a star of that magnitude."

A. F. I. Forbes,
Director.

VARIABLE STAR SECTION.

In presenting his report for the Session 1928-29, your Director is pleased to be able to report steady progress in the work of the Section. The total number of observations recorded during the year was 3,100, a drop of 295 compared with last year's figures.

On the other hand, 94 variables are now being observed compared with 71 last year, and with our two new members contributing there should be a decided improvement in our output during the coming year.

The 3,100 observations are divided among the members as follows:—

H. E. Houghton, Cape Town: 1,104 observations of 68 variables.

W. H. Smith, Plumstead, Cape: 629 observations of 71 variables.

H. Hayman, Pretoria, 35 observations of 13 variables.

G. E. Ensor, Pretoria, 1,332 observations of 89 variables.

Houghton uses a 3½in. refractor; Smith a 4in. refractor; Hayman a 4¼in. refractor; and Ensor a 6½in. reflector.

Smith has unavoidably fallen short of his normally fine record. It is hoped that in the new year his output will show a return to the high level of past years.

New Members.

Our first lady member, Miss C. Orpen, of Bloemfontein, has commenced regular work; she has a 3in. refractor.

Hayman has made a good start. He works in conjunction with your Director, using a 4¼in. refractor loaned by J. Hallifax, Esq., of Pretoria.

We welcome these new members, and feel sure that their work will be a credit to themselves and the Society.

Variable Star Register.

The work of typing the whole of the variable star observations of the Society into the new Variable Star Register is nearly up to date. The value of a permanent record of our work fully justifies the expense and labour entailed.

Your Director has much pleasure in thanking the Union Astronomer and Staff of the Union Observatory and the Harvard College Observatory for circulars and star charts, also Mr. A. W. Long, F.R.A.S., for a large number of Harvard photographs that he has placed at the disposal of the members of the Section; and Mr. Hallifax for the loan of a fine 4¼in. refractor. This

telescope has been of the greatest value to Mr. Hayman and your Director, and we are very grateful to Mr. Hallifax for his kindness in allowing us to continue using it.

Maxima and Minima.—A list of the maxima and minima of certain of the variable stars observed by the members of the Section is attached. As is usual, many maxima and minima have been missed owing to proximity of the variable to the Sun.

VARIABLE STAR NOTES.

Nova Pictoris.—This nova, with the exception of a slight fluctuation during the year, has steadily grown fainter; its magnitude is now 7.7.

Mr. H. E. Wood, the Union Astronomer, informed your Director that the nuclei are becoming more stellar in character, and the nebulosity appears to be diminishing. The following extract from the report for 1928 of H.M. Astronomer at the Cape is also of interest.

"In consequence of the report that Nova Pictoris was surrounded with a system of rings, plates with focus and out-of-focus exposures were obtained with the Victoria telescope, the Astrographic telescope, and with a Zeiss Tessar lens of 8.5 cms. aperture and 30 cms. focal length. Photographs were also obtained with the Victoria and Astrographic telescopes using a series of colour filters. These photographs showed conclusively that the rings were an optical phenomenon, depending upon the peculiar distribution of light in the spectrum of the nova and upon the colour curve of the objective.

Photographs of the spectrum were obtained, using a small objective prism in front of the Tessar lens. In July the large 8-degree objective prism was mounted in front of the 24-inch objective of the Victoria telescope and the spectrum of the nova was photographed.

The spectrum is a bright line one, approximating to that of a star of the Wolf-Rayet type. The continuous spectrum is weak.

The nebular lines, N1 and N2, are not seen, but λ 4363 is still strong."

The following description of Nova Pictoris by H.M. Astronomer at the Cape is repeated for the benefit of those members who have not read last year's report:—Dr. Spencer Jones said: "The star shows an oval nebulosity, the major axis of which, lying approximately East and West, is about $1\frac{1}{2}$ secs. in length. Within this are four nuclei, the relative positions of which may be understood if a triangle is drawn with the base upwards. The nuclei are (1) at the centre, the brightest; (2) at the

lower angular point, the faintest; (3) and (4) slightly below the upper angular points." (Report in "Nature.")

S Apodis.—After a long continued minimum, during which this variable star remained too faint to be seen in small telescopes, S Apodis is again visible, and slowly increasing in brightness. (Magnitude 11.2 on 30th June, 1929.) The normal brightness of S Apodis is about Magnitude 10.0.

RY Carinae.—On the 6th of May last a letter was received from Mr. W. H. Smith informing your Director that he had observed what appeared to be a new star or an unknown variable close to *111661* RS Centauri

Mr. Smith stated that the star did not appear on the Harvard chart of RS Centauri. On the following night the area was examined by your Director, and a 10.3 magnitude star found, slightly preceding, and to the N. of RS Centauri. In reply to a letter notifying him of Mr. Smith's discovery, the Union Astronomer, Mr. H. E. Wood, informed your Director that he had examined a number of plates of the area on which RS Centauri was present. The supposed new star had been identified as *111561* RY Carinae, a known variable star, period about 416 days.

