

Radio Recombination Lines: 25 Years of Investigation

**M. A. Gordon
R. L. Sorochenko
(editors)**



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Radio Recombination Lines Twenty Five Years Of Investigation

M.A. Gordon, Roman L. Sorochenko



Radio Recombination Lines Twenty Five Years Of Investigation:

Radio Recombination Lines: 25 Years of Investigation M.A. Gordon, Roman L. Sorochenko, 2012-12-06 Text no 1 Radio Recombination Lines RRLs discovered in the USSR in 1964 have become a powerful research tool for astronomers Available throughout the radio spectrum these lines carry information regarding the density temperature turbulence and velocity of thermal plasmas Their very existence shows the presence of thermal gas They also can carry information regarding magnetic fields if Zeeman splitting were to be detected Containing the proceedings of an IAU Colloquium celebrating the 25th anniversary of their detection this volume tells us what has happened since It contains the story of the detection of RRLs and reviews of many areas of physics of the interstellar gas from which stars form HII regions excited by newly formed stars planetary nebulae involving dying stars and the structure of our Milky Way and other galaxies reflecting the large scale morphology of the star formation process In addition there is an article describing modern laboratory studies of Rydberg atoms to probe the basic physics of atomic structure and articles describing the theory of collisions and radiation upon Rydberg atoms leading to observable effects to be used as diagnostic tools in astronomy This book focuses on the 25 years of astronomical research with radio recombination lines RRLs since their discovery in 1965 It covers a wide range of topics papers dealing with research into Rydberg atoms both in the laboratory and in the interstellar medium of our galaxy and others papers on the interaction of radiation and atomic systems as well as with the effects of inelastic collisions between these atoms and both ions and electrons It deals with astronomical observations of atoms with diameters ranging from 0.08 to 50 μm a size factor of 625 It deals with RRLs in absorption in emission and as true masers And it deals with plasmas with temperatures ranging from 10 to greater than 10⁴ kelvins and with an even greater range of volume densities Much new work is reported including low frequency RRLs discovered in 1980 and the maser RRLs from the star MWC349 discovered in 1989 The advent of aperture synthesis telescopes and large single element telescopes have made possible RRL studies with high angular resolution The sum total of the work reported here will make the volume a platform from which to search new horizons in RRL research **Twenty-five Years of Research Management** Associated Universities, Inc, 1972 **Radio**

Recombination Lines M.A. Gordon, R.L. Sorochenko, 2009-01-10 This guide to the physics and observations of Radio Recombination Lines from astronomical sources includes history theory applications 250 equations and 110 illustrations This soft cover edition contains corrections and updates from hardbound edition **Radio Recombination Lines** Mark Gordon, Roman L. Sorochenko, 2002-11-30 This book is a comprehensive guide to the physics and observations of Radio Recombination Lines from astronomical sources written for astronomers physicists and graduate students It is suitable for a graduate level textbook It includes the history of RRL detections the astrophysics underlying their intensities and line shapes including topics like departures from LTE and Stark broadening the maximum possible size of an atom as well as detailed descriptions of the astronomical topics for which RRLs have proved to be effective tools The text includes more than 250

equations and 110 illustrations It also contains hundreds of specific references to the astronomical literature to enable readers to explore additional details The appendix includes supplementary information such as the detailed physics underlying the Bohr atomic model tables of RRL frequencies including fine structure components techniques for calculating hydrogenic oscillator strengths FORTRAN code for calculating departure coefficients and a discussion with formulas for converting observational telescope intensity units to astrophysical ones

