

1986 III

The American Physical Society

DIVISION OF ATOMIC, MOLECULAR, AND OPTICAL PHYSICS

RICHARD D. DESLATTES, Chairperson
NATIONAL BUREAU OF STANDARDS
4141, PHYSICS BUILDING
GAITHERSBURG, MARYLAND 20899
(301) 921-2061

W. CARL LINEBERGER, Vice-Chairperson
JILA-BOX 440
UNIVERSITY OF COLORADO
BOULDER, COLORADO 80309
(303) 492-7834

KATE P. KIRBY, Secy.-Treas.
CENTER FOR ASTROPHYSICS
60 GARDEN STREET
CAMBRIDGE, MASSACHUSETTS 02138
(617) 495-7237

July 1986

To Members of the AMO Physics Division from Kate Kirby

I. AMO PHYSICS DIVISION ELECTION RESULTS

Congratulations to Carl Lineberger of JILA and the University of Colorado and to Pat Dehmer of Argonne National Laboratory who were elected to the offices of Vice-Chairperson and Executive Committee Member, respectively. It was a very close election, with more members voting than ever before. Thanks go to all the candidates who agreed to run and have served the Division in so doing.

II. REPORT ON THE 1986 AMO PHYSICS DIVISION ANNUAL MEETING,
HELD JOINTLY WITH DCP IN EUGENE, OREGON

The Seventeenth Annual Meeting of the Division of AMO Physics was held jointly with the Division of Chemical Physics on the campus of the University of Oregon in Eugene, 18-20 June 1986. We extend our thanks to Bernd Crasemann, Paul Engelking, Sandy Hill and all of the other members of the local committee who did an outstanding job of hosting the meeting. There were approximately 486 registered attendees, 35 invited papers, 373 contributed papers and a number of postdeadline contributions. Shotgun Creek was a beautiful setting for a delicious outdoor salmon bake attended by over 400 people. Charles Townes gave a fascinating plenary talk on molecular and atomic probes of the dark dust clouds in our galaxy. Approximately 20-25% of the attendees were from DCP. A meeting of theorists in the Atomic, Molecular, and Optical Physics Community (TAMOC) was held the evening of June 18 (see item IX. in this newsletter).

At the Business Meeting, Kate Kirby reported that the Division Membership (as of June 1, 1986) is 2,989, and the treasury balance, as of July 1, 1985, was \$15,986.91. The major expense for the Division continues to be the newsletters. Ronald Stebbings expressed appreciation and thanks to Bernd Crasemann, the AMO Physics Divisional Councilor whose term expires 12/86, for the outstanding job he has done for the Division. Ronald Stebbings awarded fellowship certificates to the following members of the Division who were present: David A. Church, Lorenzo J. Curtis, David R. Herrick, Verne L. Jacobs, Chi-Dong Lin, and James H. Scofield. Lloyd Armstrong reported on the activities of CAMS over the past year (see item VI. in this newsletter). Peter Mohr, rotator in AMO Physics at NSF, presented the budget picture for FY85, FY86, FY87. Peter Mohr will continue for a second year at NSF. Dan Kleppner reported that the Brinkman Panel Physics Survey, Physics Through the 1990's, has been published. He discussed lobbying efforts to increase funding for physics (see item X. in this newsletter). In order to provide a forum for discussion of issues of importance to AMO physicists (such as political action, funding of major facilities, etc.), it was suggested that a session at forthcoming Division Annual Meetings might be arranged to focus on such topics.

III. AMO PHYSICS DIVISION COMMITTEES FOR 1986/87

The membership of the various AMO Physics Division committees for 1986/87 has been finalized and is given below. In each case, the name of the chairperson is underlined and his address is given in parentheses. This is to facilitate and encourage communication between Division Members and these committees. Your input is needed!

Executive Committee: Richard Deslattes (National Bureau of Standards, A141, Physics Building, Gaithersburg, MD 20899); W. Carl Lineberger (Vice-Chairperson), Bernd Crasemann (Divisional Councillor until 12/86), Ronald Stebbings (Most Recent Past Chairperson), Kate Kirby (Secretary-Treasurer), William Wing, Gordon Dunn, Patricia Dehmer, Gordon Drake, and Steve Lundeen.

