

# Electromagnetic Cascade and Chemistry of Exotic Atoms

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# Electromagnetic Cascade And Chemistry Of Exotic Atoms

**Giorgio Benedek, Hubert Schneuwly**



## **Electromagnetic Cascade And Chemistry Of Exotic Atoms:**

Electromagnetic Cascade and Chemistry of Exotic Atoms D. Horváth, L.M. Simons, G. Torelli, 2013-12-14 This Workshop was organized to bring once more together the scientists of the rather heterogeneous field of exotic atoms. At present the main topic of the field seems to be the study of the atomic cascade. There are some who study it intentionally. Let us call them cascadeurs and others who think they investigate other features of the exotic atoms like Coulomb capture, particle transfer, muon catalyzed fusion, chemical effects, fundamental properties, etc. users, while in fact they study some special consequences of the same atomic cascade. We decided to get cascadeurs and users discuss the problems of exotic atoms at wonderful Erice at the 5th Course of the International School of Physics of Exotic Atoms. Our Workshop was quite successful; we have heard excellent talks from participants from a dozen countries and most of them have prepared written contributions for this volume. The Organizers express their gratitude to all participants for their contributions, especially to David Measday for his concluding remarks not printed here and to James Cohen for jumping in for Leonid Ponomarev who had to leave unexpectedly in the middle of the meeting. We greatly appreciate the enthusiastic help of Marianne Signer in every stage of the organization work. And of course the Workshop could not happen at all without the incredibly efficient organization by the Ettore Majorana Centre of Scientific Culture. Leopold M. Simons, Dezs. Horvath, Gabriele Torelli. V. CONTENTS. OPENING ADDRESS xi

Exotic Atoms in Condensed Matter Giorgio Benedek, Hubert Schneuwly, 2012-12-06 Exotic Atoms in Condensed Matter reviews the state of the art in this field from meson factories to the basic interactions of muons in condensed matter. The application of muon and pion based analysis of solid state structural magnetic and superconducting properties is discussed. The spectroscopic features of exotic atoms are reviewed together with their application to chemical analysis. Also muon catalyzed fusion is presented.

Review of Fundamental Processes and Applications of Atoms and Ions C. D. Lin, 1993 This book reviews the major progress made in the fields of atomic, molecular and optical physics in the last decade. It contains eleven chapters in which contributors have highlighted the major accomplishments made in a given subfield. Each chapter is not a comprehensive review but rather a succinct survey of the most interesting developments achieved in recent years. This book contains information on many AMO subfields and can be used as a textbook for graduate students interested in entering AMO physics. It may also serve researchers who wish to familiarize themselves with other AMO subfields.

Muonic Atoms and Molecules Schaller, Petitjean, 2012-12-06 From Sunday evening April 5 until Thursday afternoon April 9, 1992, 49 scientists from 10 countries met at the Centro Stefano Franscini on Monte Verità overlooking Ascona in the state of Ticino in Switzerland for an international workshop on Muonic Atoms and Molecules. More than two thirds of the participants presented their results in talks of 20 to 40 minutes duration. In addition Prof. Gabriele Torelli gave, under the patronage of the Ministro del Ambiente of the state of Ticino, Dr. Mario Camani a lecture in Italian entitled *Un modo insolito di studiare le proprietà nucleari atomiche e chimiche*. The scientific program commenced on Monday morning with

discussions centering on nuclear muon capture and nuclear fusion and fission moving on to muonic atom spectroscopy in the afternoon All of Tuesday was devoted to muon catalyzed fusion and muon transfer On Wednesday morning different aspects of hot muonic atoms were discussed followed by informal gatherings in the afternoon and evening On Thursday morning we took a look at the prospects for the TRIUMF and PSI meson factories and new experimental methods The conference was brought to a close in the afternoon with C P summarizing the events of the past days The two organizers want to thank all participants for their contributions and for the lively discussions which often followed the different talks Physics Briefs

