

# **CONTENTS**

# SESSION A

	Chairman: E. Gerjuoy	
	Resonances	
	(Invited Papers)	
<b>A</b> 1	Review of Resonances in Electron Scattering and Proton Absorption, by P. G. Burke (title only)	1
A2	The Quasi-Stationary-State Approach to Electronic Resonances in the Scattering of Electrons from Atoms and Molecules, by A. Herzenberg	1
A3	Theoretical Investigations on Quasi-Discrete Energy States of Two-Electron Atoms; by J. Midtdal and E. Holgien	6
	SESSION BA	
	Chairman: H. S. W. Massey	
	Theory I	
BA1	Calculation of Lower Bounds for the Electron-Hydrogen Scattering Phase Shifts, by M. Gailitis	10
BA2	On the Theory of Electron-Hydrogen Atom Scattering, by F. S. Levin	14
BA3	Application of the Optical-Potential Method to Excitation of Forbidden Transitions in Atomic Hydrogen by Electron Impact, by Stephan Ormonde and Robert T. Pu	17
BA4	Scattering of Electrons by Hydrogen-Like Ions: I. Convergence of the Eigenfunction Expansion Method, by C. H. Humphrey, Stephan Ormonde, and William Whitaker	18

BA5	Excitation of the 1s-np Transitions in Hydrogen by Low-Energy Electrons (11 to 120 eV), by Stephan Ormonde	20
BA6	A Note on Vainstein's Approximation, by M. R. C. McDowell	20
BA7	The Quantal Impulse Approximation for Electron-Impact Excitation of Hydrogen, by J. P. Coleman and M. R. C. McDowell	23
BA8	Variational Calculation of Electron-Hydrogen Scattering for All Partial Waves with the Use of Kohn's Method, by A. Joanna Taylor	27
BA9	Treatment of Exchange in the Theory of Electron-Atom Collisions, by R. Peterkop	31
	SESSION BB	
	Chairman: L. Spruch	
	Theory II	
BB1	Ionization of a Hydrogen Atom by Slow Electrons, by V. J. Veldre and I. Vinkaln	35
BB2	Excitation from Highly Excited Levels of Hydrogen Atoms by Electron Impact, by V. J. Veldre and L. L. Rabik	40
BB3	Excitation of Excited Atomic Hydrogen by Electron Collision in Born and Born-Exchange Approximations, by Kazem Omidvar	41
BB4	Ionization of Excited Atomic Hydrogen by Electron Collision in Coulomb-Born and Coulomb-Born-Exchange Approximations, by Kazem Omidvar	43
BB5	The Elastic Scattering of Low-Energy Electrons from Helium, by R. W. LaBahn and Joseph Callaway	46
BB6	A Narrow Resonance in the Elastic Scattering of Electrons by Helium, by K. L. Kwok and F. Mandl	47
BB7	Free-Free Transitions in Atoms and Molecules, by A. Dalgarno and N. F. Lane	49
	SESSION BC	
	Chairman: A. Dalgarno	
	Theory III	
BC1	Scattering of Positrons by Helium, by H. S. W. Massey	50

BC2	Resonances in the Elastic e-He Scattering, by G. F. Drukarev and T. W. Zikarjeva	52
BC3	Second-Order Poles of the S-Matrix and Resonance Scattering, by Yu. N. Demkov and G. F. Drukarev	52
BC4	Elastic Scattering of Electrons by Helium Atoms at Low Energies, by D. Husain, A. L. Choudhury, A. K. Rafiqullah, and F. B. Malik	53
BC5	Variational Principle for Quasi-Stationary States, by V. S. Rudakov	54
BC6	Adiabatic Approximation for Quasi-Stationary States, by G. F. Drukarev	54
	SESSION CA	
	Chairman: J. W. McGowan	
	Neutral-Neutral Transfer I	
CA1	Excitation Transfer between the ${}^2P_{1/2}$ and ${}^2P_{3/2}$ Resonance Levels in Alkali Atoms Induced by Inelastic Collisions, by G. D. Chapman, M. Czajkowski, A. G. A. Rae, and	
-row initials	L. Krause	55
CA2	Excitation-Transfer Cross Sections in Helium, by H. J. Reich	59
CA3	Molecular Wave Functions and Atomic Collisions, by William Lichten	63
CA4	Collisional Excitation Transfer of S-P Type between Identical Atoms, by Tsutomu Watanabe	67
CA5	Quenching of O(1S), by Robert A. Young and Graham Black	71
CA6	Quenching of Metastable States of Interest in the Upper Atmosphere, by D. M. Hunten and M. B. McElroy	72
	SESSION CB	
	Chairman: Edgar Everhart	
	Neutral-Neutral Transfer II	
a- 1	•	
CB1	A Mass-Spectrometric Study of the Bimolecular Formation of Rare Gas Diatomic Ions, by Philip M. Becker and F. W. Lampe	74
CB2	Detection of Long-Lived Excited States of Diatomic Molecules by Penning Ionization, by V. Čermák	75

