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<th>140-11427-2-P</th>
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<tr>
<td>TITLE (and Subtitle)</td>
<td>ATOMIC AND MOLECULAR PROCESSES</td>
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<tr>
<td>AUTHOR(s)</td>
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<td>KEYWORDS (Continue on reverse if necessary and identify by block number)</td>
<td>lasers, ion-molecule reaction rates, metal atoms, chemiexcitation, metastable species, excited states, electron-ion recombination, infrared emission, energy transfer processes, air species, fuel-oxidizer reaction, optical discrimination</td>
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<tr>
<td>ABSTRACT (Continue on reverse if necessary and identify by block number)</td>
<td>The research topics carried out under the present contract are stated and references are given to the scientific findings resulting from the research. The personnel supported by the contract are listed.</td>
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ATOMIC AND MOLECULAR PROCESSES

ARPA Order No. 2686
Proposal 11427-r

Final Report
by
Manfred A. Biondi

February 24, 1975
For Period 1 July 1973 - 30 June 1974

The Advanced Research Projects Agency
DAHC04-73-C0037

Physics & Chemistry Departments
University of Pittsburgh
Pittsburgh, Pa. 15260

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The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.
I. Summary of Research

During the period of the present contract, July 1, 1973 to June 30, 1974, research was carried out in the following areas of atomic collisions and upper atmosphere studies:

A. Laboratory and Theoretical Studies
   1. Laser Ion-Molecule Reaction Rates
   2. Metal Atom Chemiexcitation
   3. Excited State Production by Electron-Ion Recombination
   4. Processes Involving Metastable Species
   5. Infrared Emission from Energy Transfer Processes of Air Species and from Fuel-Oxidizer Reactions
   6. Radiative Properties of Simple Molecules for Optical Discrimination

B. Atmospheric Studies
   1. Particulate Detection Technology
   2. Optical Interferometer Studies of the Upper Atmosphere

The progress in these researches has been summarized in detail in the semi-annual Technical Progress Summary Reports Nos. 16 and 17.

II. Research Publications Produced under the Contract

The following is a list of the scientific publications which set forth the results of the research under this contract:

1
PUBLICATIONS


6300Å Intensity Variations Produced by the Arecibo Ionospheric Modification Experiment, Dwight P. Sipler, E. Enemark and Manfred A. Biondi, J. Geophys. Res. 72, 4276, 1974.


Publications - cont'd.

Kinetics of the Reactions of $\text{N}_2\text{H}^+$, $\text{H}_4^+$, and $\text{N}_3^+$ with $\text{H}_2\text{O}$ in the Gas Phase,

Vibrational Emission of $\text{NO}_2$ from the Reaction of NO with $\text{O}_3$, M. F. Golde

Lifetime of the Metastable $^5\text{S}_0$ State of Atomic Oxygen, W. C. Wells and

The Excitation of the CO Fourth Positive System by the Dissociative Recombination of $\text{CO}_2^+$ Ions, R. A. Gutcheck and E. C. Zipf, J. Geophys.

Electrical Detection of Airborne Particulates Using Surface Ionization
Techniques, Wade L. Fite and R. L. Myers, accepted for publication in
Environmental Science and Technology, 1975.

An Automatic Real-Time Detector and Sizer for Submicron Airborne Particulate
Matter, Wade L. Fite, R. L. Myers and T. M. Barlak, submitted to the
Review of Scientific Instruments, January 1975

A New Computer Controlled Quadrupole Mass Spectrometer System, Wade L. Fite,
M. A. Hender, R. L. Myers and Y. P. Chong, to be published.
III. Personnel Supported by this Contract

The following personnel have received partial or total support under this contract:

Faculty Members:
J. N. Bardsley
M. A. Biondi
T. M. Donahue
W. L. Fite
E. Gerjuoy
F. Kaufman
E. C. Zipf

Post-Doctoral Personnel:
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J. W. Bozzelli
E. Enemark
T. Finn
E. Graham IV
M. A. Hender
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H. H. Lo
R. L. Myers
T. L. Patterson
G. Unger

Graduate Research Assistants:
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V. M. Bierbaum
B. Carnahan
J. S. Chang
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P. Erdman
G. Halle
B. N. Kim
S. Z. Levine
S. Lin
S. L. Lin
J. J. Margitan
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W. T. Rawlins
S. Sinha
C. V. Sukumar