,1992 **Atoms, Molecules and Photons** Wolfgang Demtröder,2010-11-10 This introduction to Atomic and Molecular Physics explains how our present model of atoms and molecules has been developed during the last two centuries by many experimental discoveries and from the theoretical side by the introduction of quantum physics to the adequate description of micro particles It illustrates the wave model of particles by many examples and shows the limits of classical description The interaction of electromagnetic radiation with atoms and molecules and its potential for spectroscopy is outlined in more detail and in particular lasers as modern spectroscopic tools are discussed more thoroughly Many examples and problems with solutions should induce the reader to an intense active cooperation **Physics at KAON** Dieter Frekers,David R.

Gill,Josef Speth,2012-12-06 Physics at KAON an international meeting jointly organized by the KFA Jillich and TRI UMF was held in the Physikzentrum Bad Honnef from June 7 through June 9 1989 This was one of a series of meetings the first one in Europe in which plans for the medium energy physics laboratory KAON were presented and some aspects of the physics at this new facility were discussed The meeting focussed mainly on the topics of hadron spectroscopy J meson scattering strangeness in nuclei and rare decays Also presented were some of the research programs at SATURNE and COSY which may well lead to KAON physics in the future These proceedings include articles which summarize our current experimental and theoretical knowledge in the various areas as well as papers which describe lines of research feasible with KAON The large number of participants limited in fact by the capacity of the Physikzentrum clearly demonstrates the great interest of the European physics community in the research avenues which will be opened by the high intensity hadron facilities March 1990 D Frekers D R Gill J Speth Contents Opening remarks By E Vogt SI The TRIUMF kaon factory accelerators By M K Craddock S3 Experimental facilities By P Kitching S9 Polarized internal targets at KAON By C A Miller S21 Hyperons in the bound state approach to the Skyrme model *Handbook of Nuclear Chemistry* Attila Vértes,Sándor Nagy,Zoltán

Klencsár,Rezso György Lovas,Frank Rösch,2010-12-10 This revised and extended 6 volume handbook set is the most comprehensive and voluminous reference work of its kind in the field of nuclear chemistry The Handbook set covers all of the chemical aspects of nuclear science starting from the physical basics and including such diverse areas as the chemistry of transactinides and exotic atoms as well as radioactive waste management and radiopharmaceutical chemistry relevant to nuclear medicine The nuclear methods of the investigation of chemical structure also receive ample space and attention The

international team of authors consists of scores of world renowned experts nuclear chemists radiopharmaceutical chemists and physicists from Europe USA and Asia The Handbook set is an invaluable reference for nuclear scientists biologists chemists physicists physicians practicing nuclear medicine graduate students and teachers virtually all who are involved in the chemical and radiopharmaceutical aspects of nuclear science The Handbook set also provides further reading via the rich selection of references **The Hydrogen Atom** S.G. Karshenboim, F.S. Pavone, F. Bassani, M. Inguscio, T.W.

Hänsch, 2001-06-20 For more than a century studies of atomic hydrogen have been a rich source of scientific discoveries These began with the Balmer series in 1885 and the early quantum theories of the atom and later included the development of QED and the first successful gauge field theory Today hydrogen and its relatives continue to provide new fundamental information as witnessed by the contributions to this book The printed volume contains invited reviews on the spectroscopy of hydrogen muonium positronium few electron ions and exotic atoms together with related topics such as frequency metrology and the determination of fundamental constants The accompanying CD contains in addition to these reviews a further 40 contributed papers also presented at the conference Hydrogen Atom 2 held in summer 2000 Finally to facilitate a historical comparison the CD also contains the proceedings of the first Hydrogen Atom conference of 1988 The book includes a foreword by Norman F Ramsey Springer Handbook of Atomic, Molecular, and Optical Physics Gordon W. F.