The position of RY Carinae is 21 secs. preceding, and slightly N. of RS Centauri. Reference to the Variable Star reports published in " Popular Astronomy," for the past three years, showed that RY Carinae had been regularly observed by Baldwin of Melbourne. Two maxima had been recorded, one of magnitude 11.0, on 18th January, 1927, and the other of 11.1 on 14th March, 1928. The duration of the maxima was very short, a matter of a few days. The star, during the greater part of its period, is far too faint to be seen in small telescopes. This accounts for the failure of the members of the Section to detect the star before the bright maximum of last May. RY Carinae has now been added to our observing lists.

Mr. Smith's discovery might well have been an original one, and should encourage our members, particularly the younger ones, to note anything in the way of a star or nebulosity that appears to be unusual in the area that they are observing.

The discovery of a comet or a nova is by no means as unlikely or impossible as one would think, and may fall to the lot of even an inexperienced observer at the most unexpected moment. Your Director's good fortune is a case in point. The main thing is never to pass by a star or nebulous object that appears to be out of the common without subjecting it to a close scrutiny, and

then to compare the field very carefully with a star atlas or a chart of the area. Should the object not appear on either of these, it is best to notify the Director of the Section and the nearest official Observatory as soon as possible. It must not be forgotten that the first to notify the presence of a nova or comet secures the honour of having his or her name connected with the discovery.

G. E. ENSOR,
Director.

MAXIMA AND MINIMA FOR YEAR ENDING JUNE 30, 1929.

001032	S	Sculptoris	M	6.7	1928	Nov. 10.	Flat
001862	S	Tucanae	M	9.2	1928	Oct. 20.	
002546	T	Phoenicis	M	9.2	1928	Nov. 16	Flat
005475	U	Tucanae	M	8.5	1929	Jan. 29	
021403	o	Ceti (Mira)	M	2.7	1928	Aug. 18	
025050	R	Horologii	M	6.5	1929	Feb: 27	
025751	T	Horologii	M	8.5	1929	Feb. 18	
043263	R	Reticuli	M	7.4	1928	Oct. 4	
044349	R	Pictoris	M	7.5	1929	Jan. 4	
051247	T	Pictoris	M	9.0	1929	Jan. 13	Flat
051533	T	Columbae	M	7.5	1929	Mar. 17	
054331	S	Columbae	M	8.4	1928	Nov. 16	
054629	R	Columbae	M	9.6	1929	Jan. 30	
055686	R	Octantis	M	8.8	1929	June 15	Flat
070772	R	Volantis	M	11.3	1928	Oct. 31	
073173	S	Volantis	M	9.3	1929	May 15	Flat
074241	W	Puppis	M	7.9	1928	Nov. 17	
		do.	m	12.6	1929	Feb. 3	
		do.	M	8.5	1929	Mar. 12	
		do.	m	12.1	1929	May 10	
082476	R	Chamaeleontis	M	8.3	1929	Feb. 6	
092551	Y	Velorum	M	9.0	1929	May 10	
092962	R	Carinae	M	4.2	1929	Feb. 10	
100661	S	Carinae	m	9.1	1928	July 9	
		do.	M	6.1	1929	Feb. 27	Flat
		do.	m	9.4	1929	May 10	
101058a	Z	Carinae	M	11.0	1928	Dec. 12	
101153	W	Velorum	M	8.5	1929	Mar. 16	
111561	RY	Carinae	M	10.3	1929	May 2	
111661	RS	Centauri	M	8.8	1929	Mar. 31	
115058	W	Centauri	M	8.1	1928	Aug. 4	
		do.	M	8.0	1929	Feb. 11	
131283	U	Octantis	M	8.4	1928	Oct. 5	Flat
132422	R.	Hydrae	m	10.1	1929	May 10	
132706	S	Virginis	M	6.5	1929	June 8	
133633	T	Centauri	M	6.4	1928	June 21	
		do.	m	8.6	1928	Aug. 7	
		do.	M	6.0	1929	Mar. 17	Flat
		do.	m	7.6	1929	May 3	

