# 15. COMMISSION POUR L'ETUDE PHYSIQUE DES COMETES

PRÉSIDENT: M. MCKELLAR.

MEMBRES: MM. Baldet, Bertaud, Beyer, Bobrovnikoff, Dobrovolsk, Dufay, Mme Herman, MM. Levin, Merton, Minkowski, Öhman, S. V Orlov, Poloskov, Quénisset†, Richter, Rijves, Swings, van Biesbroeck, Vsekhsvyatsky, Wurm.

In the interval since 1948, there has been only one bright comet, namely Comet 1948*l*. However, as shown by the items listed below, numerous fruitful researches in the field of cometary physics have been reported. Of general interest is a 'Liste Générale des Comètes de l'Origine à 1948' compiled by F. Baldet and containing 1619 entries between the years 2315 B.C. and A.D. 1948. It was published in *L'Annuaire du Bureau des Longitudes* for 1950.

## THE ORIGIN AND PHYSICAL NATURE OF COMETS

A. J. J. van Woerkom (*B.A.N* No. 399, 1948) has carried out a careful investigation of the effects on parabolic cometary orbits of the perturbations by Jupiter and other major planets. Following this work, J. H. Oort (*B.A.N* No. 408, 1950) has given an interesting and promising hypothesis of the origin of the comets, involving their production, along with that of the asteroids, in the break-up of a planet. The argument suggests that about 3% of the mass of the planet went into cometary bodies which, forming a cloud with aphelia between 50,000 and 150,000 AST.U., now exist as members of the Solar System. The rest of the planet, except for the asteroids, left the solar system. Examining the effects of perturbations of the nearby stars on the cloud of comets, also, conditions for members of the cloud eventually coming within the visible range, and planetary perturbations on these members, Oort has produced reasonable agreement with various results of observation.

R. A. Lyttleton has advanced a quite different suggestion as to a possible origin of the comets (*M.N* **108**, 465, 1948). He examined the effect of the Sun encountering and travelling through a cloud of interstellar dust. As a result, arguments were put forward to show that the particles, concentrating in the train of the Sun, along the accretion axis, could divide into segments, contract, and so form the comets.

S. M. Poloskov (*Astr. J Sov. Union*, **25**, 343, 1948) has discussed questions of the motions and stratification of molecules throughout a comet, in terms of radiation pressure, velocity of expulsion from the solid particles, etc. Subsequently (*Astr. J Sov. Union*, **26**, 260, 1949) he re-discussed various points in the light of improved *f*-values of the band systems used. He has also reconsidered the problem of the densities of matter in the cometary gases (*Sternberg Comm.* No. 60, 1950).

A. D. Dubyago (*Astr. J Sov. Union*, **25**, 361, 1948) critically examined the data on the motions of six well-observed comets and concluded that both accelerations and decelerations have taken place. He concluded that the expulsion of solid particles from the comet was required to produce the observed effects, the expulsion of gases alone being not sufficient. The same author (*Astr. J. Acad. Sci. U.S.S.R.* **27**, 5, 1950) discussed the structure of the nuclei of comets and their disruption to form nuclear streams. He treated in particular the effects of collision between the solid particles making up the cometary nucleus.

O. V Dobrovolsky (*Circ. Stalinabad Ast. Obs.* No. 65, 1948 and *Stalinabad Publ.* **3**, No. 1, 1950) discussed the fluctuations in brightness of Comet 1942*g*, and concluded that they were well correlated with emission of bursts of short wave-length radiation from the Sun.

B. J. Levin has contributed a chapter on 'Advances in the Physics of Comets' to the book, *Progress of Astronomical Science*, Vol. **3**, *Acad. Sci. U.S.S.R.* 1947.

