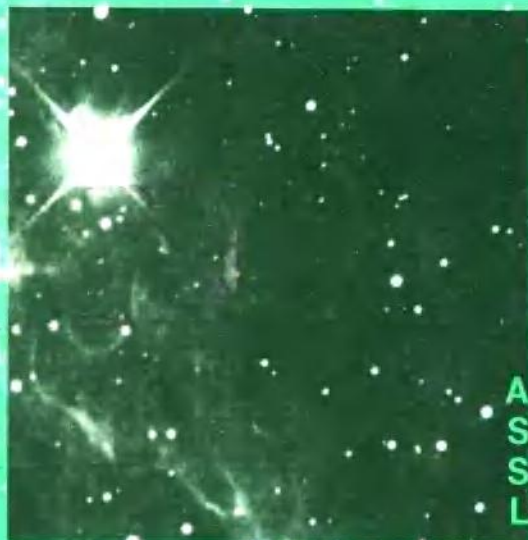


Origin and Evolution of Interplanetary Dust

A. C. Levasseur-Regourd
H. Hasegawa
(editors)



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ORIGIN AND EVOLUTION OF INTERPLANETARY DUST

PROCEEDINGS OF THE 126TH COLLOQUIUM OF THE
INTERNATIONAL ASTRONOMICAL UNION,
HELD IN KYOTO, JAPAN, AUGUST 27-30, 1990

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PREFACE

THE KYOTO COLLOQUIUM

It has almost become a tradition to periodically review the progress of our knowledge of interplanetary dust at an interdisciplinary level. After the Honolulu (1967), Heidelberg (1975), Ottawa (1979) and Marseilles (1984) meetings, it was decided to hold a meeting specially devoted to the Origin and Evolution of Interplanetary Dust in Kyoto, Japan on 27-30 August 1990. This colloquium was certainly appropriate in location, timing and objective.

The choice of the location was most appropriate, not only because of the charm of the beautiful city of Kyoto, but also because of the important involvement of our Japanese colleagues, both in observations of interplanetary, cometary, meteoritic, circumplanetary or circumstellar dust, and in physico-chemical analysis or theoretical developments. We owe many thanks to the Local Organizing Committee and to the Japanese supporting organizations (ICRR, NAO, ISAS, KIT) for the efficient and most pleasant way in which colloquium was organized.

The timing of the meeting was equally appropriate. During the eighties, new knowledge had emerged from comprehensive studies of cometary flybys or remote observations, while infrared space observations of asteroidal dust bands, cometary debris trails, and thermal emission from interplanetary dust cloud. More recently, new in-situ data were provided by the Long Duration Exposure Facility, the space station Mir, the Hiten spacecraft and the Galileo space probe; simultaneously the question of the interrelation between interstellar or circumstellar dust and interplanetary dust received much attention.

The colloquium was sponsored by commission 21 (Light of the Night Sky) from the International Astronomical Union, and cosponsored by commission 15 (Physical Study of Comets, Minor Planets and Meteorites) and commission 22 (Meteors and Interplanetary Dust) of the IAU, together with commission B of COSPAR. The Science Organizing Committee represented a broad range of nationalities and expertise. The programme, with 20 invited papers, 30 contributed talks and 60 poster presentations, attracted 122 registered participants from 15 different nations.

THE PROCEEDINGS

The order of presentation of these proceedings virtually follows the order in the meeting: Interplanetary dust by space and Earth environment studies, with special emphasis on new results (Part I); interplanetary dust by physical and chemical analysis, along with laboratory simulations on relevant ices and mineral (Part II); interplanetary dust by zodiacal light and optical studies with interpretation of the observations in the infrared range (Part III); Cometary dust, observations and evolution (Part IV); Meteoroids and meteor streams (Part V); Circumplanetary dust, collisional and electrostatic processes (Part VI); Origin of interplanetary dust, from comets as asteroids, back to interstellar and

circumstellar dust (Part VII). The colloquium summary, prepared by Mayo Greenberg, shows - from its multifaceted approach - just how much the interplanetary medium is thriving; it suggests that the question of the dual source of the interplanetary dust has now been answered, the final stage being to trace asteroids and comets back to the interstellar cloud out of which the solar system was born.