Application of the Franck-Condon Principle to Molecular Excitation by Collision with Excited Atoms and Molecules, by W. W. Robertson	78
Ionization of Nitrogen Molecules and Argon Atoms by Collisions with Argon and Nitrogen, by Howard C. Hayden and Robert C. Amme	81
Studies of the $N_2$ - $N_2$ , $N_2$ -Ar, and Ar- $N_2$ Ionization Cross Sections Utilizing Asymmetric Charge Transfer, by Robert C. Amme and Howard C. Hayden	82
Ionization Produced by Collisions of Nitrogen Molecules with Methane and Carbon Monoxide Molecules, by Nyle G. Utterback	8 <b>3</b>
Double-Inelastic Collisions of Excited Hydrogen Atoms with Excited Hydrogen Atoms, by Frank R. Pomilla and S. N. Milford	87
SESSION DA	
Chairman: S. J. Smith	
Negative Ions I	
Fast Atomic Hydrogen, by Richard Cutts, T. M. Donahue, and Kotu Lulla	94
	94 96
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals	
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin	96
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley Dissociative Attachment of Electrons to Hot O <sub>2</sub> ,	96 97
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley  Dissociative Attachment of Electrons to Hot O <sub>2</sub> , by W. L. Fite, R. T. Brackmann, and W. R. Henderson Kinetic-Energy Studies of O <sup>-</sup> Produced by Dissociative	96 97 100
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley  Dissociative Attachment of Electrons to Hot O <sub>2</sub> , by W. L. Fite, R. T. Brackmann, and W. R. Henderson Kinetic-Energy Studies of O <sup>-</sup> Produced by Dissociative Attachment, by P. J. Chantry and G. J. Schulz Electron Detachment during Slow Collisions between	96 97 100 103
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley  Dissociative Attachment of Electrons to Hot O <sub>2</sub> , by W. L. Fite, R. T. Brackmann, and W. R. Henderson Kinetic-Energy Studies of O <sup>-</sup> Produced by Dissociative Attachment, by P. J. Chantry and G. J. Schulz  Electron Detachment during Slow Collisions between Negative Ions and Atoms, by Yu. N. Demkov	96 97 100 103
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley  Dissociative Attachment of Electrons to Hot O <sub>2</sub> , by W. L. Fite, R. T. Brackmann, and W. R. Henderson Kinetic-Energy Studies of O Produced by Dissociative Attachment, by P. J. Chantry and G. J. Schulz  Electron Detachment during Slow Collisions between Negative Ions and Atoms, by Yu. N. Demkov	96 97 100 103
Donahue, and Kotu Lulla  Electron Detachment from Negative Ions of Alkali Metals in Collision with Atoms of Inert Gases, by Yu. F. Bydin Resonant Dissociative Attachment, by T. F. O'Malley  Dissociative Attachment of Electrons to Hot O <sub>2</sub> , by W. L. Fite, R. T. Brackmann, and W. R. Henderson Kinetic-Energy Studies of O <sup>-</sup> Produced by Dissociative Attachment, by P. J. Chantry and G. J. Schulz  Electron Detachment during Slow Collisions between Negative Ions and Atoms, by Yu. N. Demkov  SESSION DB  Chairman: R. H. Neynaber	96 97 100 103
	Molecular Excitation by Collision with Excited Atoms and Molecules, by W. W. Robertson  Ionization of Nitrogen Molecules and Argon Atoms by Collisions with Argon and Nitrogen, by Howard C. Hayden and Robert C. Amme  Studies of the N <sub>2</sub> -N <sub>2</sub> , N <sub>2</sub> -Ar, and Ar-N <sub>2</sub> Ionization Cross Sections Utilizing Asymmetric Charge Transfer, by Robert C. Amme and Howard C. Hayden  Ionization Produced by Collisions of Nitrogen Molecules with Methane and Carbon Monoxide Molecules, by Nyle G. Utterback  Double-Inelastic Collisions of Excited Hydrogen Atoms with Excited Hydrogen Atoms, by Frank R. Pomilla and S. N. Milford  SESSION DA  Chairman: S. J. Smith  Negative Ions I