S. K. Vsekhsvyatsky (*Astr. J Sov. Union*, **25**, 257, 1948) has written a paper on the origin of the comets. He discusses hypotheses of Schmidt and of Orlov which postulate comets arising from interstellar clouds and from asteroids, respectively, and goes on to



https://doi.org/10.1017/S0251107X00032375 Published online by Cambridge University Press

discuss and advocate his own earlier theory that comets originate through explosive ejections from the major planets. The same author in a later article (*Astr. J Acad. Sci. U.S.S.R.* **27**, 15, 1950) re-discusses the several apparitions of the short-lived comet Wolf I from 1884 to 1942, paying particular attention to its absolute magnitude at the different times. He concludes that the observations are consistent with the hypothesis that the comet was formed by ejection from Jupiter in 1875.

S. V Orlov has written (*Astr. J Sov. Union*, **25**, 289, 1948) on the subject of the classification of comets according to their forms. The paper treats primarily the tails of comets and argues for two different forms of tail, depending upon whether the principal constituents are small dust particles or molecules.

F J. Ziegel determined the types of tails of twenty-two comets (*Bull. U.S.S.R. Astron.-Geodet. Soc.* 1951, in Press).

S. B. Pikelner and O. N. Metropolskaya (*Astr. J Sov. Union*, **25**, 299, 1948) have studied the effect of the accelerations of the $CO^+$ or $N_2^+$ ions due to the positive charge built up in the tail of a comet arising from escape of free electrons. The acceleration was found to be probably too small to observe (2–20 cm./sec.$^2$), but it might possibly be effective in producing certain structural features of cometary tails.

M. G. J. Minnaert (*Proc. Amsterdam Acad.* **50**, 826, 1947) has calculated the temperatures of solid particles in cometary nuclei under several sets of postulates. He has considered cases of stone and iron meteorites, and elliptic orbits (like Halley's Comet) and parabolic orbits, and has taken different depths in the meteoric masses. He finds maximum surface temperatures about 300° K. Applying his result to Levin's formula, he obtains, for the heat of adsorption of cometary gases, about 5000 cal./mol.

K. Wurm and Wera Lehmann (*Himmelswelt*, **55**, 16, 1947) have made a study of the structure of cometary tails, with particular attention paid to the ray-structure observed in many cases. K. Wurm and L. Biermann have carried out some (unpublished) theoretical work on the tail rays, with no definite results. They believe that probably the effects observed have an electrodynamic cause.

F L. Whipple has advanced a novel and interesting hypothesis of the structure of cometary nuclei and has applied it to several problems (*Ap. J* **111**, 275, 1950 and **113**, 464, 1951). He envisages the nucleus as made up of a conglomerate of meteoric material and 'ices', the latter being solidified $H_2O$, $CH_4$, $NH_3$, $CO_2$, etc. When distant from the Sun, the low temperature keeps the vaporization low. On approach to the Sun, however, the ices are melted, providing the parent molecules, the dissociation products of which are observed spectrographically. After one or more visits to the Sun's neighbourhood, the outside ices are all vaporized and the inside ices protected from the solar radiation by a covering of meteoric material. Various observed phenomena, such as sudden outbursts of gases, orbital accelerations, etc., are explainable on the new model. Its further development and application will be awaited with interest.

J. H. Oort and M. Schmidt (*B.A.N* **11**, 259, 1951) have investigated differences between new and old comets. They define new comets as those that are visiting the region of the Sun for the first time (and for which $1/a < 0{\cdot}00010$) and old comets as those which probably have been in the vicinity of the Sun several times (for which $1/a > 0{\cdot}00010$). They find, among other things, that new comets are distinguished from old ones: (1) by having a more rapid rate of deterioration; (2) by those with $q > 1$ AST.U. having stronger continuous spectra, and (3) by showing a slower variation in brightness with heliocentric distance. They estimated, applying Levin's formula (see Section II, p. 201), that the heat of liberation of the occluded gases giving rise to $C_2$ and CH molecules in the cometary nuclei was about 3100 cal./mol.

