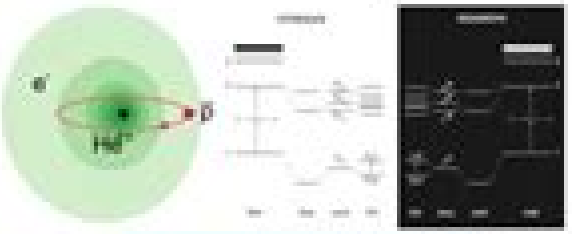
Low Energy Antiproton Physics at FLAIR

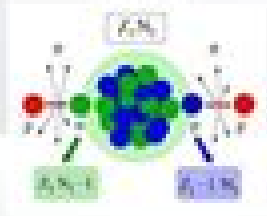
E.Widmann CAMOP, *Plans for a Next-Generation Low-Energy Antiproton Facility*, Physica Scripta 72 (2005) C51-C56

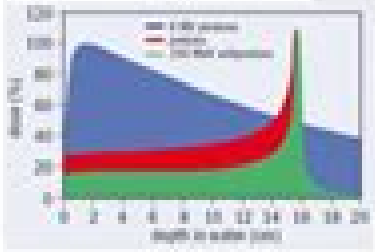
- Spectroscopy for tests of CPT and QED
  - Antiprotonic atoms (pbar-He, pbar-p), antihydrogen



- Atomic collisions
  - Sub-femtosecond correlated dynamics: ionization, energy loss, antimatter-matter collisions

- Antiprotons as hadronic probes
  - X-rays of light antiprotonic atoms: low-energy QCD
  - X-rays of neutron-rich nuclei: nuclear structure (halo)
  - Antineutron interaction
  - Strangeness –2 production





- Medical applications: tumor therapy

Low Energy Antiproton Physics

F. Bradamante,J.M. Richard,R. Klapisch

Low Energy Antiproton Physics:

Low Energy Antiproton Physics - Proceedings Of The First Biennial Conference Per Carlson,A Kerek,S Szilagyi,1991-01-10 The proceedings of this important conference consist of plenary and invited papers published in hard copy and CD ROM versions The contributed oral and poster presentations are included in the CD ROM version only *Low Energy Antiproton Physics - Proceedings Of The Third Biennial Confr Physics* Gabrijel Kernel,Peter Krizan,Marko Mikuz,1995-09-15 These proceedings cover the latest results in low energy antiproton physics The volume consists of invited talks and invited contributions on the following subjects nucleon antinucleon interactions antiprotons in astrophysics meson spectroscopy strangeness and charm production antinucleon nucleus interactions fundamental symmetries antiproton facilities atomic physics with antiprotons antihydrogen facilities and experiments **Physics at LEAR with Low-Energy Cooled Antiprotons** Robert Klapisch,Ugo Gastaldi,2012-12-06 The Workshop on Physics at LEAR with Low Energy Cooled Anti protons was held in Erice May 9 16 1982 at the Ettore Majorana Centre for Scientific Culture in the framework of the International School of Physics of Exotic Atoms The Workshop was organized by a committee composed of R Armenteros D Bugg P Dalpiaz U Gastaldi K Kilian R Klapisch P Lefevre D M6hl S Polikanov B Povh and J M Richard It was attended by 101 physicists from 44 insti tutions and 14 countries representing one third of the LEAR users Thjs Workshop was the first general meeting of the LEAR commu nity after the approval of the CERN Low Energy Antiproton Ring faci lity and of the experiments scheduled there for the initial period of oper ii to review the facility and the progress in its construction and to discuss the conditions of its operation iii to discuss future developments of the facility and of the experi mental programme These Proceedings contain the papers presented in Erice both orally and in the poster session which displayed also contributions from colleagues who unfortunately could not attend the Workshop The reports have been ordered in four sessions following the pro gramme of the meeting The CERN low energy antiproton facility is presented in Section I *Low Energy Antiproton Physics* Dieter Grzonka,2005-11-15 This conference brought together about 150 physicists and covered the entire field of research with antiprotons from atomic physics at low energies to hadronic reactions at high energies The conference demonstrated that this field is evolving with new physics being studied at existing and planned facilities **Low Energy Antiproton Physics** C. Cicalo,1999 Low Energy Antiproton Physics Dieter Grzonka,2005 **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 **Physics with Antiprotons at LEAR in the ACOL Era** Ugo Gastaldi,1985 Handbook of Nuclear Physics Isao Tanihata,Hiroshi Toki,Toshitaka Kajino,2023-09-04 This handbook is a comprehensive systematic source of modern nuclear physics It aims to summarize experimental and theoretical discoveries and an understanding of unstable nuclei and their exotic structures which were opened up by the development of radioactive ion RI beam in the late 1980s The handbook comprises three major parts In the first part the experiments and measured facts are well organized and reviewed The second part summarizes recognized theories to explain the experimental facts introduced in the first part Reflecting recent synergistic progress involving both experiment and theory the chapters both parts are mutually related The last part focuses on cosmo nuclear physics one of the mainstream subjects in modern nuclear physics Those comprehensive topics are presented concisely Supported by introductory reviews all chapters are designed to present their topics in a manner accessible to readers at the graduate level The book therefore serves as a valuable source for beginners as well helping them to learn modern nuclear physics Hadron Physics T. Bressani,A. Filippi,U. Wiedner,2005-07-29 This volume of the International School of Physics Enrico Fermi is dedicated to Valerio Filippini He devoted his life to physics Valerio Filippini was born in Somma Lombardo Milano on December 8 1958 He obtained the Master Degree in Physics at the University of Pavia in 1982 cum laude After a working parenthesis at an industrial firm he became Research Physicist of INFN Sezione di Pavia in 1988 and was promoted Senior Research Physicist in 1993 He participated to the experiments PS 179 TOFRADUPP and PS 201 Obelix at LEAR CERN FINUDA at LNF and ATHENA at AD CERN His outstanding scientific contributions were provided in the OBELIX and FINUDA experiments Nobody could compete with Filippini in exploiting at best the daily evoluting performances of the computing tools for the needs of the experiments both for on line and off line purposes The FINUDA experiment collected physics data immediately after the roll in thanks to the reliability and simplicity of the on line system designed and assembled by the physicist However he was not only a Clavier Physicist but a complete Scientist he also leaded the Pavia Group in designing and providing advanced detectors and in developing mathematical methods for the analysis of the data His scientific contributions are documented by