Drake, 2023-02-09 Comprises a comprehensive reference source that unifies the entire fields of atomic molecular and optical AMO physics assembling the principal ideas techniques and results of the field 92 chapters written by about 120 authors present the principal ideas techniques and results of the field together with a guide to the primary research literature carefully edited to ensure a uniform coverage and style with extensive cross references Along with a summary of key ideas techniques and results many chapters offer diagrams of apparatus graphs and tables of data From atomic spectroscopy to applications in comets one finds contributions from over 100 authors all leaders in their respective disciplines Substantially updated and expanded since the original 1996 edition it now contains several entirely new chapters covering current areas of great research interest that barely existed in 1996 such as Bose Einstein condensation quantum information and cosmological variations of the fundamental constants A fully searchable CD ROM version of the contents accompanies the handbook Optoelectronics for Environmental Science Arthur N. Chester, S. Martellucci, 2013-03-08 As we enter the nineties there is worldwide awareness that the future of all mankind is inexorably linked by the world we share and its response to man's activities Lasers and the optical sciences have brought powerful tools to measure and understand our environment LIDAR laser radar and laser fluorescence allow us to measure atmospheric and oceanic pollutants as well as industrial emissions from many kilometers distance And a variety of sensitive laser based spectroscopic techniques permit the accurate analysis of heavy metals and other trace elements in the environment In September 1989 an international group of scientists met in Erice Sicily for the 14th Course of the International School of Quantum Electronics This Course was devoted

to Optoelectronics for Environmental Science and was ably directed by Prof V S Letokhov of the USSR Institute of Spectroscopy and Prof A M Scheggi of the C N R Electro magnetic Waves Institute Florence Italy This book gives the proceedings of that conference which covered not only basic tutorial papers but also reports on the latest research results The first half of this volume describes the techniques used for direct In Situ Measurements of the environment In Techniques and Programs four chapters and one extended abstract give tutorial discussions of the most important remote sensing techniques LIDAR laser fluorescence and optical fiber sensors plus a description of the Italian program in this area

*Few-Body Problems in Physics '95* Rafael Guardiola, 2012-12-06 Proceedings of the XVth European Conference on Few Body Problems in Physics Peniscola Castellon Spain June 5-9 1995      **QCD at 200 TeV** L. Cifarelli, Y. Dokshitzer, 2012-12-06 This volume contains the Proceedings of the 17th Workshop of the INFN ELOISATRON Project on QCD at 200 TeV held at the Ettore Majorana Centre for Scientific Culture EMCSC Erice Trapani Italy in the period 11-17 June 1991 The new multi TeV frontiers of Subnuclear Physics are no more beyond our imagination A conceptual design of the highest energy 100-100 TeV proton-proton collider the ELOISATRON already exists Intensive R D studies are on the go to develop the most promising and innovative detector technologies for the highest energy and luminosity QCD Quantum Chromo Dynamics will be the theory to describe the expected Physics scenario of future Supercolliders The purpose of the Workshop was therefore to review the recent status of QCD in High Energy interactions and to discuss the novel aspects of Perturbative and Non Perturbative QCD with special emphasis on future experimental studies at Super High Energy Colliders up to the 200 TeV limit The topics were Classical QCD particle multiplication multiplicities and spectra jet profiles coherence effects etc Hadron interaction cross sections and structure functions at Super High Energies small x behaviour QCD Pomeron hot spots QCD fragmentation models present and future Artificial neural networks in High Energy Physics New theoretical aspects of QCD at Super High Energies instanton induced large cross sections baryon number violation and peculiar multi quark production events etc      **New Techniques for Future Accelerators III** G. Torelli, 2012-12-06 A fundamental step towards gaining a deeper understanding of our world is to increase the resolution of the investigative instruments we use i.e. to increase the energy and hence to decrease the wavelength of the particles which constitute our probes Almost any substantial progress in our understanding of the fundamental laws of Nature has been obtained when a new generation of accelerators has allowed us to achieve a new energy range The new results have generated new questions thus encouraging us to construct new machines to reach even higher energy levels The relative energy gain from one generation of accelerators to the next is progressively increasing The energy gain suggested by the theoretical predictions at the time has usually been much greater than the value allowed by our technical capabilities But this smaller energy gain permitted by accelerator technology improvement has generally been sufficient up until now to bring about a substantial increase in our knowledge Hence a large increase in accelerator energy is very important and we know that this result can essentially be obtained by developing some