## Observations of Brightness and Appearance

Numerous reports of measurements and estimates of the brightness and of the physical appearance of various comets are distributed through the literature of the last three years. Among those that have come to our attention are the following.

G. Merton, director of the comet section of the British Astronomical Association, has summarized the cometary observations of the members of his section for the last three years in annual reports (*J Brit. Astr. Assoc.* **58**, 265, 1948; **60**, 191, 1950 and **60**, 240, 1950). Members of the group attempt to obtain 'determinations' as distinct from 'estimates' of brightness by comparing the comet in focus with stars placed suitably out of focus.

There are observations of the brightness of comets 1932*v*, 1936*a*, 1941*a* (Encke), 1942*g*, 1947*i* (Encke), and 1947*k* recorded in the *Stalinabad Astronomical Circulars* from Nos. 57 to 78 (1948–50) by A. M. Bakharev and O. V Dobrovolsky.

D. J. Martynov has carried on photography of all comets within the range of the 37 cm. Schmidt-type telescope of the Engelhardt Observatory.

B. A. Vorontsov-Velyaminov has studied the structure of the head of Comet 1942*g* from plates obtained at the Abastumani Observatory (*Astronomical Spectroscopy Conference*, **8**, 1950). He found, for the side toward the Sun, strictly circular isophotes for a period of two months. Values were derived for the decrease in density of $C_2$ and CN molecules with distance from the centre of the nucleus.

V Guth, secretary of the Czechoslovak National Committee of Astronomy, has reported that J. Bouska and V Vanysek have deduced values of the absolute brightness of Comets 1947*k*, 1947*n*, 1946*e*, 1948*g*, 1946*a*, and 1941*d*. These results are all given in *B. Astr. Inst. Czech.* Vol. **1**, 1949. For comet Timners (1946*a*) J. Bouska has obtained values of diameter of the nucleus and of mass which are 13 km. and $3{\cdot}25 \times 10^{18}$ gm., respectively. J. Bouska and Z. Svestka studied the variation of the diameter of Encke's comet with solar activity on the basis of observations from 1759 to 1947. They found that the diameter was generally larger at times of low solar activity and that the changes were independent of the comet's absolute brightness. J. Bouska also investigated comet 1942*g* in the same way (*B. Astr. Inst. Czech.* **2**, 24, 1950) and concluded that its diameter and brightness did not show the same dependence on solar activity.

M. Beyer has continued his work on the physical observations of comets (*Mitt. Hamburg Stern. Bergedorf*, Nos. 72 and 73, 1950). A particular point of interest is that he believes there is a real correlation in various cases between the fluctuations in cometary brightness and solar activity.

S. K. Vsekhsvyatsky (*Astr J Sov. Union*, **25**, 337, 1948 and *Kiev Publ.* No. 3, 1948) has carried out a study of the brightness estimates for comets made in the interval 1880–1900. He has revised previously published values and listed the numbers of comets in various groups of absolute brightness. Also, he and his collaborators at the Kiev Observatory have continued their work on determining absolute magnitudes for recent comets.

V P Konopleva has determined the photometric parameters $H_o$ and $n$ for sixty-six comets from 1910 to 1945 (*Kiev Publ.* No. 3, 1950).

B. J. Levin, in an article on the change in brightness of comets (*A.J U.S.S.R.* **25**, 246, 1948), generalizes somewhat his formula (see *A.J U.S.S.R.* **20**, 48, 1943 or *Trans. I.A.U* **8**, 159, 1950) for cometary brightness as a function of heliocentric distance. He treats the photometric observations of thirty-five comets by his formula, which is based on the theory of the release of gases from the solids composing the cometary nucleus.

V Rijves has discussed Levin's formula and its application to photometric observations of several comets (Dissertation, Tartu, 1950).

M. Schmidt (*B.A.N.* **11**, 253, 1951) has studied the variation of brightness of comets with heliocentric distance. He used Levin's expression in the form $m = A + Br^{1/2}$, and evaluated the constants $A$ and $B$ for sixty comets. He noted that the new formula seemed to represent the observations of brightness as well as the old one, $I = I_0/\Delta^2 r^n$.