DB3	Forbidden Continuum in Photodetachment, by Michael Weinberg and R. Stephen Berry	108
DB4	Laser Double-Quantum Photodetachment of I, by J. L. Hall, E. J. Robinson, and L. M. Branscomb	110
	SESSION E	
	Chairman: P. A. Fraser	
	Electron-Neutral I	
E1	Resonance in Electron Scattering from $H_2$ , $HD$ , and $D_2$ , by C. E. Kuyatt, J. Arol Simpson, and S. R. Mielczarek	113
<b>E</b> 2	Resonance Phenomena in $e-H_2$ Scattering, by D. E. Golden and H. W. Bandel	116
E3	Experimental Observation of a "Resonance" in the Elastic Scattering of Helium at Low Energy, by G. J. Schulz	117
E4	The Momentum-Transfer Cross Section for Low-Energy Electrons in Helium, by R. W. Crompton and R. L. Jory	118
<b>E</b> 5	The Angular Dependence of the Resonance Scattering of Electrons by Helium, by H. Ehrhardt and G. Meister	125
E6	Low-Energy Electron-Cesium Atom Collision-Probability Investigations, by W. L. Nighan	127
E7	Elastic Scattering of Electrons by Lithium, by M. J. W. Boness and J. B. Hasted	130
E8	Low-Energy Electron Scattering by Atomic Oxygen, by G. Sunshine, B. B. Aubrey, and B. Bederson	130
	*	
	SESSION F	
	Chairman: E. M. Clarke	
	Electron-Neutral II	
F1	Collisions of Slow Electrons with Alkali Atoms, by E. Karule and R. Peterkop	134
F2	Elastic Scattering of Low-Energy Electrons by Alkali Atoms, by E. Karule	139
F3	Influence of Hyperfine Structure on Electron-Alkali Atom Spin-Exchange Collisions, by Kenneth Rubin	143
F4	Spin-Exchange Scattering in Uniform Magnetic Fields, by A. E. Glassgold	147

F5	The Electron Alkali-Atom Interaction Potential and Elastic Scattering Cross Section, by J. C. Crown and A. Russek	150
F6	Polarization in Low-Energy Electron Scattering: Lithium, by Philip M. Stone	151
F7	Exchange Scattering of Electrons by Atoms, by V. I. Ochkur	152
F8	Fine Structure in the Energy Spectra of Electrons from Gases Bombarded by Positive Ions, by M. Eugene Rudd and David V. Lang	153
	SESSION GA	
	Chairman: L. M. Branscomb	
	Neutral-Neutral I	
GA1	Elastic Scattering of High-Velocity Neutral Helium Atoms by Polyatomic Molecules. Interactions between He and Peripheral Bonded Atoms, by I. Amdur, M. S. Longmire, A. B. Marcus, and D. E. Paulsen	159
GA2	The Calculation of Large Numbers of JWKB Phase Shifts, by Francis J. Smith	160
GA3	Measurements of Total Cross Sections for Rare Gas Collisions, by Erhard W. Rothe and R. H. Neynaber	162
GA4	Elastic Scattering in Hydrogen-Helium Systems:  Measurement of the "Knock-On" Cross Section, by Fred van der Valk, George E. Moore, and Sheldon Datz	164
GA5	The Velocity Dependence of the Total Scattering Cross Section of K on Rare Gases, by F. von Busch, H. J. Strunck, and C. Schlier	167
GA6	Anisotropy Effects on the Total Collision Cross Section in First-Order Distorted-Wave Approximation, by J. Reuss	170
	SESSION GB	
	Chairman: F. T. Smith	
	Neutral-Neutral II	
GB1	Phase-Space Theory of Chemical Kinetics, by J. Lin, P. Pechukas, and J. Light	172