Program Committee: W. Carl Lineberger (JILA - Box 440, University of Colorado, Boulder, CO 80309); members serving through 5/87: Sheldon Datz, Eugen Merzbacher, John Risley, Dave Golden, Ron Henry; members serving through 5/88: Fred Schlachter, Dan Larson, J.D. Garcia, Peter Mohr, Peter L. Smith; members serving through 5/89: Dana Anderson, H. Jeffrey Kimble, John Hutchinson, Vincent McKoy, plus one additional member still to be confirmed.

Nominating Committee: John Moseley (Department of Physics, University of Oregon, Eugene, OR 97403); Randy Knight, Dan Larson, Robert Saxon, Bernd Crasemann.

Fellowship Committee: Patrick Richard (Department of Physics, Kansas State University, Manhattan, KS 66506); Neal Lane, Arthur Rich, Aaron Temkin, and the Divisional Councillor to be elected.

Publications Committee: Steven Chu (4F433, AT&T Bell Labs., Crawfords Corner Road, Holmdel, NJ 07733); Peter Mohr, David Pritchard, Carl Wieman.

IV. FUTURE DIVISION ANNUAL MEETINGS

The 1987 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics will be held at the Hyatt Regency Hotel in Cambridge, Massachusetts, 18-20 May 1987. The host for the meeting will be the Harvard-Smithsonian Center for Astrophysics, with William Parkinson serving as chairman of the local organizing committee. Housing for the meeting will be primarily at the Hyatt, where double and/or triple room occupancy is available to help cut costs. Campus housing is not available at this time of year. The Hyatt is located on the Charles River, mid-way between the Harvard and MIT campuses. Further details will be given in the next newsletter. Plans or ideas for possible workshops to take place before or after this meeting should be submitted to William Parkinson (Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138).

The 1988 Annual Meeting will be held in conjunction with the "April" A.P.S. General Meeting in Washington, D.C., 25-28 April 1988. The details are still to be arranged; however, the local hosts from NBS-Gaithersburg are looking into

having several Divisional functions within the larger A.P.S. Meeting to enhance our Divisional identity and to facilitate Division members connecting with one another.

The Executive Committee voted to accept the offer of the University of Windsor (in Ontario, Canada) to host the 1989 Annual Meeting, to be held in conjunction with the Divisional Meeting of the Canadian Atomic and Molecular Physicists.

V. SITE SELECTION FOR 1990 ANNUAL MEETING

A sub-committee of the Executive Committee, consisting of Carl Lindeberger, Pat Dehmer and Steve Lundeen, has been formed to evaluate proposals and make recommendations to the Executive Committee regarding a site for the 1990 Division of AMO Physics Annual Meeting. Invitations from institutions for sites and circumstances for the Division's 1990 Annual Meeting should be received by Carl Lindeberger before March 15, 1987, in order that the committee's work may be completed before the Annual Meeting in Cambridge, Massachusetts. The principal criteria and the relative weights used in the past to evaluate sites were: accessibility (10), facilities (10), local science (5), geographic balance (5), local attractions (10), fostering developing institutions (5), joint meeting opportunities (7), and availability of inexpensive housing accommodations (8). Similar considerations will be used this year and the recommendations will be presented to the Executive Committee at the 1987 Annual Meeting.

VI. SUMMARY OF CAMS ACTIVITIES

Lloyd Armstrong, Chairman of the NAS-NRC Committee on Atomic and Molecular Science (CAMS), reports that during the past year CAMS has:

1. Studied the utility of a cooled, heavy-ion storage ring for the field of heavy-ion physics
2. Organized a workshop on "The Laser-Atomic Frontier"
3. Published proceedings of a workshop on VUV and X-Ray sources for Atomic and Molecular Science
4. Revised the AMO Directory (to be published in September 1986)
5. Studied the state of AMO Theory in the U.S.
6. Completed an international survey of AMO Science
7. Hosted a spring forum in conjunction with the Solid State Sciences Committee on "Basic Science in an Era of Budgetary Stringency" and "Frontiers of Spatial and Temporal Resolution"

Lloyd asks for suggestions regarding: a) workshop topics; b) topics for study; c) membership on CAMS; d) ideas for increasing communication and discussion of issues in the AMO community.