F Baldet and C. Bertaud report that they are continuing their photometric work on comets, including that using a method of extra-focal photometry. Their most recent set of good photographs was of Comet 1948*g*.



https://doi.org/10.1017/S0251107X00032375 Published online by Cambridge University Press

One of the most interesting developments concerning cometary spectra has followed from further laboratory studies of the well-known $\lambda4050$ group of bands. It will be recalled that these bands, known in the spectra of comets for many decades, were first produced in the laboratory by G. Herzberg in 1942 (*Ap. J* **96**, 314, 1942). The source was a discharge through rapidly streaming $CH_4$, and the evidence pointed to $CH_2$ as the origin of the bands. Preliminary attempts to obtain the bands in absorption, and to secure emission spectrograms with sufficiently high resolution for rotational analysis, were not successful.

Meanwhile Herman (*C.R.* **223**, 281, 1946) found that the $\lambda4050$ group could be produced with good intensity in a discharge tube having carbon electrodes and containing xenon, to which hydrogen could be added. Also, Mme Herman has pointed out (*C.R.* **228**, 1691, 1949) the similarity of the $\lambda4050$ group and certain emissions of CO. In addition, in recent years, A. Monfils and B. Rosen, at Liége, developed as a strong source of the bands a graphite hollow-cathode tube, containing either various hydrocarbon vapours or pure hydrogen (*Nature*, **164**, 713, 1949). Of even more interest, they showed that when the hydrogen, apparently necessary in the source to produce the bands, is replaced by deuterium, the band structure remains identical. The conclusion is thus that the emitting molecule does not contain hydrogen, and that therefore it cannot be $CH_2$. The experiment using deuterium has been repeated by A. E. Douglas at Ottawa. Douglas has further produced the bands in a source in which the $C^{12}$ was replaced with the heavier isotope, $C^{13}$. In this case definite slight shifts were found to occur, indicating that the emitting molecule does contain carbon. Douglas (*Ap. J* **114**, 466, 1951) suggests $C_3$ as a possible emitter. However, the problem of the emitter is not yet solved for certain. Further investigations are being carried out at Ottawa and at Liége.

A further point of interest concerning the $\lambda4050$ group of bands is that they have been tentatively identified with certain strong absorption features in the spectra of late N-type stars, in particular Y CVn (A. McKellar, *Ap. J* **108**, 453, 1948 and P. Swings and A. McKellar, *Ap. J* **108**, 458, 1948).

An investigation in the laboratory, important to cometary spectroscopy, is K. N. Rao's study of the comet-tail system of $CO^+$ bands (*Ap. J* **111**, 306, 1950). Rao has given rotational analyses for several bands, has re-examined and integrated earlier work on the system, and has advanced convincing arguments for revising the vibrational analysis by lowering the $v'$ values by three units.

Mme R. and M. L. Herman (*Ann. d'Ap.* **12**, 52, 1949) have produced evidence that the 0·1 $OH^+$ band makes no appreciable contribution to emissions in the $\lambda4050$ region in cometary spectra.

J. Hunaerts (*Ann. Obs. Roy. Belgique*, **5**, No. 1, 1950) has constructed synthetic profiles of the various sequences of the Swan System of $C_2$ as they might appear in cometary spectrograms. He has assumed a temperature of 3000° K. Hunaerts has also studied the profiles to be expected from bands of several molecules such as HCN, $C_2H_2$, $CO_2$, $NH_3$, $CH_4$, and CN which might possibly be present in the infra-red region of cometary spectra (*Bull. Acad. Roy. Belgique*, **34**, 531, 1948).

C. Fehrenbach (*Ann. d'Ap.* **13**, 170, 1950) has also studied the contours of the Swan bands of $C_2$ as functions of temperature and of spectral resolution. His results should be applicable both to cometary spectra and to stellar spectra.