GB2	Molecular-Beam Studies of the Alkali-Halogen Reactions: The Spectator-Stripping Model, by Sheldon Datz and Robert E. Minturn	177
GB3	Velocity Analysis of Reactive Scattering in Crossed Molecular Beams: Internal Energy and Center-of-Mass Angular Distribution of Products, by Arthur E. Grosser and Richard B. Bernstein	180
GB4	Inelastic Collisions of Slow Atoms, by Joseph Callaway	183
GB5	A Comparison of Approximate Translational-Vibrational Energy-Transfer Formulas to Exact Classical Calculations, by J. Daniel Kelley and Max Wolfsberg	186
GB6	Evaluation of Approximations Used in the Calculation of Excitation by Collision: I. Vibrational Excitation of Molecules, by T. E. Sharp and D. Rapp	188
GB7	Atomic Interactions of Muonium, by R. M. Mobley, J. M. Bailey, W. E. Cleland, V. W. Hughes, and J. E. Rothberg	194
	SESSION H	
	Chairman: M. J. Seaton	
	Panel Members: A. Burgess, M. Gryzinski, I. C. Percival, R. C. Stabler, and L. Vriens	
	Discussion Session on the Use of Classical Theory for Atomic-Collision Cross-Section Calculations	198
	SESSION IA	Œ
	Chairman: U. Fano	
	Theory IV	
IA1	Elastic Scattering of Electrons by S-State Atoms, by Marvin H. Mittleman and Kenneth M. Watson	199
IA2	Collisional Excitation of Forbidden Lines, by A. Billings, S. J. Czyzak, T. K. Krueger, H. E. Saraph, M. J. Seaton, and J. Shemming	201
IA3	Electron-Impact Excitation of Atoms and Ions with Configurations 1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>q</sup> , by Kenneth Smith, R. J. W. Henry, and P. G. Burke	201
IA4	An Impact-Parameter Treatment of Electron-Atom Collisions, by A. D. Stauffer and M. R. C. McDowell	205
IA5	Dependence of the Excitation Cross Section on the	208

IAO	Ion-Resonant Elastic Scattering States, and of the Preionization States of Electronic Spectroscopy, by Howard S. Taylor and J. K. Williams	208
	SESSION IB	
	Chairman: A. Temkin	
	Theory V	
IB1	Ehrenfest's Theorem and Scattering Theory, by B. A. Lippmann	210
IB2	Detailed Balancing and Probability Conservation for the Impact-Parameter Method, by Thomas A. Green	211
IB3	Low-Energy Expansion of the Scattering Matrix for Collisions of Electrons with Diatomic Molecules, by Neal F. Lane	214
IB4	Direct and Resonance Excitation of Molecular Rotation by Slow Electron Impact, by Joseph C. Y. Chen	215
IB5	Comments on the Two-State Pseudo-Crossing Problem, by Walter R. Thorson and Seth A. Boorstein	218
IB6	Theory of Slow Atomic Collisions: II. Extension to a General Diatomic System, by Seth A. Boorstein and Walter R. Thorson	220
IB7	Effect of Higher Continuum Levels, by Joseph H. Macek	221
IB8	Classical Theory of Collisions of Protons and Electrons with Hydrogen Atoms, by R. Abrines, J. C. Percival, and N. A. Valentine	223
IB9	Rearrangement Collisions—Electron Excitation of He(2°S), by Charles J. Joachain and Marvin H.	225
	Mittleman	220
	SESSION J	
	Chairman: R. F. Stebbings	
	Ion-Molecule Reactions	
J1	Computer Experiments on Ion-Molecule Reactions, by Fred A. Wolf	228
<b>J2</b>	Some Laboratory Measurements of Thermal-Energy Charge-Transfer Reactions, by F. C. Fehsenfeld, A. L. Schmeltekopf, and E. E. Ferguson	229