The great interest in the colloquium was obvious to all the participants and the editors have attempted to produce conference proceedings reflecting the quality of so many fine presentations on a wide range of interrelated topics. The discussion remarks were handed out at the end of the meeting to the authors, who were recommended to incorporate them in their manuscript. All articles were scrutinized by various experts, and the revised manuscripts were later edited, either in France or in Japan. It is indeed a great pleasure to thank the following referees for their help: J.A. Burns, N. Fujii, A. Fujiwara, T. Fukuoka, E. Grün, J.M. Greenberg, M.S. Hanner, I. Hasegawa, S.S. Hong, D. Jewitt, H. U. Keller, C. Koike, P. Lamy, A.C. Levasseur-Regourd, B.A. Lindblad, K. Lumme, T. Maihara, J.A.M. McDonnell, H. Mizutani, S. Mukai, T. Mukai, Y. Nakagawa, T. Nakano, K. Nogami, A. Sakata, H. Tanabe, N.C. Wickramasinghe, K. Yamakoshi, T. Yamamoto. As is likely in a colloquium, not all the papers represent the points of view of the majority of the participants. It is nevertheless to be emphasized that the efforts of the referees are appreciated and their comments have been taken into account by the authors, to the benefit of the reader.

Even with many published papers, such a book has to remain a convenient tool for future daily work. It was therefore decided that the proceedings should not exceed 500 pages and that the emphasis would be put on conciseness: eight pages for invited reviews, six pages for invited contributions and four pages for contributions and posters. Besides, all the participants wanted the proceedings to be published in less than a year after the colloquium. Strict deadlines were imposed for manuscript submission, refereeing procedures, final submission and editing. It is indeed a pleasure to thank all the authors for their kind and efficient cooperation.

The editorial was mainly carried out at Université Pierre et Marie Curie (Paris VI)/Service d'Aéronomie du CNRS. I especially thank Pierrette Montagné, Edwige Regnault, Jean-Baptiste Renard and Emmanuel Villame for their assistance. The book has been produced from camera ready manuscripts prepared in 15 different countries all over the world. It nevertheless contains very few non-uniformities, since some papers, together with all the headings, were appropriately retyped by the publisher.

Finally, I wish to express my gratitude to Tadashi Mukai, secretary of Science organizing Committee, and contact person with the publisher in Japan for his invaluable help both at the meeting and in the preparation of the proceedings.