S. M. Poloskov (*Astr. J. Sov. Union*, **25**, 224, 1948) has written on the excitation mechanism of molecules in the heads of comets, with particular attention paid to the problem of determining the distribution of the cometary molecules among their rotational states.

Y. Öhman has discussed polarimetric work on cometary light and spectra in a series of lectures, 'Polarization Measurements in Astronomy', issued as a volume by the High Altitude Observatory, Climax and Boulder, Colorado.

A number of papers have treated the spectra of individual comets. Included in these papers are those listed below.

Spectrograms of the bright comet 1947*n* were obtained and studied by J. Sahade (*Ap. J* **108**, 159, 1948) and by P Swings and T. Page (*Ap. J* **108**, 526, 1948). The note by the former describes the spectrum in the blue-violet region. The paper by Swings and Page gives a complete description of the spectrum from the ultra-violet to the infra-red beyond $\lambda$8000. The spectra of the two components into which the cometary nucleus split were identical, and two strong emission features in the infra-red at $\lambda$7906 and $\lambda$8106 were discovered but not, however, identified with certainty.

The spectrum of comet 1947*k* (Bester) was also studied in much detail by P Swings and T. Page (*Ap. J* **111**, 530, 1950). Spectra of both nucleus and tail were obtained from $\lambda$3000 to beyond $\lambda$8000. Among the many points of interest brought out were the probable identification of $CO_2^+$ bands in the tail spectrum and observation of the $\lambda$7906 emission found for Comet 1947*n*, which was tentatively identified with CN.

The spectrum of Comet 1948*l* was photographed by P. D. Jose and P. Swings (*Ap. J* **111**, 41, 1950) and by J. Sahade (*Ap. J* **111**, 664, 1950). The study by the former authors is much more complete and detailed than the note by Sahade. Comet 1948*l* had a spectrum showing a fairly strong solar background, so was not as favourable for studying cometary emission features as some recent comets have been.

Periodic Comet Encke (1947*i*) was studied spectrographically by P Swings (*Ann. d'Ap.* **11**, 124, 1948). A series of plates obtained in October 1947 showed that the spectrum did not differ essentially from those of long-period comets on approach to the Sun, and led to a discussion of the spectrum of the comet and to the problem of cometary excitation processes.

Spectrograms of comets 1947*k* (Bester) and 1948*g* (Honda Bernasconi) were obtained at the Haute Provence Observatory and studied by C. Fehrenbach and G. Courtès (*Ann. d'Ap.* **12**, 66, 1949). As well as listing the wave-lengths of emissions measured between $\lambda$3850 and $\lambda$6400, they measured intensities of the $C_2$ Swan bands in the three strongest sequences. Comparison of these intensities with calculated values led to results between 3000° and 4000° K. as values of the vibrational and rotational temperatures indicated by the structure of the Swan bands.

J. Dufay and M. Bloch (*Ann. d'Ap.* **11**, 58, 1948 and **11**, 107, 1948) have reported on studies of the spectra of Comets 1936*a*, 1937*b*, 1937*c*, and 1937*h*. They give lists of wave-lengths for the features measured on objective-prism spectrograms obtained at the Lyon Observatory.

## Suggestions for Consideration

In addition to any subjects arising from the substance of this Report, topics put forward for discussion are those listed below.

P Swings has suggested that among the most pressing requirements for the advance of cometary physics are:

(1) Monochromatic photometry, probably photo-electric, of a few comets before and after perihelion passage. The use of interference filters is advocated and wave-lengths suggested include those of the bands of $C_2$, CN, CH, $NH_2$, solar maximum of radiation, $\lambda$4050 and $\lambda$7096.

(2) Obtaining of cometary spectra with higher resolution than previously, particularly at $\lambda$7906 to try to identify the emission feature there, and near the $\lambda$3590 band of CN to make a more definitive test of the presence of the $OH^+$ band.