<b>J</b> 3	Some Laboratory Measurements of Thermal-Energy Ion-Atom Interchange Reactions, by A. L. Schmeltekopf, P. D. Goldan, F. C. Fehsenfeld, E. E. Ferguson, and H. I. Schiff	230
J4	Laboratory Studies of Thermal-Energy Positive Ion-Neutral Reactions, by E. E. Ferguson, P. D. Goldan, F. C. Fehsenfeld, and A. L. Schmeltekopf	232
<b>J</b> 5	Volume Destruction Processes in Helium, by C. Grey Morgan, F. Llewellyn Jones, and D. Kenneth Davies	234
J6	Atom-Atom Interchange Collisions by Drifting Ions, by J. B. Hasted	234
J7	Crossed Ionic and Molecular-Beam Studies of Atmospheric Reactions, by B. R. Turner, J. A. Rutherford, and R. F. Stebbings	236
<b>J</b> 8	Angular and Energetic Studies of Reactive Ion-Neutral Collisions, by T. L. Bailey, R. L. Champion, L. D. Doverspike, and J. J. Leventhal	237
19	Studies of Ionic Drift Velocities and Ion-Molecule Reactions in a Drift-Tube Mass Spectrometer, by E. W. McDaniel, G. E. Keller, D. L. Albritton, T. M. Miller, and D. W. Martin	239
J10	A Semiclassical Theory of Capture Collisions between Ions and Polar Molecules, by John V. Dugan, Jr., and John L. Magee	245
		9
	SESSION K	
	Chairman: M. F. Harrison	
	Electron Capture	
<b>K</b> 1	Highly Excited States of H <sub>2</sub> , by C. F. Barnett and J. A. Ray	250
K2	Production of Excited Hydrogen Atoms in the Presence of Ions and Electrons, by A. C. Riviere and D. R. Sweetman	251
<b>K</b> 3	Electron Capture by High-Energy Deuterons in Gases, by Klaus H. Berkner, Selig N. Kaplan, George A. Paulikas, and Robert V. Pyle	252

# SESSION L

# Chairman: J. A. Simpson

# New Experimental Techniques

L1	Production of Highly Polarized Electrons by Low-Energy Scattering, by K. Jose and J. Kessler	255
L2	Polarized Electrons from a Polarized Atomic Beam, by W. Raith, R. L. Long, Jr., V. W. Hughes, and M. Posner	256
L3	A Merging-Beams Technique for Studying Low-Energy Collisions, by S. M. Trujillo, R. H. Neynaber, Lawrence L. Marino, and Erhard W. Rothe	260
L4	A Molecular-Beam Apparatus for the eV Region, by J. Politiek, P. K. Rol, and J. Los	261

## SESSION MA

# Chairman: N. V. Fedorenko

	Ion-Neutral I	
MA1	The Measurement of Low-Energy Cesium Ion-Cesium Atom Cross Sections by Beam Techniques, by R. H. Bullis	263
MA2	Measurement of the Angular Distribution of Elastically Scattered Cs <sup>+</sup> Ions from Ar, Kr, and N <sub>2</sub> , by Manuel G. Menendez and Sheldon Datz	264
MA3	Elastic Differential Scattering of Li <sup>+</sup> Ions by He, $O_2$ , and $N_2$ in the 10 to 600 eV Range, by W. Aberth and D. C. Lorents	269
MA4	Potentials from Symmetric and Asymmetric Ion-Atom Scattering, by Felix T. Smith and Raymond P. Marchi	269
MA5	Inelastic Collisions of $H_2^+$ Ions with Hydrogen Molecules, by Dennis W. Vance and T. L. Bailey	273
ма6	The Collisional Cross Sections of Low-Energy Hydrogen Ions in Hydrogen, by J. Dutton, F. Llewellyn Jones, and E. M. Williams	276
MA7	Vibration and Rotation in N <sub>2</sub> <sup>+</sup> First Negative Bands Excited by Ion Impact, by J. R. Sheridan and K. C. Clark	276