A. Chantal Levasseur-Regourd
Pairs, April 1991

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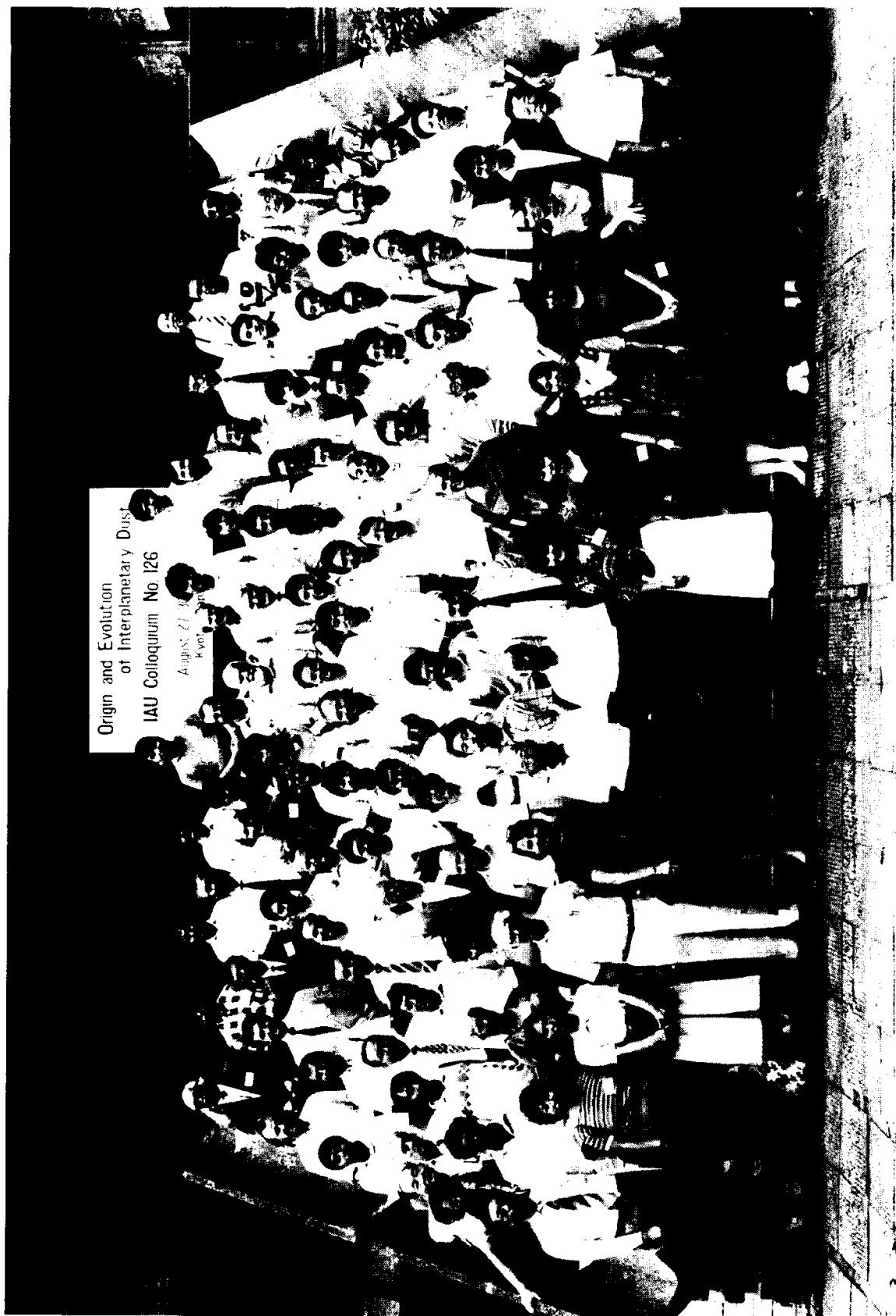
The IAU Colloquium #126 "ORIGIN AND EVOLUTION OF INTERPLANETARY DUST" was held in August 27~30, 1990 at the Kyoto Auditorium.

The "Interplanetary Dust Community" had held four meetings in the past; Honolulu (1967), Heidelberg (1975), Ottawa (1979) and Marseille (1984). Kyoto Colloquium is the 5th meeting in this series.