VII. NOMINATIONS FOR DIVISIONAL COUNCILLOR

At a meeting held on June 17, 1986, the AMO Physics Division Executive Committee nominated Alex Dalgarno, Hugh Kelly, and Eugen Merzbacher to run for the Office of Divisional Councillor. The Divisional Councillor serves as liaison between the Division and the APS and the term of office is four years. According to our Division Bylaws, additional nominations for this office by mem-

bers of the Division may be made and will be included on the ballot if the nomination is supported in writing by 5% (149) of the members. Such nominations must reach me no later than September 12, 1986, so that they may be included on the ballot.

VIII. MEMORIALIZING DECEASED MEMBERS OF THE DIVISION

At the Executive Committee meeting in Eugene, it was suggested that an appropriate way to memorialize deceased members of the Division would be to publish once a year in the newsletter the names of members who have died during the year along with a sentence or two about their scientific accomplishments. This list would also be read at the Business Meeting of the Division. Any further action, such as organizing a memorial scientific session for a deceased member, requires approval of the Executive Committee of the Council of the A.P.S.

In order that we don't overlook someone, we ask for help from the membership in notifying the Chairperson (Dick Deslattes) or Secretary-Treasurer (Kate Kirby) regarding deaths of scientists in the AMO community.

IX. THEORETICAL ATOMIC, MOLECULAR AND OPTICAL PHYSICS WORKSHOP

A meeting of the Theoretical Atomic, Molecular, and Optical Physics Community (TAMOC) was held Wednesday evening, June 18, at the Eugene AMO/DCP meeting, chaired by Aaron Temkin.

Peter Mohr reviewed the NSF theory funding situation. The outlook for FY87 is still uncertain; however, some new grants in AMO theory will probably be made and good proposals are encouraged. Lloyd Armstrong presented some data from the CAMS study on Theoretical Atomic, Molecular, and Optical Physics. Theoretical Molecular Physics remains well represented at major universities in Chemistry Departments. In major university Physics Departments, AMO theorists are either a very endangered species or extinct, depending on one's degree of optimism.

Tony Starace presented a brief report and handed out copies of the joint Kansas State/Nebaska proposal for a theory institute. Alex Dalgarno reviewed AMO participation at the Institute for Theoretical Physics at Santa Barbara. A program on Relativistic Quantum Electrodynamics and Weak Interactions in Atoms proposed by Peter Mohr, Walter Johnson and Joseph Sucher seems very likely to be approved. Joseph Callaway is considering a program on atoms in plasmas, while T. Uzer and Baha Balantekin are interested in a program on semi-classical methods. Because the AMO community is small, we need broad participation in order to put together a group the Institute would consider a "critical mass". Anyone interested is urged to contact the organizers listed above. Alex Dalgarno also presented a brief report on the possibility of locating an AMO theory institute at the Harvard-Smithsonian Center for Astrophysics.

Richard Drachman gave a brief review of the plans of the APS Topical Group on "Few-Body Systems and Multiple Dynamics". Tony Starace was elected Chairman of TAMOC and George Victor remains Secretary.

X. PUBLICATION OF THE PHYSICS SURVEY (BRINKMAN REPORT)

The Physics Survey has now been published in eight volumes under the title Physics Through the 1990's. The report has generated a lot of interest in Washington. Dan Kleppner headed the panel on Atomic, Molecular, and Optical Physics and is in large part responsible for helping to focus the report on the needs of "small" physics. An editorial from SCIENCE Magazine, reprinted on the following page with permission from Philip Abelson, cites the AMO Physics volume as illustrating the excitement, advances, and opportunities in the field. An order blank for the volumes, for the convenience of those Division members who would like copies, is included. More information and suggestions for AMO physicists with regard to lobbying for increased physics funding will be forthcoming in the next newsletter.

XI. NBS FISCAL YEAR 1988 PRECISION MEASUREMENT GRANTS

Applications are being solicited for two new NBS Precision Measurement Grants to be awarded beginning 1 October 1987 (Fiscal Year 1988). Each grant is in the amount of \$30,000 per year, renewable for up to two additional years. NBS sponsors these grants to encourage research in the field of measurement science, and to foster contacts between NBS scientists and those researchers in the U.S. academic community who are actively engaged in such work. Candidates' pre-proposal summaries and biographical information must reach NBS by 1 February 1987. For more information contact Barry N. Taylor, Chairman, NBS Precision Measurement Grants Committee, National Bureau of Standards, Building 220, Room B258, Gaithersburg, MD 20899, (301) 921-2701.