#### SESSION MB

#### Chairman: M. Mittleman

#### Ion-Neutral II

MB1	Ionization and Charge-Transfer Cross Sections for Fast Neutral Helium Atoms (0.15 to 1.0 MeV), by D. W. Martin, L. J. Puckett, and G. O. Taylor	280
MB2	Rotational Excitation in Alkali-Ion Collisions, by R. P. Lowe and H. I. S. Ferguson	285
MB3	Ionization and Scattering at Characteristic Energy Losses in Atomic Collisions, by V. V. Afrosimov, Yu. S. Gordeev, M. N. Panov, and N. V. Fedorenko	286
MB4	Widths of Q-Distributions in Ar <sup>+</sup> on Ar Collisions, by Edgar Everhart and Quentin Kessel	287
MB5	Quelques Remarques sur les Pertes d'Energies Subies par des Ions Rapides (80 à 180 keV) Subissant des Collisions avec des Atomes de Gaz Rares, by Michel Barat	288
мв6	Measurements of Inelastic Energy Loss in Ion-Atom Collisions, by P. R. Jones, T. L. Batra, and H. A. Ranga	292
	SESSION NA	
	Chairman: M. A. Biondi	
	Charge Transfer I	
NA1	Mass-Spectrometer Studies of Dissociative Charge Transfer, by L. Friedman and T. F. Moran	294
NA2	Charge Transfer by Ionic Collisions in the Coulomb Interaction, by V. K. Bykhovskii and E. E. Nikitin	295
NA3	Charge-Exchange Processes with $^2P_{y/2}$ and $^2P_{1/2}$ States of Ar and Kr Ions in Their Own Gases, by Masud Hussain and Larkin Kerwin	296
NA4	An Experimental Study of Charge Transfer in Proton- Atomic Hydrogen Collisions at Energies Higher than 50 keV, by G. Ryding and H. B. Gilbody	302

Charge Transfer and the  $1s\sigma_g\text{-}2p\sigma_u$  Eigenenergies,

NA5 The Proton-Hydrogen Atom System at Large Distances.

by James M. Peek

306

NA6	Electron Capture into Excited States by Helium Ions Incident on Helium, by F. J. deHeer, L. Wolterbeek Muller, and R. Geballe	309
	SESSION NB	
	Chairman: E. W. McDaniel	
	Charge Transfer II	
NB1	Charge Exchange of Protons in Alkali Metal Vapors Involving Highly Excited Hydrogen-Atom Formation, by R. N. Il'in, V. A. Oparin, E. S. Solovyov, and N. V. Fedorenko	315
NB2	Cross Sections for the Production of Metastable 2s Hydrogen Atoms in $H_2^+$ -Rare Gas Collisions, by D. Jaecks and E. Tynan	316
NB3	The $1s\sigma_g$ - $2p\sigma_u$ Transition Induced in the Hydrogen-Molecule Ion on Collision with the Hydrogen Molecule, by James M. Peek, W. H. Weihofen, and Thomas A. Green	322
NB4	Charge Exchange Involving Complex Atoms, by E. T. Florance, H. K. Macomber, G. A. Victor, and T. G. Webb	324
NB5	Charge Capture and Loss Cross Sections for Al <sup>+</sup> and Fe <sup>+</sup> in Gases, by R. T. Brackmann, W. L. Fite, W. R. Ott, J. K. Layton, R. F. Stebbings, J. A. Rutherford, and P. Mahadevan	326
NB6	Charge Transfer of He <sup>+</sup> and Ar <sup>+</sup> in Rb and Cs: Near- Resonant Transitions to Excited States, by D. C. Lorents and J. R. Peterson	328
NB7	Calculation of the Angular Distribution for Resonance Electron Capture in Helium, by Yu. N. Demkov and Yu. E. Murakhver	332
NB8	Excitation des Niveaux Vibrationnels et Dissociation des Ions $\mathrm{H}_2^+$ par Impact avec les Molecules du Gaz $\mathrm{H}_2$ , by F. P. G. Valckx and P. Verveer	333
	SESSION NC	
	Chairman: Sheldon Datz	
	Charge Transfer III	
NC1	Collisions of Alkali Metal Atoms and Ions with Gas Molecules, by B. I. Kikiani, G. N. Ogurtsov, N. V. Fedorenko, and I. P. Flaks	335