new device or some new approach      *New Technologies for Supercolliders* L. Cifarelli, Thomas Ypsilantis, 2012-12-06 The present volume is based on the proceedings of the 12th Workshop of the INFN ELOISATRON Project held at the Ettore Majorana Centre for Scientific Culture EMCSC Erice frapani Sicily Italy in the period September 15 20 1990 The proceedings deal with the presentation of New Technologies for Supercolliders Three new energy frontiers 16 40 and 200 TeV are now opened up for the future of Subnuclear Physics Basic problems above the Fermi energy are crowding up but no one knows the energy levels needed for their solution This is why the technology for experiments with the new generation of Supercolliders needs to be pursued having in mind the problems which are of common interest in the three energy frontiers The primary purpose of the Workshop was to contribute towards the highest energy limit in the search for new instruments and new technologies Furthermore the present status and performances of various detector technologies were reviewed The possible options for a powerful apparatus whose goal would be the discovery of the top Higgs and SUSY particles in a very high energy high rate environment were finally analysed The Workshop was sponsored by the Italian National Institute for Nuclear Physics INFN the Italian Ministry of Education the Italian Ministry of Scientific and Technological Research and the Sicilian Regional Government We are thankful to the staff of EMCSC for their efficient and warm support      Semimagnetic Semiconductors and Diluted Magnetic Semiconductors M. Averous, M. Balkanski, 2012-12-06 Semimagnetic semiconductors SMSC and diluted magnetic semiconductors DMS have in the past decade attracted considerable attention because they confer many new physical properties on both bulk materials and heterostructures These new effects are due either to exchange interactions between magnetic moments on magnetic ions or to exchange interactions between magnetic moments and the spin of the charge carrier These effects vary with the transition metal Mn Fe Co or rare earth Eu Gd etc used and thus provide a range of different situations The field is very large zero gap small gap wide gap and the magnetic properties also are very rich paramagnetic spin glass antiferromagnetism These materials are very convenient for studying the magnetism the magnetism is diluted or the superlattices SL with a continuous change from type II SL to type III SL This Course attempted to provide a complete overview of the topic The participants of this summer school held in Erice came from ten countries and were from various backgrounds and included theoreticians experimentalists physicists and chemists Consequently an attempt was made to make the Course as thorough as possible but at the same time attention was devoted to basic principles The lecturers drawn from all the groups in the world involved in the field were asked to be very didactic in their presentation After two introductory lectures Dr      **Medium-Energy Antiprotons and the Quark—Gluon Structure of Hadrons** R. Klapisch, R. Landua, J.M. Richard, 2012-12-06 The fourth course of the International School on Physics with Low Energy Antiprotons was held in Erice Sicily at the Ettore Majorana Centre for Scientific Culture from 25 to 31 January 1990 The previous courses covered topics related to fundamental symmetries light and heavy quark spectroscopy and antiproton nucleus interactions The purpose of this school is to review theoretical and experimental aspects of low energy

antiproton physics concerning the quark gluon structure of hadrons and the dynamics of the antiproton nucleon interaction Another important objective is the discussion of future directions of research with low and medium energy antiprotons in the context of future medium energy facilities at CERN and elsewhere These proceedings contain both the tutorial lectures and the various contributions presented during the school by the participants The proceedings have been organised in three sections The first section is devoted to the theoretical lectures and contributions The selection of the various subjects wants to emphasize the correlation between antiproton nucleon physics and the underlying description in terms of quarks and gluons The second section contains an overview about 35 years of experiments with antiprotons It gives an introduction to the particle physics aspects of the field by outlining the historical development of experiment and theory and by describing the motivation and the results of three recent LEAR experiments in more detail The third section contains most of the contributions of the participants describing in more detail certain aspects of current or planned experiments at LEAR

*Data Analysis in Astronomy IV* R. Buccheri, P. Crane, Vito di Gesù, M.C. Maccarone, L. Scarsi, H.U.

