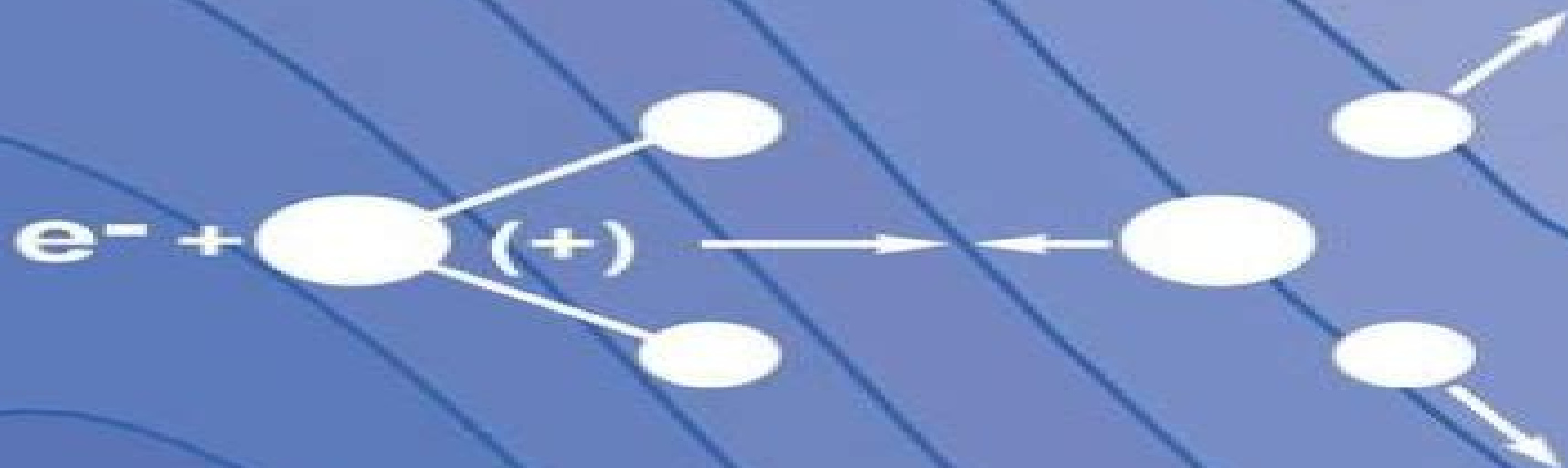


# Dissociative Recombination of Molecular Ions with Electrons



Edited by  
**Steven L. Guberman**

# Dissociative Recombination Of Molecular Ions With Electrons

**Ralf I. Kaiser**



## **Dissociative Recombination Of Molecular Ions With Electrons:**

*Dissociative Recombination of Molecular Ions with Electrons* Steven L. Guberman, 2012-12-06 Dissociative Recombination of Molecular Ions with Electrons is a comprehensive collection of refereed papers describing the latest developments in dissociative recombination research The papers are written by the leading researchers in the field The topics covered include the use of microwave afterglows merged beams and storage rings to measure rate coefficients and to identify the products and their yields The molecules studied range in size from the smallest H<sub>2</sub> to bovine insulin ions The theoretical papers cover the important role of Rydberg states and the use of wave packets and quantum defect theory to deduce cross sections rate constants and quantum yields Several theoretical and experimental papers address the controversial topic of H<sub>3</sub> dissociative recombination and its importance in the interstellar medium Dissociative recombination studies of other molecular ions in the interstellar medium and in cometary and planetary atmospheres are covered Ionization is an important competitive process to dissociative recombination and its competition with predissociation and its role in the reverse process of the association of neutral species is presented Dissociative attachment in which an electron attaches to a neutral molecule has many similarities to dissociative recombination The topics covered include the accurate calculation of electron affinities attachment to molecules clusters and to species absorbed on solid surfaces and electron scattering by a molecular anion

**Dissociative Recombination of Molecular Ions** Larsson Mats Orel Ann E, Mats Larsson, Ann E. Orel, 2014-05-14 Dissociative recombination DR of molecular ions with electrons is a complex poorly understood molecular process Its critical role as a neutralising agent in the Earth's upper atmosphere is now well established and its occurrence in many natural and laboratory produced plasma has been a strong motivation for studying the event In this book theoretical concepts experimental methodology and applications are united revealing the governing principles behind the gas phase reaction The book takes the reader through the intellectual challenges posed describing in detail dissociation mechanisms dynamics diatomic and polyatomic ions and related processes including dissociative excitation ion pair formation and photodissociation With the final chapter dedicated to applications in astrophysics atmospheric science plasma physics and fusion research this is a focused definitive guide to a fundamental molecular process The book will appeal to academics within physics physical chemistry and related sciences