XII. THIRTY-NINTH ANNUAL GASEOUS ELECTRONICS CONFERENCE

UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN

7-10 OCTOBER 1986

The Thirty-Ninth Annual Gaseous Electronics Conference will be held on 7-10 October 1986 at the University of Wisconsin, Madison, Wisconsin. The meeting is a topical conference of the American Physical Society and is sponsored by the Division of Atomic, Molecular, and Optical Physics. The Gaseous Electronics Conference addresses basic phenomena of collisional processes and interactions in ionized gases. Traditional topics include fundamental processes in electric discharges, arcs, gas lasers, electrical breakdown, switching, plasma chemistry, phenomena in ionized gases. For more information contact: Professor L. W. Anderson, Secretary of the Gaseous Electronics Conference, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706, (608) 262-8962.

Physics Through the 1990's

More than a thousand scientists participated in the preparation of the recently released *Physics Through the 1990's*.^{*} Theirs was a labor of love and devotion that may or may not have much impact on federal support in the days of Gramm-Rudman. Their efforts resulted in a collection of eight volumes containing about 1900 pages that treat in great detail past accomplishments, future opportunities, and needs for federal support of the various branches of physics. Parts of the report are at a level designed for policy-makers. Much of it is at a level comprehensible mainly by physicists. However, there are portions of interest to scientists in other disciplines. One major theme of the publication is a multiplicity of examples of how past discoveries in physics have had important sequelae in the advancement of other branches of science and in a host of practical applications. Another facet of the report is the air of excitement that physicists are bringing to the study of the various branches of their science. Examples are especially observable in the volume devoted to atomic, molecular, and optical physics (AMOP). This area of physics is highly likely to develop information, techniques, and equipment that affect other disciplines.

Physicists engaged in AMOP research have much to be enthusiastic about. Their work has both fundamental significance and important practical applications. Developments in equipment and instrumentation have opened rich frontiers for study. As many as two score of different kinds of measuring equipment have been invented and produced. Perhaps most important are various types of lasers, synchrotrons, vacuum equipment capable of maintaining pressure less than 10^{-11} torr, and molecular beam techniques.

With a combination of these equipments and techniques it is possible to prepare virtually any simple molecule in any desired quantum state to study its structure, the physics that underlies this structure, and the dynamics of electrons moving in molecular fields.

Picosecond and femtosecond laser experiments can reveal how energy flows from one part of the molecule to another, the transition to chaotic vibrational motion, and the rates and mechanisms that determine the system's choice of a particular decay mode. Lasers provide highly selective excitation and interrogation schemes.

By using lasers sharply tuned to a frequency just below a particular vibrational mode of an atom or molecule, it is possible to cool the atom or molecule to millikelvin temperatures. In the very high vacuum it is possible to trap either individual atoms or ions and to make observations on them for hours at a time.

Another interesting topic for study are Rydberg atoms or molecules. These are neutral entities with an outer electron in a high quantum state, for example, $n = 100$. Such an atom has a very large diameter. It interacts with electromagnetic fields to an extent 10^8 greater than that for ordinary atoms and can be used to detect infrared, submillimeter, and microwave radiation.

Some synchrotrons produce intensities at least 10^6 greater than those of conventional sources, and even greater levels of radiation are on the way. Use of this source in crystallography will be especially helpful to biologists and chemists. Already, the structures of zeolite crystals ranging in size from 1 to 10 micrometers have been determined. Synchrotrons have also made accessible the complete spectrum between the ultraviolet and x-rays, much of which had been inaccessible.

One of the goals of AMOP physicists is to determine physical properties with ever higher precision. An impressive result is the determination that space is isotropic to the speed of light. Laser interferometry has shown that space is isotropic to a few parts in 10^{15} . Of all the quantities in physics, time is by far the most accurately measured. The primary time standard in the United States is basically an atomic beam magnetic resonance apparatus. It has an accuracy of 1 part in 10^{13} , approximately 3 seconds in 1 million years.

These are only a few examples from the AMOP volume, but they should convey a glimpse of the opportunities. If it is a good sample of the other volumes of *Physics Through the 1990's*, physicists have much to be enthusiastic about.—PHILIP H. ABELSON

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