

COMMISSION 15: PHYSICAL STUDIES OF COMETS, MINOR PLANETS AND METEORITES
(L'ETUDE PHYSIQUE DES COMETES, DES PETITES PLANETES ET DES METEORITES)

Report of Meetings on 25, 26, 29 and 31 July 1991

PRESIDENT: J. Rahe. VICE-PRESIDENT: A.W. Harris. SECRETARY: D.I. Steel.

BUSINESS MEETING OF COMMISSION 15 : 26 July 1991, Session 1

The meeting was called to order by the President, J. Rahe, with approximately 25 members of Commission 15 being present. Those assembled stood in silence in remembrance of the following of our co-workers who had died in the last triennium: O.V. Dobrovolsky, E. Everhart, P.M. Millman, C.B. Opal and Zhou Z.-H.

Officers and Organizing Committee

A.W. Harris and M.F. A'Hearn were proposed by the OC for President and Vice-President, respectively, of the Commission, and were confirmed by the Executive Council of the Union, for the triennium 1991-1994. D.I. Steel was appointed Secretary. Following long tradition, members of the Organizing Committee serve for two three-year terms. Those retiring from the Committee include: C. Arpigny, J. Wasson, O.V. Dobrovolsky (deceased), H. Haupt, and S. Wyckoff, and are thanked for their service. Newly appointed members are M.A. Barucci, W.F. Huebner, H.U. Keller, N.N. Kiselev and Z. Knezevic. Continuing members are M. Belton, J. Brandt, E. Grün, D.W. Hughes, D. Lupishko, H. Rickman, and E. Tedesco. Following two terms of service, C. Arpigny stepped down as Chairman of the Working Group on Comets, and was replaced by H.U. Keller. V. Zappalá will continue as Chairman of the Working Group on Minor Planets and Meteorites through 1994. After a brief discussion of the relationship of the meteoritical community within the IAU, it was agreed to combine the Working Group on Meteorites with the Working Group on Minor Planets.

Membership

The following were admitted as new members of Commission 15: M. Barucci, R. Binzel, F. Capacioni, M.T. Capria, G. Carruthers, U. Carsenty, A. de Almeida, G. Forti, P. Gamelgaard, W.T. Huntress, H. Karttunen, C.S.L. Keay, N.N. Kiselev, A.L. Lane, K. Meech, T. Michalowski, K.S. Noll, C.B. Opal (deceased), C.T. Pillinger, T. Sato, M.V. Sykes, I. Toth, T. Van Flandern, A.S. Walker, J.-I. Watanabe. Five persons were appointed Consultants for the next triennium: D. Boice, R. Gil-Hutton, S. Hoban, G. Tancredi, and T. Yanai.

Communications

Future meetings of interest to members of the commission were discussed, amongst them that at Liège in June 1992, and that on 'Meteoroids and their Parent Bodies' to be held in Bratislava in early September 1992; the incoming President of Commission 22, J. Stöhl, warmly extended an invitation to all present to attend that meeting.

A communication from the Giotto Extended Mission Office at ESOC was received, requesting astrometric observations of P/Grigg-Skjellerup (the next target for the Giotto spacecraft) prior to the July 1992 encounter.

Resolutions

The various resolutions before the GA and Commission 15 were then discussed. The GA resolution on the detection and study of Near-Earth Objects was adopted unopposed. The GA resolution on Interplanetary Pollution was discussed with some dissension on the grounds that it might limit future spacecraft missions and hence the activities of the commission; the resolution was adopted by a majority vote. A Commission 15 resolution advocating the encouragement of investigations of likely target comets for the CRAF spacecraft was adopted unopposed. A proposal to set up a Working Group on disruptive impacts between minor planets was introduced and discussed, but dropped. Finally, a communication from Wamsteker asking the support of Commission 15 for world astronomy days and coordinated observation programs was tabled; the fact that 1992 is International Space Year was noted.

SCIENTIFIC PRESENTATIONS ON COMETS : 25 July 1991, Session 1

A session dedicated to comets was organized and chaired by J.C. Brandt.