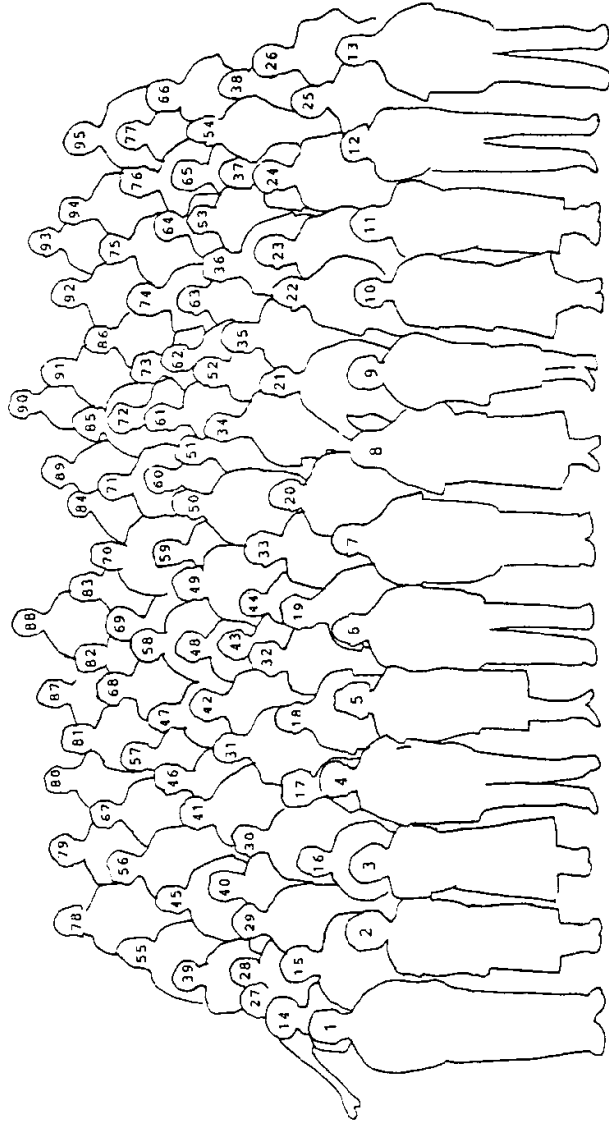
This Colloquium was sponsored by IAU Commissions 15, 21 and 22 and also COSPAR B-1. The supporting organizations were Kyoto Univ., Institute for Cosmic Ray Research, Univ. of Tokyo (ICRR), National Astronomical Observatory (NAO), Institute of Space and Astronautical Science (ISAS) and Kanazawa Institute of Technology (KIT). The meeting was supported by grants from the Commemorative Association for Japan World Exposition, Nishina Memorial Foundation, Yoshida Foundation for Science and Technology, the Murata Science Foundation, Yamada Science Foundation, Shimadzu Science Foundation, Konica Corporation, Space Development Group of Fujitsu Ltd., Central Research Laboratory of Sumitomo Metal Mining Co.Ltd., Sanpa Industries Ltd., Arakawa Technical Research Co.Ltd. and Osaka Sangyo University. We would like to express our deep appreciation for their valuable support.

We hope that all participants gathered at the Colloquium were able to carry on fruitful discussion about the origin and evolution of interplanetary dust and perhaps found new scientific subjects to work on. We also hope that the discussion created a basis for future collaborations. Finally, we are grateful for the advice and help by the members of the Scientific Organizing Committee and the staff in the office of the Local Organizing Committee.

Prof. Dr. Hiroichi Hasegawa
The Chairman of Local Organizing Committee
of IAU Colloquium #126



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R.H. Giese (1931-1988)

Richard H. Giese was born in Stuttgart/Germany. While in High School he was already enthusiastic about Astronomy and Space Science. He studied Physics and Astronomy at the Universities of Stuttgart and Tübingen. His thesis was on "Scattering of Electromagnetic Radiation at Absorbing and Dielectric Spheric Particles" and in 1961 he graduated with the well known astronomer Prof. Siedentopf, Tübingen. Three years later he became a University Teacher through Habilitation on "Optical Determination of the Rotation Axis of Artificial Satellites". After a few years of scientific work at the Institute of Extraterrestrial Physics in the Max-Planck-Institut für Physik und Astrophysik, Munich, he was asked to join the Ruhr-University of Bochum. There he founded the Bereich Extraterrestrische Physik as part of the Faculty of Physics and Astronomy of the Ruhr-University.