**Dissociative Recombination** Bertrand R. Rowe, J. Brian A. Mitchell, André Canosa, 2012-12-06 Proceedings of a NATO ARW held in Saint Jacut de la Mer Brittany France May 3-8 1992 *Dissociative Recombination, Theory, Experiment And Applications* iii Daniel Zajfman, James Brian Alexander Mitchell, Bertrand R Rowe, Dirk Schwalm, 1996-04-25 In this book the latest developments in the study of the dissociative recombination of electrons and molecular ions are discussed This process is of great importance in controlling the physical and chemical states of ionized gases It has direct application to astrophysics aeronomy thermonuclear fusion research plasma processing and combustion science

Atomic Processes in Electron-Ion and Ion-Ion Collisions F. Brouillard, 2013-03-09 Four years after a

first meeting in BADDECK Canada on the Physics of Ion Ion and Electron Ion collisions a second Nato Advanced Study Institute in HAN Lesse Belgium reexamined the subject which had become almost a new one in consideration of the many important developments that had occurred in the mean time The developments have been particularly impressive in two areas the dielectronic recombination of electrons with ions and the collisional processes of multiply charged ions For dielectronic recombination a major event was the obtainment in 1983 of the first experimental data This provided at last a non speculative basis for the study of that intricate and subtle process and strongly stimulated the theoretical activities Multiply charged ions on the other hand have become popular thanks to the development of powerful ion sources This circumstance together with a pressing demand from thermonuclear research for ionisation and charge exchange cross sections has triggered systematic experimental investigations and new theoretical studies which have contributed to considerably enlarge over the last five years our understanding of the collisional processes of multiply charged ions Dielectronic recombination and multiply charged ions were therefore central points in the programme of the ASI in HAN Lesse and are given a corresponding emphasis in the present book

**Recombination of Molecular Positive Ions with Electrons** M. A. Biondi, T. R. Connor, C. S. Weller, W. H. Kasner, PITTSBURGH UNIV PA., 1964 Results of studies of the recombination of electrons with molecular positive ions are presented Theoretical arguments indicate that the dissociative process in which a molecular ion captures an electron without change of energy forming an unstable excited molecule which then dissociates provides a highly efficient recombination mechanism The nature of the process responsible for the large recombination rates observed in Laboratory afterglow studies is investigated using combined microwave optical spectrometric and interferometric and mass spectrographic techniques Dissociative recombination is shown to be the process operative in the laboratory studies since it is found that a molecular positive ion must be present to observe a large recombination rate b when diatomic ions are present excited atoms are formed in the recombination process and c these excited atoms have kinetic energy of dissociation substantially in excess of thermal energy Author

*Novel Aspects of Electron-molecule Collisions* Kurt H. Becker, 1998 Covers theoretical and experimental activities in the field of electron molecule collisions with chapters on areas including positive and negative ion formation in electron collisions with fullerenes spin effects in electron molecule collisions collisions with oriented and aligned molecules and electron impact dissociative excitation and ionization of molecular ions Other subjects include electron molecule cross sections for plasma application and improvements to the complex Kohn variational method No index Annotation copyrighted by Book News Inc Portland OR

**Cold-Ion Populations and Cold-Electron Populations in the Earth's Magnetosphere and Their Impact on the System, 2nd edition** Joseph E. Borovsky, Gian Luca Delzano, Elena Kronberg, Cecilia Norgen, 2023-05-11 Cold ion populations and cold electron populations are extremely difficult to measure in the Earth's magnetosphere and their properties evolutions and controlling factors are poorly understood They are sometimes referred to as the hidden populations But they are known to

have multiple impacts on the behavior of the global magnetospheric system. These impacts include a the reduction of the dayside reconnection rate and consequently the reduction of solar wind magnetosphere coupling b alteration of the growth rate and saturation amplitudes of plasma waves resulting in alterations of the energization rates of the radiation belts c changes in plasma wave properties resulting in changes in the loss rates of the ring current and radiation belts d changes in the mass density of the magnetosphere resulting in changes in the radial diffusion of the radiation belts e spatial and temporal structuring of the aurora f altering magnetotail reconnection g changing spacecraft charging and h acting as sources for warm and hot magnetospheric populations. A recent workshop on the cold particle populations of the magnetosphere inspired new work on the outstanding problems caused by a lack of understanding of those cold populations. This Research Topic will collect reports of that new work and will stimulate the formation of author teams to write review articles on what is known and what needs to be known. Commentaries assessing the present situation and guiding the research field into the future will be solicited from the community. Methods articles describing new measurement techniques and new spaceflight mission concepts will be welcomed.