134236	RT	Centauri	M	9.2	1928	July 9	Flat
		do.	M	9.2	1929	Mar. 28	
134677	T	Apodis	M	9.1	1929	Mar. 7	
140959	R	Centauri	M	5.8	1929	Apr. 1	Flat
145254	Y	Lupi	M	10.9	1928	Sep. 9	
152849	R	Normae	M	7.4	1929	Apr. 13	
153654	T	Normae	M	6.0	1928	July 9	
154736	R	Lupi	M	9.7	1929	May 6	
155823	RZ	Scorpii	M	8.9	1928	Oct. 5	Flat
		do.	m	11.6	1929	Apr. 30	
161122a	R	Scorpii	M	11.2	1928	July 23	
161122b	S	Scorpii	M	11.0	1928	July 23	
164844	RS	Scorpii	M	7.1	1928	Sep. 25	
172486	S	Octantis	M	8.1	1928	Aug. 6	
		do.	M	9.4	1929	Apr. 11	
180363	R	Pavonis	M	8.9	1928	July 23	
190819a	RW	Sagittarii	M	9.0	1928	Aug. 17	
190818	RX	Sagittarii	M	10.0	1928	Aug. 7	
191124	TY	Sagittarii	M	9.8	1928	June 22	
193972	T	Pavonis	M	8.0	1928	Sep. 5	
		do.	M	7.3	1929	May 11	
194659	S	Pavonis	M	7.2	1928	July 10	
		do.	m	9.0	1928	Nov. 12	
195142	RU	Sagittarii	M	7.5	1928	Dec. 12	
221938	T	Gruis	M	8.2	1928	Nov. 1	

COMPUTING SECTION.

Although the Computing Section has not been so active as had been anticipated, this is owing more to the failure of the observers to call in the aid of the Section than to any slackness in the computers themselves.

Predictions of phenomena have been furnished to newspapers and a considerable amount of correspondence has been exchanged between the members of the Section.

A commencement has been made of an extension to the Union Observatory "Tables of X and Y, Elliptic Rectangular Co-ordinates." When the eccentricity is large the period of visibility of comets is so short that it is seldom the mean anomaly, M, exceeds 3 degrees. The extension will give X and Y for each tenth of a degree of M to 3 degrees from e=0.80 to e=1.00.

Dr. Crommelin has made considerable use of the original Tables (see M.N., R.A.S., 1927, November, p. 87, etc.) and Dr. Stracke of the Berlin Rechens-Institut has published less extensive Tables of the same sort.

Observing members desiring predictions should communicate with the Secretary of the Section, Mr. T. MacKenzie, whose address is 46, Market Street, Grahamstown.

R. T. A. INNES, *Director.*

METEOR SECTION.

The Director desires to thank all who forwarded reports of meteors during the year. Unfortunately these were, with the exceptions mentioned below, all isolated observations.

Two brilliant fireballs were observed, one on 18th July and the other on 27th July, 1928. A description of the latter by Mr. A. King, F.R.A.S., appears in this issue of the Journal. The best thanks of the Society are due to Mr. King for the great amount of trouble he took to determine the real path from the very rough observations available. Fortunately the large number of reports made up to some extent for the lack of accurate data.

Mr. King is desirous of determining Southern radiants, as these are little known, and it is well within the capabilities of this Section to furnish the necessary data if only systematic observations are carried on. What is required is that two or more members living, say, twenty miles apart, should arrange simultaneous watches and that such groups should be formed in different parts of the country. The use of Long's "Constellations" to identify the stars along the meteor's path is strongly recommended, as with this book at hand a little practice will soon lead to results of value.

Detailed instructions will be forwarded gladly to anyone interested.

The Director desires to acknowledge the practical interest in the work of the Section of H.M. Astronomer and the Union Astronomer.

THEODORE MACKENZIE,
Director.

CAPE CENTRE.

FIFTEENTH ANNUAL REPORT, 1928-29.

Your Committee in presenting this, the Fifteenth Annual Report, has to record the continued activity and advancement of the Centre during the year now closed.

MEMBERSHIP.

Twelve ladies and gentlemen have joined the Centre during the year—ten as members and two as associates. Two members having resigned have been struck off the roll of membership. There is now a total of ninety-five on the roll (eighty-six members and nine associates). The total in the last report was eighty-five.

MEETINGS.

During the period under review there have been held eight Ordinary Meetings of the Centre, at which the following subjects were presented and discussed, viz.:—

"Proxima Centauri." By Mr. H. E. Houghton.

"Lunar Craters and the Volcanic Theory." By Mr. H. C. Mason. (Paper published in Journal, Vol. II.,, No. 3.)

"Elongation of Mercury." By Mr. A. W. Long, F.R.A.S.

"Lunar Bubbles as the Origin of Craters on the Moon." By Mr. A. G. Hoyer.

"Precession of the Equinoxes." By Mr. D. C. Burrell.

"Great Daylight Meteor of 8th July, 1927." By Mr. A. King, F.R.A.S.

"Observations and their Reductions." By Mr. H. Horrocks, B.A.

"The Physical Conditions on Mars." By Mr. H. W. Schonegevel.

"Meteors." By Mr. A. W. Long, F.R.A.S.

"The Leiden Meeting of the International Astronomical Union." By Dr. H. Spencer Jones, F.R.A.S.

"Large Reflecting Telescopes." By Mr. H. E. Houghton.

"Bright Meteor of 27th July, 1928." By Mr. A. King, F.R.A.S.

"The Possibility of the Navigation of Space." By Mr. H. C. Mason.