NC2	Measurement of K <sup>+</sup> -Rb Charge-Transfer Cross Sections, by Julius Perel, Richard H. Vernon, and Howard L. Daley	336
NC3	Resonance in Electron Capture by Proton from Hydrogen Atoms, by D. Basu, N. C. Sil, and D. M. Bhattacharya	338
NC4	Charge Transfer between Cesium Atoms and Potassium Ions, by L. L. Marino	339
NC5	Coupled-Channel Calculations for H <sup>+</sup> -H Scattering, by L. Wilets and D. F. Gallaher	340
NC6	Experimental Determination of the Cross Sections for Some Inelastic Collision Processes Involving He <sup>+</sup> , H <sup>+</sup> , and H(1s) Atoms, by R. F. Stebbings and R. A. Young	344
NC7	Heitler-London Interaction Potentials and Resonant Charge-Exchange Cross Sections for Atoms and Atomic Ions, by Jerrold M. Yos	345
NC8	Atomic and Ionic Partial Stopping Powers of Helium Gas for a Helium Beam, by J. Cuevas, P. Torres, and S. K. Allison	347
	GEGGTON, O	
	SESSION O	
	Chairman: R. W. Nichols	
	Molecular Excitation by Electrons	
01	Excitation of Electronic, Vibrational, and Rotational Transitions by Fast Electrons, by H. Boersch	351
O2	Excitation of Molecular Vibrations by Fast Electrons, by J. Geiger and K. Wittmaack	354

359

360

365

Vibrational Excitation and Dissociative Attachment in the Collisions of Electrons with Hydrogen Molecules, by J. N. Bardsley, A. Herzenberg, and F. Mandl

Rotational Excitation of Oxygen Molecules by Low-Energy Electrons, by Kazuo Takayanagi and Sydney Geltman

Diffraction des Electrons par les Gaz, Mise en Evidence

des Densites Electroniques et des Vibrations Moleculaires, by Marcel Rouault, Claude Tavard,

and Philippe Audit

**O**3

04

**O**5

#### SESSION P

Chairman: G. J. Schulz

## Recombination

P1	Recombination of O <sup>+</sup> Ions with Electrons by Assisted Dielectronic Recombination, by R. Stephen Berry, John C. Mackie, and Raymond L. Taylor	367
P2	Helium Molecular Recombination in a Radio-Frequency Discharge, by H. Schütter and B. Stafford	368
P3	Spatial Distribution of Radiation in a Helium Negative Glow, by W. B. Hurt	369
P4	Positron Annihilation in the Noble Gases, by G. Jones, W. R. Falk, and P. H. R. Orth	372
	SESSION QA	
	Chairman: B. Bederson	
	Electronic Excitation I	
QA1	Measurement of Electron-Impact Excitation of Lyman- $\alpha$ Photons from the $2p \rightarrow 1s$ Transition, by Stephen J. Smith	377
QA2	Electron-Impact Spectra of Helium and Argon, by G. E. Chamberlain, H. G. M. Heideman, J. Arol Simpson, and C. E. Kuyatt	378
QA3	The Threshold Behavior of Electron Excitation and Polarization Functions in Helium, by D. W. O. Heddle and R. G. W. Keesing	382
QA4	Excitation of Helium to 2 <sup>3</sup> P and 2 <sup>1</sup> S States by Electron Bombardment, by H. K. Holt and R. Krotkov	384
QA5	The Polarization of Alkali Lines in Electron-Alkali Atom Collisions with Reference to the Level Width and the Fine and Hyperfine Structure, by H. Hafner, H. Kleinpoppen, and H. Krüger	386
QA6	Excitation and Polarization of He II Fowler- $\alpha$ Line, $\lambda$ = 4686 A, in Electron-Helium Atom Collisions, by D. Haidt, H. Kleinpoppen, and H. Krüger	390
QA7	Resonances in the Excitation Functions of Atoms,	