*Dissociative Recombination of Stored and Phase-spaced Cooled Molecular Ions in CRYRING.*, 1993 Ion storage rings offer several advantages for studies of recombination of molecular ions by electrons a process which in general leads to dissociation. During the last year dissociative recombination of H<sub>3</sub><sup>+</sup>, HD<sup>+</sup>, H<sub>2</sub><sup>+</sup>, D<sub>2</sub><sup>+</sup>, 3HeH<sup>+</sup>, 4HeH<sup>+</sup> and 4HeD<sup>+</sup> have been studied in storage rings in Stockholm, Heidelberg, Tokyo and Aarhus. Only a fraction of the results obtained at these places have been processed to the point where they have been published in the literature. Hence the discussion of some of the results in this article must be regarded as tentative.

**Microphysics of Atmospheric Phenomena** Boris M. Smirnov, 2016-08-29 This book investigates elementary processes in the Earth's atmosphere involving photons, electrons, ions, radicals, and aerosols. It is based on global atmospheric models such as the standard atmospheric model with averaged atmospheric parameters across the globe and over time, the Earth's energetic balance, and the global electric circuit that allows to analyze fundamental atmospheric properties to be analyzed. Rate constants of elementary processes in the Earth's atmosphere together with measured atmospheric parameters and existing concepts of atmospheric phenomena are used in the analysis of global and local atmospheric processes. Atmospheric photoprocesses result from the interaction of solar radiation with the atmosphere and processes involving ions, oxygen atoms, excited atomic particles, and ozone molecules. Atmospheric electricity as a secondary phenomenon to atmospheric water circulation results in a chain of processes that begins with collisions of water aerosols in different aggregate states. Cosmic rays are of importance for atmospheric electricity as they create positive and negative ions in the air. Air breakdown in an electric field of clouds in the form of lightning may develop under the influence of cosmic ray created seed electrons which are necessary for electron multiplication in ionization wave streamers. The upper atmosphere ionosphere is formed under solar radiation in a vacuum ultraviolet spectrum and absorption of this radiation leads to air photoionization. The greenhouse effect is determined by

atmospheric water whereas transitions between a water vapor and aerosols may lead to a change in atmospheric optical depth Carbon dioxide contributes in small portions to the atmospheric greenhouse effect Cosmic rays are of importance for atmospheric discharge the origin of lightning and cloud formation in the first stage of aerosol growth This book provides a qualitative description of atmospheric properties and phenomena based on elementary processes and simple models

**Plasma Chemistry** Alexander Fridman, 2008-05-05 Providing a fundamental introduction to all aspects of modern plasma chemistry this book describes mechanisms and kinetics of chemical processes in plasma plasma statistics thermodynamics fluid mechanics and electrodynamics as well as all major electric discharges applied in plasma chemistry Fridman considers most of the major applications of plasma chemistry from electronics to thermal coatings from treatment of polymers to fuel conversion and hydrogen production and from plasma metallurgy to plasma medicine It is helpful to engineers scientists and students interested in plasma physics plasma chemistry plasma engineering and combustion as well as chemical physics lasers energy systems and environmental control The book contains an extensive database on plasma kinetics and thermodynamics and numerical formulas for practical calculations related to specific plasma chemical processes and applications Problems and concept questions are provided helpful in courses related to plasma lasers combustion chemical kinetics statistics and thermodynamics and high temperature and high energy fluid mechanics **Proceedings** ,1970

**Atomic Physics at Accelerators: Stored Particles and Fundamental Physics** Helge Knudsen, Jens Ulrik Andersen, Heinz-Jürgen Kluge, 2012-12-06 This volume contains the proceedings of the third Euroconference on Atomic Physics at Accelerators APAC 2001 with the title Stored Particles and Fundamental Physics It was held in Aarhus Denmark from September 8 to 13 at the Marselis Hotel located near the beach and the Marselis Woods outside Aarhus but some of the activities took place at the Department of Physics University of Aarhus The conference was sponsored by the Commission of the European Union Contract No ERBFMMACT980469 and also by the Danish Research Foundation through ACAP Aarhus Center for Atomic Physics The meeting was focused on the application of storage rings for atomic physics and there are two fairly small rings in Aarhus ASTRID Aarhus Storage Ring for Ions Denmark and ELISA Electrostatic Ion Storage ring Aarhus The research at these rings has contributed to the strong position of European Science in this field Both rings are designed according to unique concepts ASTRID is a dual purpose ring which half the time stores electrons for the generation of low energy synchrotron radiation The storage of negative particles has also been a unique feature for the application of ASTRID as an ion storage ring