"Comets and Comet Finding." By Mr. T. B. Blathwayt.

Two Observational Meetings were held. The first, by the courtesy of His Majesty's Astronomer, took place at the Royal Observatory in October, 1928, when the 7-inch refractor was placed at the disposal of members. The second meeting was held by the invitation of Mr. Bert F. Jearey, F.R.A.S., at his Observatory at Muizenberg in March, 1929. Observation was confined to the Moon, descriptive remarks on various craters and formations being contributed by the Hon. Secretary. Both meetings were well attended, and the thanks of the Centre are accorded to His Majesty's Astronomer and to Mr. Jearey for these privileges.

The Committee has met seven times.

Finance.

The finances of the Centre continue to be satisfactory, as the financial statement will show. The Centre has made a donation of £10 to the funds of the Society.

Discovery.

The Committee have pleasure in recording the rediscovery of a comet by Mr. A. F. I. Forbes, who has succeeded the late Mr. William Reid as Director of the Comet Section of the Society. His Comet will be known as "Pons-Coggia-Winnecke-Forbes." The Astronomical Society of the Pacific have awarded Mr. Forbes the Donohoe Comet Medal for his discovery.

Articles in the Press.

Monthly notes with charts of the sky have been published in the "Cape Times" as in previous years, these being contributed by Mr. A. W. Long, F.R.A.S., and articles in Afrikaans by Mr. T. MacKenzie continue to be published in "Die Burger."

Financial Statement for the Year ended June 30, 1929.

Income.	£	s.	d.
Balance in hand, 30th June, 1928	15	6	1
Subscriptions—			
Arrears (£ 6 0 0)			
Current Year (50 12 9)			
In advance (6 0 9)			
	62	13	6
Subscriptions to *Cape Times*	0	9	0
Commis'ns on cheques	0	7	6
	£78	16	1

Expenditure.	£	s.	d.
Contributions to Headquarters under Article IX. of Constitution	31	6	8
Rent of Meeting Rm.	10	0	0
Rent of P.O. Box	1	5	0
Donation to Astronomical Socy. of S.A.	10	0	0
Typewriting and Stationery	7	2	6
Cape Times & Postage to Country Members	5	8	0
Lantern Slides and Books from Estate of the late W. Reid	2	10	0
Secretary's Expenses	1	19	9
Treasurer's Expenses	0	9	6
Bank Charges	1	12	1
By Balance	7	2	7
	£78	16	1

JOHANNESBURG CENTRE.

ANNUAL REPORT, 1928-29.

The Committee record their regret at the passing away of a valued colleague, Dr. James Moir, and their great indebtedness to him as a real friend and indefatigable scientist, who was always ready to assist and enlighten from his wide and comprehensive knowledge any student who sought his counsel. The Mars Section, in particular, has lost in him an efficient and enthusiastic director.

In the course of the year visits were paid to the Union Observatory on 24th August, 1928, and 22nd March, 1929.

A question night was held at Mr. Jackson's house in October, and in January a paper on "The Pleiades" was read at the same venue by the host.

At the November meeting a paper on "Comets and Comet Finding," by Mr. T. B. Blathwayt, was read.

To these members our appreciation is due for their interesting and instructive addresses.

During the twelve months two members and five associates were elected. Two members have recently resigned on account of removal from the district. This leaves the membership of the centre at 33 as the year closes.

FINANCIAL STATEMENT FOR THE YEAR ENDED 30TH JUNE, 1929.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance on hand, 30th June, 1929 ..	24	6	11	By Periodicals	4	2	0
„ Subscriptions	22	8	0	„ Rent Salstaff Socy.	0	10	0
„ Donation	0	10	6	„ Secretary's Membership to British Astronomical Association	1	1	0
„ Bank Charges, 1928 allowed	0	12	6	„ Postage & Stationery	0	4	6
				„ Bank Charges	0	7	3
				„ Contribution to Headquarters ..	11	13	6
				„ Donation to Headquarters	0	10	6
				„ Balance	29	9	2
	£47	17	11		£47	17	11

The late James Moir, M.A., D.Sc.

Astronomical Society of South Africa.

FINANCIAL STATEMENT FOR THE YEAR ENDED 30TH JUNE, 1929.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance, 30th June, 1928	20	3	4	By Printing Journal (Vol. 2, No. 3)	46	12	3
„ 50% Subscriptions (Cape Centre)	31	11	11	„ Printing & Stationery	9	15	6
„ 50% Subscriptions (Johannesburg Centre)	11	13	6	„ Postages & Sundries	5	14	9
„ Sale of Journals	0	8	0	„ Rent & Electric Light	1	6	0
„ Sale of Sundial	1	19	7	„ Bank Charges	0	4	8
„ Donations—				„ Balance carried forward	28	8	2
Anonymous	2	0	0				
Natal A.A.	5	0	0				
Anonymous	1	0	0				
Mr. B. F. Jearey	3	3	0				
Capt. Cameron-Swan	2	0	0				
Mr. A. W. Long	1	1	0				
Mr. H. C. Mason	1	0	0				
Mr. H. Sausenthaler	0	10	6				
Cape Centre	10	0	0				
„ Bank Ledger Fee Refunded	0	10	6				
	£92	1	4		£92	1	4

Examined and found correct.
E. J. STEER.