The Physics of Star Formation and Early Stellar Evolution Charles J. Lada, N.D. Kylafis, 2012-12-06 The origin of stars is one of the principle mysteries of nature During the last two decades advances in technology have enabled more progress to be made in the quest to understand stellar origins than at any other time in history The study of star formation has developed into one of the most important branches of modern astrophysical research A large body of observational data and a considerable literature now exist concerning this topic and a large community of international astronomers and physicists devote their efforts attempting to decipher the secrets of stellar birth Yet the young astronomer/physicist or more advanced researcher desiring to obtain a basic background in this area of research must sift through a very diverse and sometimes bewildering literature A literature which includes research in many disciplines and sub disciplines of classical astrophysics from stellar structure to the interstellar medium and encompasses the entire range of the electromagnetic spectrum from radio to gamma rays Often the reward of a successful foray through the current literature is the realization that the results can be obsolete and outdated as soon as the ink is dry in the journal or the conference proceeding in which they are published

Reports on Astronomy Derek McNally, 2012-12-06 IAU Transactions are published as a volume corresponding to each General Assembly Volume A is produced prior to the Assembly and contains Reports on Astronomy prepared by each Commission President The intention is to summarize the astronomical results that have affected the work of the Commission since the production of the previous Reports up to a time which is about one year prior to the General Assembly Volume B is produced after the Assembly and contains accounts of Commission Meetings which were held together with other material The reports included in the present volume range from outline summaries to lengthy compilations and references

Physics Briefs, 1991 Amazing Light

Raymond Y. Chiao, 2012-12-06 This Festschrift is a collection of essays contributed by students colleagues and admirers to honor an eminent scholar on a special anniversary Charles Hard Townes on the occasion of his 80th birthday July 28 1995 In 1964 Townes shared the Nobel Prize in physics with Alexander Mikhailovich Prokhorov and Nikolai Gen nadyevich Basov for fundamental work in the field of quantum electronics which has led to the construction of oscillators and amplifiers based on the maser laser principle His contributions have covered a much wider area however His fruitful interests spanning several decades have included many scientific subjects including microwave spectroscopy and astrophysics other articles in this volume will expand further on this point He has also contributed to public service having served as the chairman of the Science and Technology Advisory Committee for NASA's Apollo program and as a member and vice chairman of the

President's Science Advisory Committee As the enormous breadth of contributions from his students shows he has educated scholars who are now in a wide range of fields The contributions from his many admirers among whom are nine fellow Nobel laureates attest to his impact on many disciplines ranging from electrical engineering to medicine His influence extends even to theology as is indicated by one essay The broadly international character of this Festschrift reflects his deep belief in the international universal nature of science *The Cold Universe* Thierry Montmerle,1994 Evolution of Interstellar Matter and Dynamics of Galaxies J. Palous,B. W. Burton,P. O. Lindblad,1992-07-02 Proceedings of the international workshop on the Evolution of Interstellar Matter and Dynamics of Galaxies **Scientific and Technical Aerospace Reports** ,1973

Radio Recombination Lines P.A. Shaver,2012-12-06 Since their first detection 15 years ago radio recombination lines from several elements have been observed in a wide variety of objects including HII regions planetary nebulae molecular clouds the diffuse interstellar medium and recently other galaxies The observations span almost the entire range from 0.1 to 100 GHz and employ both single dish and aperture synthesis techniques The theory of radio recombination lines has also advanced strongly to the point where it is perhaps one of the best understood in astrophysics In a parallel development it has become possible over the last decade to study these same highly excited atoms in the laboratory this work provides further confirmation of the theoretical framework However there has been continuing controversy over the astrophysical interpretation of radio recombination line observations especially regarding the role of stimulated emission A workshop was held in Ottawa on 24-25 August 1979 bringing together many of the active scientists to review the field and discuss these questions of interpretation A broad consensus has emerged the subtleties of the line formation process are understood and the conditions under which reliable information can easily be extracted from the line measurements are known It thus appears likely that the emphasis will shift increasingly from the study of the line phenomenon itself to further application in other areas of astrophysics ranging from physical processes in plasmas temperatures densities ionization structure to the large scale properties of our galaxy abundances kinematics structure and studies of extragalactic systems *Nuclear Science Abstracts* ,1971 NSA is a comprehensive collection of international nuclear science and technology literature for the period 1948 through 1976 pre dating the prestigious INIS database which began in 1970 NSA existed as a printed product Volumes 1-33 initially created by DOE's predecessor the U.S Atomic Energy Commission AEC NSA includes citations to scientific and technical reports from the AEC the U.S Energy Research and Development Administration and its contractors plus other agencies and international organizations universities and industrial and research organizations References to books conference proceedings papers patents dissertations engineering drawings and journal articles from worldwide sources are also included Abstracts and full text are provided if available **25 Years of Radio Astronomy at Tata Institute of Fundamental Research** ,1989 **Literature 1989, Part 1** Astronomisches Rechen-Institut,2013-11-11 From the reviews Astronomy and Astrophysics Abstracts has appeared in semi annual volumes since 1969 and it has already