From this time onwards (1963) Richard H. Giese worked with young scientists and students in the field of Interplanetary Dust. His special interest was the scattering of solar radiation on dust grains, the so-called Zodiacal Light. He has promoted this field in two directions: experimentally by using microwaves and laser- light and theoretically by modelling the dust distribution in the solar system. We had a continuous close collaboration in interpreting our joint results from space observations of the zodiacal light and from direct dust experiments on space probes. In particular he strongly cooperated as a Co-experimenter in the dust experiments of the space mission Helios, GIOTTO, Galileo and Ulysses.

Richard H. Giese's international cooperation both within the International Astronomical Union (President of Commission 21 from 1982 to 1985) and COSPAR (commission B.1) brought him high prestige. During his IAU-presidency he was Chairman of the IAU-Colloquium No.85 on "Properties and Interactions of Interplanetary Dust" which was held in Marseille/France in 1984, the most recent IAU-Meeting devoted to our field of research.

At the Ruhr-University, Bochum, he was a highly esteemed teacher and lecturer. We all have lost not only an excellent scientist but also a good friend. We will never forget his

integrity and friendly personality with a good sense of humor.

Hugo Fechtig, Christoph Leinert



M. Huruata (1912-1988)

Masaaki Huruata was born in Nagano-ken/Japan. In his school days he was already very active in observation of the variable stars. Immediately after graduation from the Astronomy Department, University of Tokyo in 1938, he worked at the Harvard College Observatory in the United States for three years. His research at this observatory was mainly concerned with variable stars and meteors. He returned to Japan in 1941 and joined the Astronomy Department and the Tokyo Astronomical Observatory of the University of Tokyo. During this period his interests expanded to encompass, besides variable stars and meteors, the zodiacal light and airglow, making use of the then newly developed technique of photoelectric photometry. He made significant contributions to these research fields with various pioneering works.

Masaaki Huruata obtained his Doctor of Science in 1955 and he was appointed Professor of the Tokyo Astronomical Observatory in 1957. At the time of the International Geophysical Year (1957-58), he organized a cooperative program among the airglow observatories in Japan. He also took charge of the World Data Center C2 for Airglow. His efforts in the promotion of Japanese airglow observations and of international cooperation were continued until his retirement.

From 1968 to 1973 Masaaki Huruata assumed the position of Director of the Tokyo Astronomical Observatory. In addition, he held many important and responsible posts, among which are Vice-President of the Astronomical Society of Japan (1961-63), President of Commission 21 of the International Astronomical Union (1967-70), Senator of the University of Tokyo (1968-73) and member of the Science Council of Japan (1969-72).

In 1973, Masaaki Huruata retired from the Tokyo Astronomical Observatory and was conferred the title of Emeritus Professor of the University of Tokyo. After the retirement, he re-started observation of the variable stars with his own telescope and, sometimes, gave useful advice to young scientists and amateur astronomers.

He passed away on 23 November 1988 at the age of seventy-six. We express our deepest regret to the loss of this pioneer and fine gentleman.

Hiroyoshi Tanabe



Peter Mackenzie Millman 1906 – 1990

Peter M. Millman died at Ottawa, Canada, on December 11, 1990 at age 84. As the son of a missionary, he spent most of his youth in Japan and remained fluent in Japanese. After an undergraduate degree at the University of Toronto, he completed a PhD in 1932 at Harvard with a study of meteor spectroscopy. His working career as an astronomer was spent at the University of Toronto, the Dominion Observatory, Ottawa, and until his retirement in 1971, as head of upper-atmosphere research at the National Research Council, Ottawa. Even after retirement he continued to come into his office at NRC until about a month before his death. His special field was the spectroscopy of meteors but he also carried out visual and radar studies.

He received many awards for his contributions to science including the J. Lawrence Smith Medal of the US National Academy of Sciences, the Gold Medal of the Czechoslovak Academy of Sciences, and most recently, he was honoured by the naming of Minor Planet No. 2904 as "Millman".

In later years he was interested in planetary-system nomenclature and served as chairman and member of the IAU Working Group for some 15 years.

Bruce A. McIntosh