W. H. SMITH,
Hon. Treasurer.

Obituary.

DR. JAMES MOIR, 1874-1929.

In the death of Dr. James Moir, which occurred on 30th March, 1929, the Astronomical Society of South Africa has lost one of its most valuable members. Dr. Moir was associated with the Society from its foundation and was a very thorough and energetic Director of the Mars Observing Section, as will be seen from the reports which he contributed frequently to the Journal. He was also an enthusiastic observer of occultations of stars by the Moon and his observations were made with such painstaking care that they have been found, on investigation, to be of equal value with those made at fixed observatories.

James Moir was born at Banff, in Scotland, in 1874, and was educated at the Aberdeen Grammar School, proceeding from there to the Aberdeen University, where

he graduated with triple 1st Class Honours in Chemistry, Mathematics and Physics. Receiving an 1851 Exhibition Scholarship, he went to London to undertake chemical research under Professor Henry Armstrong at the Central Technical College, South Kensington. As a result of his work there he was awarded the degree of Doctor of Science by Aberdeen University at the unusually early age of 27.

For health reasons he came to South Africa in 1902, and his first post was as Science Master in the Jeppe High School, Johannesburg. Later he joined the staff of Messrs. H. Eckstein & Co. as a chemist and was in charge of mine air experiments in connection with the first Miners' Phthisis Commission. In 1904 he was appointed chemist to the Transvaal Mines Department, a position which, with slight changes of title due to reorganisations of the Department, he held until his death.

He was a very active member of the Chemical, Metallurgical and Mining Society of South Africa, of the South African Chemical Institute, of the South African Association for the Advancement of Science, and of the Royal Society of South Africa. For his researches on chemical subjects he was awarded the South African Medal in 1919 by the South African Association for the Advancement of Science and in 1921 he received the Research Medal for Chemistry from the Chemical, Metallurgical and Mining Society. His chief work was an investigation into the chemical cause of colour and many papers dealing with this subject were contributed by him to the Royal Society of South Africa and to the London Chemical Society.

His love for Astronomy was very sincere. Approaching his house at Auckland Park, it was very evident that an enthusiastic astronomer lived there, for the two most prominent objects in his garden were an equatorially mounted 5¼-inch refractor and a large equatorial type of sundial with an interesting device of his own design, by means of which the shadow was still cast on the south face when the Sun had moved north of the equator. He missed no opportunity of making an astronomical observation and was only prevented by weak health from playing a much greater part in the astronomical world. In 1927 he visited England mainly for the purpose of viewing the total solar eclipse at Southport on 29th June, and on his return he gave the Johannesburg Centre of the Society a very vivid account of seeing a total eclipse of the Sun. He was due to retire from his official position at the end of this year and was looking forward to the greater opportunities of increased leisure to carry out more astronomical work.

There are still not a large number of amateurs of astronomy in South Africa; and enthusiasts of the type of Dr. James Moir and William Reid, who were not only active workers themselves, but who also possessed the rare gift of inspiring enthusiasm in others, are greatly missed.

H.E.W.

PROFESSOR PHILIP G. GUNDRY, Ph.D., B.Sc.

We record with much regret the death at Pretoria on the 25th September, 1929, of Dr. Philip G. Gundry, Professor of Physics at the Transvaal University College.

Professor Gundry was born in London in 1877 and was educated there and at Cambridge and Gottingen. After holding posts at Cardiff University and at the Cirencester College of Agriculture, he joined the staff of the Transvaal University College in 1908 as Professor of Mathematics and Physics. Latterly, owing to the growth of the College, he devoted himself principally to Physics. During the Great War Dr. Gundry served in German S.W. Africa and later proceeded to England and joined the scientific staff of the Royal Air Force, where he was responsible for the invention of many valuable devices making for greater speed and accuracy in flying. His work was most highly appreciated by the British authorities and his duties were carried out in circumstances of great danger involving him in more than one crash.

Dr. Gundry took an active part in astronomical work in Pretoria. He joined the Society in October, 1924, and was also President of the Pretoria Astronomical Association. He was responsible for the building and equipment of the observatory in the grounds of the T.U.C. The fine 5-inch Zeiss equatorial refractor there was discovered by him among some laboratory equipment in the Boys' High School. The cases in which it was packed had remained unnoticed and forgotten since the importation of the refractor by Lord Milner many years earlier. Professor Gundry induced the Council of the T.U.C. to expend a considerable sum in the building of the observatory to house the refractor and a 3-inch transit instrument. He personally supervised the erection of the instruments on concrete foundations and their adjustment was carried out by him. A chronograph was also fitted, connected with a mean time clock in the Physics Laboratory, by an air line about 200 yards in length.