A.-C. Levasseur-Regourd (University of Paris VI), with J.B. Renard and E. Hadamcik, described polarimetric mapping of the coma of Comet Levy (1990c), and showed that in the inner coma the slope of the polarization versus phase angle curve is higher than at distances above 2000 km. This may indicate that the dust grains are smaller than typical, with dust jets like those in P/Halley. Future observations should try to resolve the inner and outer coma since differing properties are found.

H.J. Reitsema with co-workers M. Descour and W.A. Delamere (Ball Aerospace, Boulder, CO, USA) reviewed the Giotto observations of the coma dust distribution within 2000 km of the nucleus of P/Halley and presented new findings on the changes observed during the 3-hour period of camera coverage.

M. Wallis (University of Wales, Cardiff), with N. Meredith (U.C. London), discussed imaging of P/Grigg-Skjellerup at the 630 nm wavelength of [OI] with a new photon detector which alleviates contamination by NH₂. They find that the H₂O parent, which in turn produces the [OI], has a scale height of ~2000 km at 1 AU, several times the [OI] collisional quenching scale.

Finally J.C. Brandt (University of Colorado) described the status of our knowledge of the cause of cometary disconnection events. He reviewed the various theories and the problems in investigating these DE's, concluding that progress is being made, and that the latest results continue to favour the mechanism of magnetic reconnection at interplanetary sector boundaries as the origin of the observed phenomenon.

SCIENTIFIC PRESENTATIONS ON MINOR PLANETS : 26 July 1991, Session 2

D. Morrison (NASA-Ames) reviewed the recent meeting on 'Near-Earth Asteroids' (NEA's) held in June-July at San Juan Capistrano, California. In particular he discussed the plans now being developed for an international program to discover essentially all near-Earth objects down to 0.5 km (~10,000 in total) within the next 25 years.

B.G. Marsden (Harvard-Minor Planet Center) gave an overview of the discussions of families of asteroids which occurred at the recent meeting in Flagstaff, Arizona. From the times when J. Williams suggested many families to those of A. Carusi and G. Valsecchi who suggested only three families existed, this subject has come a long way. There are now suggestions of not only distinct families but also, from V. Zappalá, the idea of clumps, clans and clusters.

K. Lumme (Helsinki) discussed how to derive some global properties (such as the shape, albedo and pole orientation) of convex minor planets using spherical harmonic expansions of their light-curves.

D.K. Yeomans presented a paper on behalf of S. Ostro (Jet Propulsion Laboratory) in which radar observations of near-Earth asteroids between 1980 and 1991 from Arecibo and Goldstone were reviewed. Of particular interest were the results which showed that 1986 DA appears to be metallic in nature, whilst 1989 PB is a dumbbell shape, possibly a contact binary. Radar data are also invaluable in refining the orbit of a NEA.

E. Tedesco (Jet Propulsion Laboratory) discussed the status of the second version of the IRAS asteroid catalog scheduled for release in April 1992. He described how the flux over-estimation and systematic difference between the albedos and diameters obtained at 12 and 25 μm were dealt with, and showed that the accuracy of the standard thermal model used to derive diameters from the IR flux is of order 5%.

T. Van Flandern (Meta Research, Washington, DC) discussed the evidence that the standard model of the origin of the minor planets is incorrect, and predicted that the Galileo spacecraft will detect many small satellites around Gaspra when it encounters that asteroid in late October 1991. This would support his hypothesis that the minor planets originated in the explosion of a larger body in the astronomically-recent past.

DISCUSSION OF COMETARY DATABASES : 29 July 1991, Session 1

A session dedicated to cometary databases was chaired by M.F. A'Hearn, advance organization having been carried out by C. Arpigny. The discussion commenced with a general overview by M.F. A'Hearn of the items to be possibly included in the database.

B.G. Marsden then reviewed the discussions on this topic which occurred at the recent meeting in Flagstaff. He pointed out the problems that existed for comets due to their diversity (compared to minor planet data), and also that the volume of data was very large, with little uniformity.

R. West suggested that data should be stored in 'as original as possible' a state, but simply intelligible. Due to the volume of data he suggested that as a first step the planned database should perhaps be just an index to the raw data sets which would be held by their originators. This met with general approval. Further suggestions were made that the most important thing required at present was a bibliography of publications on each comet, and a listing of people who hold data which are available to others.

