RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS

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HISTORY

Since the inception of this contract, various reports have been submitted regularly to the Advanced Research Projects Agency and the Army Research Office-Durham. These reports include:

Semi-Annual Status Reports

Quarterly Management Reports

Technical Reports (consisting of preprints of articles submitted for publication to various journals)

Special Reports (consisting of preparation for meetings, symposia, etc.)

Annual Report of Publications

The many areas of research and the many researchers involved have presented their findings in detail over the years since 1964. Perhaps best representative of highlighting this research would be a Complete List of Publications. This list is attached.

PERSONNEL

Faculty, professional research and graduate students have been listed in each semi-annual by name and title. Degrees and dates degrees were awarded have also been listed for graduate students.
COMPLETE

PUBLICATION LIST


8. One-Center Expansions in H₂⁺; Convergence in One-Center Expansions in H₂⁺, by George S. Handler and Hubert W. Joy, J. Chem. Phys. 42, 3047 (1965); 43, S252(1965) (IPAPS #47)


20. The Theory of Correlated Crystals, by K. A. Brueckner and Jobst Frohberg, Progress of Theoretical Physics (Japan), Supplement-Commemorative Issue 30th Anniversary of the Meson Theory, 1965, Extra Number, Tokyo Summer Lecture in Theoretical Physics, 383-399 (IPAPS #62)


29. Even Further Comments on Estimation of Power Spectra by a Wave Analyzer, by Carl Gibson, Technometrics 7, 553 (1965); 8, 1562 (1966) (IPAPS #73)


43. Transient Coupling Between Motions of Plasma and Neutrals in the F-Region, by J. R. Barthel, Phys. Fluids 9, 2540 (1966) (IPAPS #87)

44. Phase Change Problems with Variable Surface Temperatures, by O. P. Sharma, M. Rotenberg and S. S. Penner, AIAA J. 5, 677 (1967) (IPAPS #88)


47. Equations of Motion for a Variable-Mass Inertially-Guided System, by Allan M. Schneider, J. Spacecraft & Rockets 4, 1366 (1967) (IPAPS #91)


60. Charged Boson Gas at High Density, by K. A. Brueckner, Phys. Rev. 156, 204 (1967) (IPAPS #104)


74. The Role of Rydberg States in Dissociative Recombination, by J. C. Y. Chen and M. H. Mittleman, Abstract - 5th Int. Conf. on the Physics of Electronic and Atomic Collisions, Leningrad, USSR, July (1967) (IPAPS #119)

76. Photoionization of Molecules Near the Threshold, by J. C. Y. Chen and N. F. Lane, Abstract - 5th Int. Conf. on the Physics of Electronic and Atomic Collisions, Leningrad, USSR, July (1967) (IPAPS #121)


83. Ion Temperature in the Upper Atmosphere, by P. M. Banks, J. Geophys. Res. 72, 3365 (1967) (IPAPS #129)
84. Bounds on Bending Moments Caused in Indeterminate Beams by Bounded Anelastic Curvature, by W. Prager, a volume of contributed papers on Engineering Plasticity, Cambridge University Press, Feb. (1968) p. 529 (IPAPS #130)


92. Bounds on Stresses Caused in Structures by Bounded Anelastic Strains, by S. Nemet-Nasser and Jenn-Ming Chern, Ingenieur-Archives J. 36, 381 (1968) (IPAPS #140)


96. Oscillatory Hypersonic Boundary Layer Flow with Ablation, by G. Lengelle, AIAA J. 6, 808 (1968) (IPAPS #145)


100. Detection Theory and Quantum Mechanics (II), by C. W. Helstrom, J. Information and Control 13, 156 (1968) (IPAPS #149)


105. Application of a Modified Differential Approximation to Radiative Transfer in a Gray Medium Between Concentric Spheres and Cylinders, by D. B. Olfe, J. Quant. Spectrosc. & Radiat. Transfer 8, 899 (1968) (IPAPS #154)


118. Geometric Factors in Nuclear Structure, by Linus C. Pauling, presented at the Marie-Curie Centenary (1967) (IPAPS #168)


121. Shock-Tube Measurements of Absolute gf-Values for Neutral and Singly Ionized Titanium, by A. A. Boni, Jr., J. Quant. Spectrosc. & Radiat. Transfer 8, 1385 (1968) (IPAPS #176)
122. Associative Detachment: \( \text{H} + \text{H}^- \rightarrow \text{H}_2^+ + \text{e} \), by Joseph C. Y. Chen and Jerry L. Peacher, Phys. Rev. 168, 56 (1968) (IPAPS #177)


129. Minimum Weight Design with Piecewise Constant Specific Stiffness, by C. Y. Sheu and W. Prager, J. Optimization Theory & Applications 2, 179 (1968) (IPAPS #185)


132. Hydrogen Ion Velocity Distribution in the Ionosphere, by P. M. Banks, Planetary and Space Science 16, 759 (1968) (IPAPS #189)

133. Multichannel Rearrangement Collisions Between H and H⁻ at Low Energies, by J. C. Y. Chen and J. L. Peacher, presented at Conference on Heavy Particle Collisions, Queen's University, Belfast (1968) (IPAPS #190)

134. Observation of the Interplanetary Plasma, by W. I. Axford, Space Science Rev. 8, 331 (1968) (IPAPS #191)

135. Theory of Transient Negative Ions of Simple Molecules, by J. C. Y. Chen, Adv. in Radiative Chemistry (to be published). (IPAPS #192)