Professor Gundry will be sorely missed by the astronomical fraternity in Pretoria. His genial person-

ality and unflagging energy endeared him to friends and students alike.

Shortly after his return from the War, Dr. Gundry married Miss Ruth Frost, daughter of Mrs. Frost, of Johannesburg, who was on the staff of the Pretoria High School for Girls. Our sympathy is extended to Mrs. Gundry.

Reviews.

" The Sun, the Stars and the Universe." By W. M. Smart. [Pp. xii. + 291 with 20 plates and 108 figures.] (London: Longmans, Green & Co., 1928. Price 12s. 6d. net.)

Dr. Smart has written a concise outline of present-day Astronomy; and in writing it he has carefully avoided those faults so usual in a " popular " exposition—hyperbole and a lack of clarity. Within the compass of 300 pages he has covered briefly and in simple language the whole gamut of the Universe, and of modern cosmogony's attempt to interpret and explain the Universe.

Dr. Smart follows the traditional sequence in developing his subject. In doing so, he has judged very rightly the length of each of his sections. Naturally, the bulk of his book deals with the stars and with problems and phenomena associated with them. This section of the book is illustrated with diagrams which are very helpful. Besides these diagrams there are many beautiful plates, and the text reflects careful and accurate proof-reading. Altogether, " The Sun, the Stars and the Universe " may be recommended with confidence to the general reader who is in search of an unadorned and authoritative outline of modern astronomy.

" The Life and Work of Sir Norman Lockyer." By T. Mary Lockyer and Winifred L. Lockyer, with the assistance of Prof. H. Dingle and contributions by Dr. Charles E. St. John; Prof. Megh Nad Saha, F.R.S.; Sir Napier Shaw, F.R.S.; Prof. H. N. Russell; the Rev. J. Griffith; Sir Richard Gregory and Prof. A. Fowler, F.R.S. [Pp. xii. + 474 with 17 plates.] (London: Macmillan & Co., 1928. Price, 18s. net.)

We commenced to read this volume with expectation but finished it with a feeling of considerable disappointment. About half of it is occupied with a general biography, written by Prof. Dingle from material compiled by Lady Lockyer and Miss Lockyer; the second half consists of chapters contributed by several writers in appreciation of Lockyer's astronomical, archaeological and general scientific work. The general biography does

not give that intimate picture of the man for which one looked; it is lacking in feeling and in those personal touches which are necessary to bring the living man before the reader.

As regards his astronomical work, it must be emphasised that Lockyer was too prone to jump to conclusions and to put forward speculations for which there was not conclusive evidence. Each new fact discovered had to be brought into relation with earlier facts; modified theories and new theories were propounded and current ideas abandoned when they did not appear to fit. Thus instead of patiently amassing and co-ordinating facts and welding them into a connected theory which would fit all the evidence, one theory after another was put forward and it is therefore difficult to separate what was of permanent value in his work from what was of transient value. In his day, Lockyer's work was regarded by many of the foremost men of science as slap-dash; the result was that much of his work was not trusted and, though there were elements of permanent value concealed in it, it did not influence current scientific work as it otherwise might have done.

Nevertheless, in a wider sphere, science owed much to Lockyer. He possessed a breadth of scientific outlook and an unselfish devotion to the cause of science which were of the greatest value. As secretary of the Duke of Devonshire's Commission on Scientific Instruction in 1870, he became more than ever convinced of the importance of science to the State. The Commission recommended unanimously that a special Department of Science should be created to promote the scientific interests of the Nation. As Sir Richard Gregory states in this volume, " Our statesmen had not sufficient knowledge of science to understand its relation to national advancement, or sufficient faith in scientific discovery to believe that provision for it would ultimately benefit the community industrially and politically; and we have had cause to pay the penalty for their neglect." Lockyer clearly saw the importance of scientific education and research for the industry and commerce of the country, but we had to wait for a Department of Scientific and Industrial Research in Great Britain until the necessities of war made clear the extent to which the State is dependent upon science.

Lockyer's other great claim to remembrance is as the founder and first editor of " Nature." That the foundations which he laid in the year 1869 were well and truly laid is shown by the fact that this journal, after fifty-nine years, is still the same, to all intents and pur-

poses, in its general arrangement and plan, as in the first number issued. For thirty years it was not a financial success. That Lockyer should have persevered undismayed through all those years is a tribute to his determination and confidence of ultimate success. It is doubtful whether there was another man of his day who could have carried this enterprise through to success. "Nature" to-day has been aptly described as the "Times" of science, which implies that it is the recognised organ of all schools of scientific opinion, and it has played no small part in securing better recognition of the value of scientific endeavour and achievement. It is a permanent memorial to the value of Lockyer's work for science and what better memorial could there be?