Mechanisms for making the cometary database available to others were then discussed, with the idea that the data should be accessible through an electronic mail network such as INTERNET being favoured. The possibility that a bulletin board might be set up for comets and minor planets was mooted, although this would require a large amount of time for one person to administer. The consensus was that direct contacts between people who are active in the field was the most likely method to succeed: an informal but effective system.

JOINT MEETING WITH COMMISSION 20 ON COMET-MINOR PLANET INTERRELATIONS : 31 July 1991, Session 4

This joint meeting, organized by A.W. Harris and R. West, was originally scheduled to occupy two sessions. Because of the fire in the San Martin Conference Building, it was necessary to compress it to a single session, chaired by A.W. Harris.

D. Steel (Anglo-Australian Observatory) discussed the evidence for meteoroid streams associated with Apollo-type asteroids; such streams might indicate the asteroids to be extinct or dormant comets. The available database on meteor orbits, and its analysis, were described. The calculation of theoretical meteor radiants was also mentioned, and it was shown that methods used to date often give misleading results: in order to get a realistic radiant it is necessary to integrate orbits of comets or minor planets to the points at which they have a node at 1 AU, and then calculate the radiant.

R. West (European Southern Observatory) described methods for detecting low-level activity in distant comets so as to determine whether they should be classified as comets or minor planets (*e.g.* Chiron). Three types of detections are possible which may indicate comet-like activity: (a) a tail (to 6–7 AU); (b) a coma (to ~17 AU); or (c) increased brightness (to 17 AU+). Observations have been made of various distant minor planets, Trojans, and 1991 DA, and now data collection for 6 comets beyond 15 AU is planned.

B. Gustafson (University of Florida) showed his backward orbital integrations of meteoroids from the Geminid shower, compared these to 3200 Phaethon, and found that the meteoroids could have been released from that minor planet during a cometary phase of its evolution within the past few millennia. Gustafson then gave a paper, jointly with S.F. Dermott and colleagues from Florida and the Brazilian National Observatory, on IRAS data fitting to models of the zodiacal dust cloud. They find that the cloud is not rotationally symmetric, and believe that particles released in an asteroid break-up are largely responsible for the origin of the cloud; in particular they implicate the asteroids in the Hirayama family.

J. Stöhl, with V. Porubčan (Slovak Academy of Sciences, Bratislava), detailed an investigation of the association of meteoroid streams with near-Earth asteroids, finding a strong association for 10 Apollos and 5 Amors which come within 0.1 AU of the Earth.

H. Rickman (Uppsala Observatory) presented evidence for rapid dust mantling on short-period comets, dependence being found upon the orbital types and physical parameters of the nuclei. Marginally stable mantles are often formed within ~10 revolutions about the Sun, but these are only just stable and so may be disrupted by a change in the orbit (*e.g.* $\Delta q > -0.5$ AU). A new parameter to measure the 'freshness' of the nucleus was introduced, and its values for different comets discussed.

I.P. Williams (Queen Mary and Westfield Colleges, London), with C.-I. Lagerkvist (Uppsala), A. Fitzsimmons (Queen's University, Belfast) and P. Magnusson (QMWC, London), described 400–800 nm spectra from minor planets suspected to be 'dead comets': mostly Trojans and distant main-belt asteroids. For 20 such objects plus 3 'real' comets they found emission features only for the comets plus Chiron. A peculiar time-dependent absorption feature was seen in the spectrum of Thule near 520 nm which requires an explanation; a similar feature was detected in Rolandia.

To close this session, and the Commission 15 activities at the GA, B.G. Marsden (Harvard-Minor Planet Center) was delegated to lead a discussion on whether 'active' minor planets should be re-designated as comets, and whether the contrary should be the case for defunct comets. This subject has become topical due to the activity of 2060 Chiron which has been identified in the past few years. Historically there are 28 cases of objects being given preliminary designations as minor planets which have later proven to be comets, and 9 cases of 'comets' which were later recognized to be minor planets. Some questions in this area have yet to be resolved. The consensus was that objects should not be re-designated (*i.e.* 2060 Chiron should continue to be described that way), and that if it is not possible to establish the cometary character of an object soon after its discovery then it should be designated as a minor planet. Re-designation as a comet prior to numbering as a minor planet is straightforward.