become one of the fundamental publications in the fields of astronomy astrophysics and neighbouring sciences It is the most important English language abstracting journal in the mentioned branches The abstracts are classified under more than a hundred subject categories thus permitting a quick survey of the whole extended material The AAA is a valuable and important publication for all students and scientists working in the fields of astronomy and related sciences As such it represents a necessary ingredient of any astronomical library all over the world Space Science Review Dividing the whole field plus related subjects into 108 categories each work is numbered and most are accompanied by brief abstracts Fairly comprehensive cross referencing links relevant papers to more than one category and exhaustive author and subject indices are to be found at the back making the catalogues easy to use The series appears to be so complete in its coverage and always less than a year out of date that I shall certainly have to make a little more space on those shelves for future volumes

The Observatory Magazine The Orion Complex: A Case Study of Interstellar Matter C.D. Goudis,2012-12-06 This work deals with some of the most typical complexes of interstellar matter and is intended to serve both as a reference book for the specialist and as an introduction for the newcomer to the field It is hoped to meet the first aim by presenting a holistic view of the well studied complexes in Orion built on information derived from various branches of modern Astrophysics The wealth of published data is presented in the form of photographs contour maps diagrams and numerous heavily annotated tables The second aim is pursued by providing an outline of the complexes the physical problems associated with them the empirical models describing their behaviour and in addition by including an extended Appendix section summarizing the numerous methods employed to derive the physical parameters of an H II region and the dust and molecular cloud physically associated with it The book consists of five chapters and four Appendix sections Chapter 1 which is concerned with the large scale view of the Orion region outlines the morphology of the area and examines in particular the nature of Barnard's Loop and the associated filamentary structure in addition to the origin of the I Orion OB association Chapter 2 focuses on the ionized gas of the Orion H II molecular complex i e *The Radio Schmidt Telescope* Dominion Radio Astrophysical Observatory,1991 The Messenger ,1988 *Millimeter Aperture Synthesis Observations of High Mass Star Forming Regions* David James Wilner,1993 **American Journal of Physics** ,2002

The book delves into Radio Recombination Lines Twenty Five Years Of Investigation. Radio Recombination Lines Twenty Five Years Of Investigation is a vital topic that needs to be grasped by everyone, ranging from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Radio Recombination Lines Twenty Five Years Of Investigation, encompassing both the fundamentals and more intricate discussions.

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 - Chapter 4: Radio Recombination Lines Twenty Five Years Of Investigation in Specific Contexts
 - Chapter 5: Conclusion
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 4. In chapter 3, the author will examine the practical applications of Radio Recombination Lines Twenty Five Years Of Investigation in daily life. This chapter will showcase real-world examples of how Radio Recombination Lines Twenty Five Years Of Investigation can be effectively utilized in everyday scenarios.
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 6. In chapter 5, the author will draw a conclusion about Radio Recombination Lines Twenty Five Years Of Investigation. The final chapter will summarize the key points that have been discussed throughout the book.
- The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Radio Recombination Lines Twenty Five Years Of Investigation.

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