"Hilfsbuch der Astronomischen Photographie." By H. J. Gramatzki. [Pp. 102 with frontispiece and 29 figures.] (Berlin: Ferd. Dümmlers Verlag, 1930. Preis: Kart. M. 4.80; geb. M6.)

Photography plays so important a part in modern astronomical observation, even for the amateur, that this small volume should appeal to a wide circle of readers. It contains a large amount of useful information in a small compass with many practical hints. The work is divided into three sections. The first deals with the optical apparatus employed in astronomical photography and contains sections dealing with the optical properties of single and compound lenses, with camera adjustments, with the properties and use of objective prisms, with the employment of diffraction gratings for the determination of effective wavelengths and with many other matters of interest.

The second section deals with the properties and treatment of the photographic plate. The differences in the gradation curves of slow and fast plates are explained. Detailed directions are given for the preparation of wet collodion plates. Practical details for development with ferro-oxalate developer for photometric purposes, whereby the Eberhard effect is eliminated, are given. Methods for sensitising plates are also detailed.

The third section is concerned with the objects to be photographed and sub-sections are devoted to the moon, the sun, the planets, comets, meteors, and stars. Considerable space is also given to the photography of stellar spectra.

The volume is clearly written and can be strongly recommended to anyone who desires to employ photographic methods.

NATAL ASTRONOMICAL ASSOCIATION.

EXTRACTS FROM ANNUAL REPORT OF THE HON. SECRETARY.
SEVENTH SESSION, 1928-1929.

The Association has maintained its activity and six monthly meetings were held, the following lectures and papers being delivered during the year:—

September: "Recent Developments in Astronomy," Prof. W. N. Roseveare.

October: "A Peep into Space," Mr. J. Willis.

November: "Astronomy, its Use and Entertainment," Mr. J. Bennett Mumford.

February: "Time," Mr. H. Roadknight.

March: "Our Nearest Star," Mr. H. J. S. Bell.

May: "The Great Meteorite at Grootfontein, S.W.A.," Dr. W. J. Luyten, Bloemfontein.

Our thanks are due to the Natal Technical College for their great help in granting us the use of a room for our meetings and frequently a lantern for illuminating slides.

During the year the membership decreased by 2 and now stands at 53, of whom 45 are Town and 8 Country Members.

During the Session there were 57 visitors at the Observatory. The work of renovating the Observatory was continued by completing several structural repairs to the walls and roof and painting the inside of the building. This has restored the place to its former serviceable condition, but there remain a few details yet to be completed. Our thanks are due to Messrs. Forbes, Roadknight and Fox for the work they have done in effecting these repairs.

Early in the Session the Association was approached by the local Boy Scouts Association seeking assistance for local Boy Scouts desiring to gain the "Starman's Badge." A study class was formed for this purpose, and the boys were instructed and examined by different members of the Association.

Cordial relations have been maintained with the Astronomical Society of South Africa. In November 36 copies of Vol. 2, No. 3, of the Journal of the Astronomical Society of South Africa were received and distributed to our members.

Early in the next Session the British Association will be visiting South Africa. A number of the visiting scientists will call at Durban. In order to attend to the arrangements in connection with these visitors a representative committee has been formed, on which the Association is represented by the President and Secretary. Mr. D. L. Forbes, F.R.A.S., is the representative of the Association on the Executive Committee. It has been arranged that Prof. A. S. Eddington will lecture on Tuesday, August 27th, on an appropriate subject.

Astronomical Society of South Africa.

OFFICERS AND COUNCIL, 1929-30.

President: H. E. Wood, M.Sc., F.R.A.S., Union Observatory, Johannesburg.

Vice-Presidents: H. Spencer Jones, M.A., Sc.D., B.Sc., F.R.A.S.; A. W. Long, F.R.A.S.; The Hon. A. W. Roberts, D.Sc., F.R.S.E., F.R.A.S.

Hon. Secretary: H. E. Houghton, P.O. Box 2061, Cape Town.

Hon. Treasurer: W. H. Smith, " Arum Villa," Plumstead, C.P.

Members of Council: Capt. D. Cameron-Swan, F.R.P.S., F.S.A. (Scot.); W. B. Jackson, M.Sc.; B. F. Jearey, F.R.A.S., F.R.M.S.; D. G. McIntyre; H. W. Schonegevel; W. M. Worssell, F.R.A.S.

Alternate Members of Council: D. C. Burrell, A. F. I. Forbes, H. C. Mason, S. Skewes, M.A., B.Sc.

Auditor: E. J. Steer.

DIRECTORS OF OBSERVING SECTIONS.

Comet: A. F. I. Forbes, " Craigie Brae," Liesbeek Road, Rosebank.

Computing: R. T. A. Innes, D.Sc., F.R.S.E., F.R.A.S., 26 Pope Street, Johannesburg.
(*Secretary:* T. MacKenzie, 46 Market Street, Grahamstown.)