391

by I. P. Zapesochny and O. B. Shpenik

## SESSION QB

# Chairman: J. B. Hasted

## Electronic Excitation II

QB1	Electron-Potassium Excitation Studies Using Atomic-Beam Recoil, by Kenneth Rubin and Benjamin Bederson	395
QB2	The Electron-Impact Spectrum of Molecular Nitrogen, by Vincent D. Meyer and Edwin N. Lassettre	397
QB3	Electron-Impact Study of the Vibrational Intensities in the $A'\Pi \leftarrow X'\Sigma^+$ Transition of CO, by Ausma Skerbele, Edwin N. Lassettre, and Vincent D. Meyer	400
QB4	Absolute Excitation Cross Sections of the Alkali Metals, by I. P. Zapesochny and L. L. Shimon	401
QB5	Excitation of Neutral Atoms by Electron Impact, by D. Crothers and R. McCarroll	404
QB6	Rare Gases Atom Excitation by Electron Impact, by V. Veldre, A. Lyash, and L. Rabik	407
QB7	Some Properties of the Generalized Oscillator Strength and Their Relation to Inelastic Scattering of Charged Particles, by M. Inokuti and R. L. Platzman	408

## SESSION RA

#### Chairman: P. Marmet

#### Ionization I

413

RA1 Long-Lifetime States of Positive Ions, by N. R. Daly

RA2	Validité de la Loi de Bethe dans le Cas d'Ionisations Doubles par Impact Électronique, by Florence Fiquet-Fayard, Françoise Muller, and Jean-Pierre Ziesel	413
RA3	On Atomic Ionization by Electron Impact, by Robert H. McFarland	416
RA4	Comparison of an Isotope Effect in Photoionization and in Electron-Impact Ionization of Molecules, by James C. Person	419
RA5	Photoelectron Retarding Experiments with Cylindrical and Spherical Geometry, by D. C. Frost, C. A. McDowell, and D. A. Vroom	421

# SESSION RB

# Chairman: M. R. C. McDowell

# Ionization II

RB1	Retarding Potential Measurements of Photoionization Processes in Gases, by Philip H. Doolittle and Richard I. Schoen	424
RB2	Autoionization of $N_2$ under Electron Impact, by M. A. Fineman, E. M. Clarke, H. P. Hanson, and J. William McGowan	425
RB3	Production of $N_2^+$ in (0-0) Radiation by 60-keV Electrons, by G. Davidson and R. O'Neil	428
RB4	Details of the Electron-Impact Ionization of H and H <sub>2</sub> Near Threshold, by J. William McGowan and M. A. Fineman	429
RB5	Ionization Cross Sections for Electrons of 0.1 to 20 keV in Noble and Diatomic Gases, by B. L. Schram, F. J. deHeer, A. J. H. Boerboom, M. J. van der Wiel, H. R. Moustafa, J. Schutten, and J. Kistemaker	434
	SESSION S	
	Chairman: F. J. deHeer	
	Electron-Ion, Ion-Ion	
S1	A Measurement of the Cross Section for the Production of He <sup>+</sup> (2S) Ions by Electron-Impact Excitation of Ground- State He <sup>+</sup> Ions, by M. F. A. Harrison, A. C. H. Smith, and D. F. Dance	442
S2	Absolute Experimental Cross Sections for Single Ionization of Na <sup>+</sup> and K <sup>+</sup> Ions by Electron Impact, by J. W. Hooper, W. C. Lineberger, and F. M. Bacon	443
S3	Measurement of the Cross Section for Dissociation of $H_2^+$ by Electron Impact, by Gordon H. Dunn, Bert Van Zyl, and Richard N. Zare	443
S4	Ionisation d'Ions Positifs par Impact d'Electrons, by F. A. Baker and J. B. Hasted	447
S5	Contributions à l'Étude des Intéractions Inélastiques entre Deux Faisceaux d'Ions, by J. Guidini, C. Manus, T. Sinda, and G. Watel	450
<b>S</b> 6	Measurement of Excitation Functions for Spectral Lines of NV as Emitted by a Plasma, by B. C. Boland, F. C. Jahoda, T. J. L. Jones, and R. W. P. McWhirter	453