137. Lower Bounds of Matrices, by Josef Stoer, Numerische Mathematik 12, 146 (1968) (IPAPS #194)


142. A Note Regarding He$^+$ in the Topside Ionosphere, by P. M. Banks and J. W. McGowan, J. Geophys. Res. 73, 15 (1968) (IPAPS #200)


152. The Polar Wind, by Peter M. Banks and T. F. Holzer, J. Geophys. Res. 73, 21 (1968) (IPAPS #213)


162. Subsidiary Resonance in the Ionosphere, by G. J. Lewak, J. Geophys. Res. 73, 6379 (1968) (IPAPS #224)


164. Laser-Induced Instabilities in Raman-Active Media, by K. A. Brueckner and S. S. Rangnekar, Phys. Rev. 175, 332 (1968) (IPAPS #226)


166. Ion and Electron Temperature and Density by Thompson Scattering with a Low Resolution Monochromator, by James Benford and Richard Siemon, Phys. Fluids 12, 249 (1969) (IPAPS #228)


173. Helium in the Atmosphere, Aurora and Solar Wind, by W. I. Axford, presented at Advanced Study Inst. on Aurora and Airglow, Oslo, Norway (1968) (IPAPS #236)


177. The Polar Wind and Its Implications, by Peter M. Banks, presented at Advanced Study Inst. on Aurora and Airglow, Oslo, Norway, (1968) (IPAPS #240)


232. Rotation During the Implosion of a Theta Pinch, by James Benford, Phys. Fluids (1969) (IPAPS #302)


247. On the Origin of Radiation Belt and Auroral Primary Ions, by W. I. Axford, Summer Advanced Study Institute, Earth's Particles and Fields, Univ. of Calif., S.B. (1969) (IPAPS #320)


270. Photofragment Spectroscopy of Dissociative Excited States, by Kent R. Wilson, presented and will appear in Proc. of Symposium on Excited State Chemistry (IPAPS #346)


294. Finite Deformation Plasticity Theory with Application to Geologic Materials, by L. W. Morland, J. Geophys. Res. (IPAPS #371)


297. The Motion of an Isolated Buoyant Thermal, by C. P. Wang, Phys. Fluids 14, 1643 (1971) (IPAPS #374)


304. Stochastic Kinetic Theory and Turbulent Heating, by G. J. Lewak and J. Ogunlana, (IPAPS #382)


310. Measurement of Turbulence by Optical Mixing Spectroscopy, by C. P. Wang, (IPAPS #388)


313. Laboratory Simulation of High-Temperature Entrainment, by S. C. Lin, Proceedings ARPA Entrainment Workshop, N. Y., N. Y., Octo. 20-21, 1970 (IPAPS #391)
R. A. Chodzko, Ph.D. Thesis (unpublished) (IPAPS #392)

315. Observations of the Variability of Dissipation Rates of Turbulent
Velocity and Temperature Fields, by C. H. Gibson and
P. J. Masiello, Lecture Notes in Physics, Proceedings
Symposium Statistical Models and Turbulence (Springer-Verlag,
1971) (IPAPS #393)

316. Self-Similarity and Inertial Subrange Turbulence, by C. W.
Van Atta and J. Park, Lecture Notes in Physics, Proceedings
Symposium Statistical Models and Turbulence (Springer-Verlag,
1971) (IPAPS #394)

317. Properties of 0.01 eV Helium Atoms Scattered Inelastically from
Silver (111), by R. B. Subbarao and D. R. Miller, J. Vac.
Sci. Tech. (IPAPS #395)

318. Laser Induced Liquid Breakdown - A Step by Step Account, by
(IPAPS #396).

319. Kinetic Processes in Noble Gas Ion Lasers, by C. C. Chen,
Ph.D. Thesis (unpublished) (IPAPS #397)

320. Observations of SIT in Bound-Free Transitions of Cl₂, by
(IPAPS #398)

321. Homogeneous Turbulence with Large Amplitude Temperature-
Density Fluctuations, by S. C. Lin and Shih-Chun Lin,
Abstract-APS Fluid Dynamics Meeting (Turbulence
Nov. 22-24, 1971 (IPAPS #399)


324. The Variability of Plasma Line Enhancement in Ionospheric Modification Experiments, by J. A. Fejer, (IPAPS #402)

325. A Single-Pulse Echo Effect in a Mirror Plasma, by G. J. Lewak, (IPAPS #403)


328. A Laboratory Study of the Turbulent Ekman Layer, by C. W. Van Atta, D. R. Caldwell and K. N. Helland, (IPAPS #406)


336. Further Results on the Effect of Longitudinal Curvature on the Laminar Boundary Layer, P. A. Libby, I'Aerotecnica Missili e Spazio, (1972) Milan, Italy (IPAPS #414)


340. Velocity Distribution Measurements of 0.06-1.4 eV Argon and Neon Atoms Scattered from the (111) Plane of a Silver Crystal, by R. B. Subbarao and D. R. Miller, J. Chem. Phys. (IPAPS #418)


343. An Experimental Study of Argon Ion Laser Discharge at High Current, by C. P. Wang and S. C. Lin, J. Appl. Phys. 43, 5068 (1972) and AIAA Paper No. 72-711 (different title), (IPAPS #421)


347. Remote Sensing of Particulate Air Pollutant by Light Scattering (Abstract), by C. P. Wang, Optical Society of America Meeting. (IPAPS #425)

348. Motion of a Turbulent Buoyant Thermal in a Calm Stably-Stratified Atmosphere, by C. P. Wang, Phys. Fluids, (IPAPS #426)


(IPAPS #430).

(IPAPS #431)

(IPAPS #432)


(IPAPS #435)