**Plasma Medicine** Alexander Fridman, Gary Friedman, 2012-12-19 This comprehensive text is suitable for researchers and graduate students of a hot new topic in medical physics Written by the world's leading experts this book aims to present recent developments in plasma medicine both technological and scientific reviewed in a fashion accessible to the highly interdisciplinary audience consisting of doctors physicists biologists chemists and other scientists university students and professors engineers and medical practitioners The book focuses on major topics and covers the

physics required to develop novel plasma discharges relevant for medical applications the medicine to apply the technology not only in vitro but also in vivo testing and the biology to understand complicated bio chemical processes involved in plasma interaction with living tissues

### **Inelastic Collisions and Recombination Between Electrons and Molecular Ions**

,2001 Inelastic collisions between molecular ions and slow electrons play an important role in naturally occurring ionized media and involve interesting interaction mechanisms which are also under intense theoretical study Several experiments focused on the collision of small molecular ions with electrons were carried out at the heavy ion storage ring TSR located at the Max Planck Institut f r Kernphysik Heidelberg Using the Coulomb explosion imaging technique it was possible to monitor vibrational cooling of the stored homonuclear molecular ions  $H_2^+$  and  $D_2^+$  it could be shown that the cooling is only due to the interaction of electrons with the molecular ions in super elastic collisions SEC where internal energy is transferred to the scattered electron This process is closely related to dissociative recombination DR For the DR and SEC of  $H_2^+$  and  $D_2^+$  ions with near zero kinetic energy electrons absolute vibrational state specific rate coefficients were measured for the first time Another series of experiments was focused on the investigation of final fragment states in the DR of LiH and HeH The electronic structure of these ions and the corresponding neutral molecules is such that DR proceeds via a non adiabatic coupling of electronic and vibrational motion at short internuclear distances The experiments revealed a dominant population of the highest energetically accessible final fragment states in such reactions In addition also the absolute rate coefficient for the DR of LiH molecules with slow electrons was measured

### **Reactions of Ions in the Upper Atmosphere W. W.**

Hunt,1962 **Electron-Emission Gas Discharges I / Elektronen-Emission Gasentladungen I** S. Flügge,2012-12-06 v Formation of negative ions by processes other than attachment in the gaseous phase at low X po 17 Introduction As early as 1912 J J THOMSON 32J in his first mass spectro graph observed negative ions of O Cl H and what he believed to be N He at first ascribed these to possible dissociation of polar gaseous compounds by electron impact but control studies using ionization at low energies in glow discharges indicated that this was not the origin O W RICHARDSON 33J in his book on emission of electricity from hot bodies reported negative ions to come from hot salts From there on many experimental studies over the years indicated that negative ions could be formed by various processes By the middle nineteen hundred and thirties the data fairly clearly identified several processes as being active and MASSEY and SMITH 34J developed the theory underlying some of them More data are summarized in MASSEY S excellent little monograph on Negative Ions and in L SSEY and BURHOP S recent book 35 Since that period stimulated by various investigations and certain industrial problems very careful studies of the appearance of such ions by mass spectrograph have been carried out in the laboratory of K G EMELEUS in Belfast by SLOANE and his co workers 3J that haw clarified the questions and indicated what ions have been observed and something of the processes at work

### **Astrochemistry** Ralf I. Kaiser,2006-10-04 The physical and chemical processes leading to the formation of molecules in the interstellar medium as well as in solar system planetary and satellite

atmospheres has fascinated scientists for many years This conference set out to shed light on the basic question How are these molecules actually formed in these extraterrestrial environments Topics included are Gas phase laboratory experiments solid state laboratory experiments observations and spectroscopy as well as modeling and theory

**Recombination of Molecular Ions** J. B. Mitchell, 1990

**The Dissociative  
Geomagnetism and Aeronomy** ,1966



## Unveiling the Power of Verbal Beauty: An Psychological Sojourn through **Dissociative Recombination Of Molecular Ions With Electrons**

In a global inundated with displays and the cacophony of fast conversation, the profound power and emotional resonance of verbal beauty usually diminish in to obscurity, eclipsed by the continuous assault of noise and distractions. Yet, set within the musical pages of **Dissociative Recombination Of Molecular Ions With Electrons**, a interesting perform of literary elegance that pulses with organic feelings, lies an unforgettable trip waiting to be embarked upon. Written with a virtuoso wordsmith, this enchanting opus manuals visitors on a psychological odyssey, gently revealing the latent possible and profound affect stuck within the complicated internet of language. Within the heart-wrenching expanse of the evocative evaluation, we can embark upon an introspective exploration of the book is key themes, dissect their captivating publishing design, and immerse ourselves in the indelible impact it leaves upon the depths of readers souls.

<https://pinehillpark.org/data/detail/Documents/Cheap%20Ai%20Social%20Media%20Scheduler%20From%20Home.pdf>

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