Zimmermann, 2012-12-06 In this book are reported the main results presented at the Fourth International Workshop on Data Analysis in Astronomy held at the Ettore Majorana Center for Scientific Culture Erice Sicily Italy on April 12 19 1991 The Workshop was preceded by three workshops on the same subject held in Erice in 1984 1986 and 1988 The first workshop Erice 1984 was dominated by presentations of Systems for Data Analysis the main systems proposed were MIDAS AIPS RIAIP and SAIA Methodologies and image analysis topics were also presented with the emphasis on cluster analysis multivariate analysis bootstrap methods time analysis periodicity 2D photometry spectrometry and data compression A general presentation on Parallel Processing was made which encompassed new architectures data structures and languages The second workshop Erice 1986 reviewed the Data Handling Systems planned for large major satellites and ground experiments VLA HST ROSAT COMPASS COMPTTEL Data analysis methods applied to physical interpretation were mainly considered cluster photometry astronomical optical data compression cluster analysis for pulsar light curves coded aperture imaging New parallel and vectorial machines were presented cellular machines PAPIA machine MPP machine vector computers in astronomy Contributions in the field of artificial intelligence and planned applications to astronomy were also considered expert systems artificial intelligence in computer vision Gravitation and Modern Cosmology N. Sánchez, A. Zichichi, V. de

Sabbata, 2013-06-29 Peter Gabriel Bergmann started his work on general relativity in 1936 when he moved from Prague to the Institute for Advanced Study in Princeton Bergmann collaborated with Einstein in an attempt to provide a geometrical unified field theory of gravitation and electromagnetism Within this program they wrote two articles together A Einstein and P G Bergmann Ann Math 39 685 1938 and A Einstein V Bargmann and P G Bergmann Th von Karman Anniversary Volume 212 1941 The search for such a theory was intense in the ten years following the birth of general relativity In recent years some of the geometrical ideas proposed in these publications have proved essential in contemporary attempts towards the



unification of all interactions including gravity Kaluza Klein type theories and supergravity theories In 1942 Bergmann published the book *Introduction to the Theory of Relativity* which included a foreword by Albert Einstein This book is a reference for the subject either as a textbook for classroom use or for individual study A second corrected and enlarged edition of the book was published in 1976 Einstein said in his foreword to the first edition Bergmann's book seems to me to satisfy a definite need Much effort has gone into making this book logically and pedagogically satisfactory and Bergmann has spent many hours with me which were devoted to this end

*The Future of Muon Physics* Klaus Jungmann, Vernon W. Hughes, Gisbert zu Putlitz, 2012-12-06 This volume comprises a collection of invited papers presented at the international symposium *The Future of Muon Physics* May 7-9 1991 at the Ruprecht Karls Universität in Heidelberg In the inspiring atmosphere of the Internationales Wissenschaftsforum researchers working worldwide at universities and at many international accelerator centers came together to review the present status of the field and to discuss the future directions in muon physics The muon charged lepton of the second generation was first observed some sixty years ago Despite many efforts since the reason for its existence still remains a secret to the scientific community challenging both theorists and experimentalists In modern physics the muon plays a key role in many topics of research Atomic physics with negative muons provides excellent tests of the theory of quantum electrodynamics and of the electro weak interaction and probes nuclear properties The purely leptonic hydrogen like muonium atom allows tests of fundamental laws in physics and the determination of precise values for fundamental constants New measurements of the anomalous magnetic moment of the muon will probe the renormalizability of the weak interaction and will be sensitive to physics beyond the standard model The muon decay is the most carefully studied weak process Searches for rare decay modes of muons and for the conversion of muonium to antimuonium examine the lepton number conservation laws and new speculative theories Nuclear muon capture addresses fundamental questions like tests of the CPT theorem

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