(3) Securing cometary tail spectra in the visual and infra-red regions, and also, if possible, slit spectra of cometary tails in the ordinary region with higher resolution than heretofore used.

(4) Additional work in the spectrographic laboratory on certain band systems and search for bands of certain molecules and ions, viz. the $\lambda$4050 bands, $NH_2$ bands and possible bands of $CH_2$, $CH_3$, $C_3$, $C_4$, $C_2^+$, $NH^+$, $CH^{++}$, $CO_2^{++}$ and $CO^{++}$

(5) Simultaneous colorimetric and spectrographic observations of Comet Schwassmann-Wachmann I to examine the spectroscopic significance of rapid variations in brightness, to try to shed light on the origin of the phenomenon.



https://doi.org/10.1017/S0251107X00032375 Published online by Cambridge University Press

(6) Spectrographic observations, probably with necessarily low dispersion, of suitable comets at greater heliocentric distances than those for which such observations have yet been made. At such great distances it would be expected that spectra of polyatomic molecules would be relatively stronger than at closer approach to the Sun.

Some of the above suggestions were made in the previous report of this Commission.

(7) K. Wurm has suggested that it might be valuable for future observers to pay some attention to the formation and development of cometary tails with ray structure of the type studied by him and Miss Lehmann, referred to earlier in this Report. In particular it would be interesting to look for the rays near the origin, that is, near the cometary nucleus. Since it would be advantageous to filter out certain radiations for study, probably only moderately large telescopes should be used. Wurm recommends, in order that the changing structure be resolved, that exposure be not longer than about fifteen minutes.

(8) G. Merton has suggested that more observations of the brightness of nuclei of comets be made, and, in particular, that in photographic observations the magnitude of the nucleus, when clearly defined and therefore reliably comparable to stars, should always be given.

S. V Orlov, S. M. Poloskov and B. J Levin have advanced the following recommendations:

(9) That observatories communicate to the Commission on Comets and Meteors of the Astronomical Commission of the Academy of Sciences of the U.S.S.R. certain data on photographs and spectrograms of the bright comets that have appeared since 1940 and of bright comets that will be observed. The data requested are those dealing with any complex structure of the head or tail (the exposure times should be mentioned). The purpose of providing the information is to enable summaries of it to be published.

(10) That, for the purpose of detailed investigation of motions of matter in cometary heads, observatories possessing large-aperture reflectors should obtain photographs of bright comets in close series, if possible, four to six photographs in succession with exposures of 10–15 minutes.

(11) That, in order to study cloud formations in the tails of comets, those observatories that are able to, should photograph the tails of bright comets with large-aperture astrographs having as wide fields as available. If possible four to six photographs should be obtained per night with exposures of about 30 minutes each.

(12) That (somewhat similarly to the recommendation of P Swings) nebular spectrographs be used to obtain slit spectra of comets' tails.

(13) That all negatives of cometary photographs and spectrograms be calibrated to enable photometric and spectrophotometric investigations to be made.

(14) That, with the aim of studying the possible rotation of cometary nuclei, series of photographs of nuclei should be made with long-focus astrographs. Groups of three exposures, 10, 30, and 90 seconds, are recommended, with intervals between the groups of about 10 minutes.

(15) P Swings has again brought forward the suggestion of preparing and publishing a photographic atlas of typical cometary spectra. The suggestion was made in 1948 at the Zürich Meeting of the Commission, but no action has yet been taken. Dr Swings has also generously offered, if suitable moderate financial assistance for photographic work, supplies, etc., be given by the I.A.U., to supervise the project. It is urged that the advisability of proceeding with this atlas be given serious consideration.

ANDREW MCKELLAR<br>*President of the Commission*



https://doi.org/10.1017/S0251107X00032375 Published online by Cambridge University Press

*Compte rendu des séances.* 8 et 10 septembre 1952

PRÉSIDENT: Dr F. BALDET.