Mars: B. F. Jearey, F.R.A.S., F.R.M.S., Villa Carina, Alexander Road, Muizenberg.

Meteor: T. MacKenzie, 46 Market Street, Grahamstown.

Variable Stars: G. E. Ensor, Pretoria Hospital, P.O. Box 201, Pretoria.

Editor: H. Spencer Jones, M.A., Sc.D.

Librarian: A. F. I. Forbes.

COMMITTEE OF CAPE CENTRE, SESSION 1929-30.

Chairman: H. C. Mason, "Ifafa," Bollihope Crescent, Mowbray.
Vice-Chairman: Bert F. Jearey, F.R.A.S., F.R.M.S.
Honorary Secretary: H. W. Schonegevel, P.O. Box 2061, Cape Town.
Honorary Treasurer: A. F. I. Forbes, "Craigie Brae," Liesbeek Road, Rosebank.
Committee: Captain D. Cameron Swan, F.R.P.S., F.S.A. (Scot.).
A. W. Long, F.R.A.S.
D. G. McIntyre.
R. R. Pratt, B.Sc., A.M.I.C.E.
W. H. Smith.
Librarian: D. C. Burrell.
Auditor: E. J. Steer.

COMMITTEE OF JOHANNESBURG CENTRE.

Chairman: J. D. Stevens, P.O. Box 1782, Johannesburg.
Hon. Secretary: A. Forrest, P.O. Box 2402, Johannesburg.
Hon. Treasurer: W. Geddes, P.O. Box 2402, Johannesburg.
Committee: Miss H. L. Troughton, T. Beamish, W. Eaton, W. B. Jackson, M.Sc., W. M. Worssell, F.R.A.S.

The following Honorary Members have been elected by the Council under Article XIX. of the Constitution:—
Leslie J. Comrie, M.A., Ph.D., F.R.A.S., Nautical Almanac Office, Greenwich, London, S.E.10.
Sir Frank Watson Dyson, K.B.E., Sc.D., LL.D., F.R.S., Royal Observatory, Greenwich, London, S.E.10.
Professor Arthur Stanley Eddington, M.A., D.Sc., F.R.S., The Observatory, Cambridge.
Professor Willem de Sitter, Sc.D., Sterrewacht, Leiden.

New Members.

Mr. N. L. Blackmore, Riverside Farm Estate, P.O. Malelane, Transvaal.
Mrs. E. A. Borlase, 390, Musgrave Road, Durban.
Mrs. K. Botes, P.O. Box 37, Fraserburg.
Mr. W. Johnston, Agent, Parow.
*Mr. H. F. Hayman, 427, Spuy Street, Pretoria.
Mr. T. Keiser, P.O. Box 39, Wakkerstroom.
Mr. J. R. Lawn, P.O. Box 620, Kimberley.
Mr. G. H. Maasdorp, J.P., Nqamakwe, Transkei.
Rev. D. A. Malan, P.O. Box 24, Krugersdorp West.

*Mrs. F. Manteuffel, Intermediate School, Brakpan.
*Mr. N. O. Marriott, Aldora, Nursery Road, Mowbray.
*Rev. J. N. Martins, 66, Richmond Avenue, Auckland Park, Johannesburg.
Mrs. H. K. Mitcheson, c/o Standard Bank, Cape Town.
Miss C. Orpen, Grey University College, Bloemfontein.
Rev. J. C. Reyneke, 9, Richmond Crescent, Port Elizabeth.
Mr. J. B. Turner, Royal Observatory, Cape Town.
Mr. B. Strobos, Huguenot Buildings, Cape Town.
*Mr. B. J. van der Vijver, Intermediate School, Brakpan.

*Associate.

The addresses of the following members are now as listed below:—

Mr. H. N. Crowther, B.A., 323, Visagie Street, Pretoria.
Mr. A. G. Hoyer, Bwana M'Kubwa, Northern Rhodesia.
Mr. C. T. Greenway, P.O. Box 53, Lydenburg.
*Mr. S. C. Venter, Heimat, Potchefstroom.
Miss H. L. Troughton, P.O. Box 4559, Johannesburg.
Mr. A. H. Wallis, C.E., J.P., F.R.Met.S., S.A. Railways, Pretoria.
Mr. R. Watson, Lourensford Road, Somerset West.
Mr. R. Woodgate, Dean Street, Rondebosch.

*Associate.

The Editor acknowledges the receipt of publications, etc., from the following:—University of Durham Philosophical Society; Lick Observatory; Vereinigung von Freunden der Astronomie und kosmischen Physik, Berlin; New South Wales Branch of the British Astronomical Association; New Zealand Astronomical Society; Antwerp Astronomical Society; Engelhardt Observatory, Kasan; Harvard College Observatory; Messrs. Cooke, Troughton and Simms; South-West Africa Scientific Society; Astronomischen Nachrichten.