SECRÉTAIRE: Prof. P. SWINGS.

En l'absence de Dr McKellar, Dr Baldet, ancien Président de la Commission, préside la séance à l'invitation du Président. Dr Baldet fait part avec émotion du décès de M. Quénisset, qui a effectué de nombreuses et excellentes observations photographiques de comètes. Sa collection de clichés est conservée à l'Observatoire Flammarion à Juvisy.

La Commission a co-opté sept nouveaux membres à qui Dr Baldet souhaite la bienvenue.

Le rapport du Dr McKellar ne couvre que les travaux parus avant la fin de 1950. Dr McKellar a demandé par écrit si la Commission désire que ce rapport soit complété jusqu'en 1951.

Prof. Swings signale qu'il s'agit là d'une question générale, concernant toutes les Commissions. Il suffira que le rapport suivant couvre la période postérieure à 1950.

*Examen des suggestions.* M. Nicolet met en question le point 15 relatif à la préparation d'un atlas de spectres typiques de comètes.

Dr Wurm doute de l'utilité d'un tel Atlas. Il serait plutôt d'avis de concentrer les efforts sur l'étude de la structure et des mouvements au sein de la tête et de la queue. Il communique certaines informations intéressantes à ce sujet.

Prof. Swings insiste sur le fait que trois conditions devraient être remplies pour qu'il accepte de tenter la réalisation de l'Atlas:

(1) Il faudrait que les membres jugent la chose suffisamment utile.

(2) Les membres devraient promettre leur aide sous la forme de prêts de clichés ou d'agrandissements.

(3) Il faudrait obtenir une aide financière de la part de l'Union.

MM. Pearse, Oort et Whipple s'expriment très en faveur de la préparation d'un atlas. Celle-ci est votée à l'unanimité de la Commission. Le vœu sera transmis au Comité Exécutif, en même temps qu'une demande de subside permettant la mise en train de la préparation de l'Atlas.

## *Communications*

1. Dr Merton fait la communication suivante:

Dr G. Merton asked the views of members of the Commission on his proposal that observers should determine the magnitude of a limited small central area of a comet, the area most easily observed. This proposal was distinct from the proposal already made (*Draft Reports*, **1**, p. 91, no. 8) for more observations of the brightness of nuclei, and the observations were of course to be in addition to those of the integrated brightness of the whole comet (whatever that might mean) which the observer usually made. He suggested that perhaps a circular area of 1′ diameter at a geocentric distance of one astronomical unit might be suitable for adoption to fix a standard volume of the comet for measurement.

Since ephemerides were now always soon available, the area to be observed determined by this diameter $1'/\Delta$, where $\Delta$ is the geocentric distance, would be known to the observer. He suggested that the symbol *C* might be appropriate to distinguish from others this magnitude of the *c*entral *c*ondensation of the *c*oma of the *c*omet. He remarked that the central condensation was frequently described by observers wrongly as the nucleus—the very small sharply bounded disc or starlike point sometimes seen under high magnification—and he hoped members would correct this error when they came across it.

Observations of P. Schaumasse last January–February had again emphasized how unsound are our present methods. Visual observers with instruments of around 6-inches aperture gave the brightness as about $8^m$ (photographs too indicated this), while those with smaller instruments who saw a much larger diameter give it as $6^m$ or $7^m$, and those who saw it with the



https://doi.org/10.1017/S0251107X00032375 Published online by Cambridge University Press

naked eye said it was $5^m$. It well demonstrates that unless a boundary is well defined the integrated magnitude cannot be a reliable measure.

Dr Merton admitted that there might be considerable difficulties in making the determinations proposed, but stressed that these difficulties would be much less than those at present encountered in trying to integrate the whole light of a large unequally illuminated area the boundaries of which could not be defined but varied according to the instrument used, observing conditions, the observer's eye or the photographic plate and exposure time, etc., numerous factors for which it was impossible to correct in the result. Recent theoretical work on comets made it very necessary that a reliable standard should soon be found for comparing their brightness, and this it seemed could only be achieved by adopting a standard area of the comet to be observed for brightness. There were now several experienced visual observers in the Comet Section of the British Astronomical Association and it would be possible for them to experiment on the best methods to be used. He asked therefore for the views of members of the Commission, and offered collaboration to anyone interested.

Dr Merton said also that he had communicated the suggestion to the President, Dr McKellar, as well as to Dr Baldet, and that Dr McKellar had written it would be of value to spectroscopic observers. Although they really desired to know the magnitude of the central 2″ or 3″, he was sympathetic toward any proposal that would lead to a better, more exact description of a cometary head.

Dr Baldet fait remarquer que le noyau d'une comète n'est observable que lorsque cette comète passe très près de la terre.

M. Bigay est d'avis qu'il faudrait connaître la relation entre la nouvelle magnitude *C* et la magnitude globale.

En réponse aux questions de MM. Bigay et Schmidt, sur la question de savoir comment une magnitude *C* serait déterminée, Dr Merton suggère qu'une étoile de comparaison convenable soit amenée hors foyer, de telle sorte que sa brillance de surface soit égale à celle de l'aire désirée de la comète. En mesurant le diamètre du disque de lumière stellaire, on pourrait alors calculer la lumière de l'aire de dimension standard, ce qui définirait la magnitude *C* de la comète.

M. Whipple exprime l'avis que des mesures effectuées de façon bien définie, par plusieurs observateurs, seraient toujours utiles pour l'interprétation des phénomènes cométaires.

Mention est faite des essais effectués à l'Observatoire de Leiden au moyen d'un photomètre photoélectrique. L'Observatoire de Leiden serait heureux de collaborer avec le groupe de Dr Merton dans le développement de la méthode préconisée.

Dr Wurm insiste sur l'importance de mesures photométriques précises, surtout en vue d'établir une comparaison entre la brillance des comètes et les phénomènes solaires.

Un échange de vues indique qu'outre la magnitude *C*, la magnitude globale de la comète reste désirable, surtout en lumière monochromatique.

2. Dr Beyer décrit sa méthode.

Pour vérifier et calibrer celle-ci, il a traité de la même façon des nébuleuses et amas bien définis du point de vue photométrique.

3. Prof. Swings propose l'étude de la comète Pons-Brooks 1884 I, comète périodique qui passera au périhélie le 27 mai 1954 et sera alors de la 5e grandeur. Cette comète est intéressante par sa similitude orbitale avec la comète Halley. Une campagne internationale de trois ans serait désirable dans quatre voies:

(*a*) Photométrie: effectuer des observations monochromatiques précises avec filtres interférentiels isolant des émissions moléculaires bien définies ainsi que la lumière solaire réfléchie.

(*b*) Spectroscopie: suivre régulièrement l'évolution du spectre, en particulier dans l'infrarouge et la région $\lambda$ 3600.

(*c*) Variations de structure de la queue et de la tête.

(*d*) Relations avec le soleil.

Cet objet ne sera jamais très brillant et les spectres requireront des instruments assez puissants.

Dr Baldet dit qu'il serait intéressant d'y ajouter des mesures de polarisation et d'étudier également les mouvements au sein de la queue et de la tête.

4. Dr Baldet lit des communications de Dr Richter concernant des variations de brillance de comètes.

5. M. Whipple insiste sur la recommandation, contenue dans le Draft Report, d'observer soigneusement la comète Schwassman-Wachmann.

6. M. Bobrovnikoff partage, dans les grandes lignes, les vues de Dr Richter. En ce qui concerne son étude des observations photométriques de la comète Schwassman-Wachmann, il n'a pas publié ses résultats à cause des fortes discordances entre les estimations photométriques faites par divers auteurs au cours de la même nuit.