about 90 publications on refereed international journals about 100 contributions to International Conferences and Workshops and 3 invited talks *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 Phys ics 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 The Long-Lasting Quest for Nuclear Interactions: The Past, the Present and the Future Laura Elisa Marcucci,2021-01-05 *Low Energy Antiproton Physics* Dieter Grzonka,2005 **First Biennial Conference on Low Energy Antiproton Physics, Manne Siegbahn Institute, Stockholm, Sweden, 2-6 July 1990** Per Carlson,1991

Physics with Ultra Slow Antiproton Beams Yasunori Yamazaki,Michiharu Wada,2005-11-02 Fifty years have passed since the discovery of antiprotons in 1955 An extremely diverse range of research topics has developed since then which involves antiproton science with a large number of cold antiprotons and ultra slow antiproton beams This workshop discussed the latest topics on ultra slow antiproton beams ranging from fundamental questions about CPT symmetry and gravitation to the structure of exotic nuclei atomic collisions and atomic physics involving antihydrogen atoms **Fundamental Symmetries** P. Bloch,P. Pavlopoulos,R. Klapisch,2012-12-06 The first 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 September 26 to October 3 1986 The purpose of this School is to review the physics accessible to experiments using low energy antiprotons in view of the new era of the CERN LEAR ring opened by the upgrade of the antiproton source at CERN ACOL In 1986 the first course covered topics related to fundamental symmetries These Proceedings contain both the tutorial lectures and the various contributions presented during the School by the participants The con tributions have been organized in six sections The first section is devoted to gravitation a particularly hot topic in view of recent speculations about deviations from Newton s and Einstein s theories Section II covers various problems related to the matter antimatter symmetries such as comparison of the proton and antiproton inertial masses or spectroscopy of antihydrogen or other antiprotonic atoms CP and CPT violations in weak interaction are presented in Section III The test of symmetries in atomic physics experiments and the strong CP

problem are covered in Section IV Section V groups contributions related to high prec s on measurements of simple systems like protonium muonium or the anomalous moment of the muon The last section is devoted to the experimental challenge of polar izing antiproton beams *Handbook of Accelerator Physics and Engineering* Alexander Wu Chao,Karl Hubert Mess,2013 Edited by internationally recognized authorities in the field this expanded and updated new edition of the bestselling Handbook containing more than 100 new articles is aimed at the design and operation of modern particle accelerators It is intended as a vade mecum for professional engineers and physicists engaged in these subjects With a collection of more than 2000 equations 300 illustrations and 500 graphs and tables here one will find in addition to the common formulae of previous compilations hard to find specialized formulae recipes and material data pooled from the lifetime experience of many of the world s most able practitioners of the art and science of accelerators The eight chapters include both theoretical and practical matters as well as an extensive glossary of accelerator types Chapters on beam dynamics and electromagnetic and nuclear interactions deal with linear and nonlinear single particle and collective effects including spin motion beam environment beam beam beam electron beam ion and intrabeam interactions The impedance concept and related calculations are dealt with at length as are the instabilities associated with the various interactions mentioned A chapter on operational considerations includes discussions on the assessment and correction of orbit and optics errors real time feedbacks generation of short photon pulses bunch compression tuning of normal and superconducting linacs energy recovery linacs free electron lasers cooling space charge compensation brightness of light sources collider luminosity optimization and collision schemes Chapters on mechanical and electrical considerations present material data and important aspects of component design including heat transfer and refrigeration Hardware systems for particle sources feedback systems confinement and acceleration both normal conducting and superconducting receive detailed treatment in a subsystems chapter beam measurement techniques and apparatus being treated therein as well The closing chapter gives data and methods for radiation protection computations as well as much data on radiation damage to various materials and devices A detailed name and subject index is provided together with reliable references to the literature where the most detailed information available on all subjects treated can be found Antiproton-Nucleon and Antiproton-Nucleus Interactions F. Bradamante,J.M. Richard,R. Klapisch,2013-03-12 The third 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 10 to 18 June 1988 The School is dedicated to physics accessible to experiments using low energy antiprotons especially in view of operation of the LEAR facility at CERN with the upgraded antiproton source AAC Antiproton Accumulator AA and Antiproton Collector ACOL The first course in 1986 covered topics related to fundamental symmetries the second course in 1987 focused on spectroscopy of light and heavy quarks This book con tains the Proceedings of the third course devoted to the experimental and theoretical aspects of the interaction of antinucleons with nucleons and nuclei The Proceedings contain both the tutorial

lectures and contributions presented by participants during the School The papers are organized in several sections The first section deals with the theoretical aspects of NN scattering and annihilation and the underlying QCD The experimental techniques and results concerning NN scattering are contained in Section II Section III contains theoretical reviews and contributions on anti proton nucleus scattering and bound states Section IV is devoted to the experimental results on the antiproton nucleus systems and their phenomenological analysis Finally some possible developments of the antiproton machines are presented Physics With High-intensity Hadron Accelerators - Proceedings Of The 18th Ins International Symposium T Nomura,Shigeru Kubono,1990-12-14 This book contains the proceedings of the 10th Hellenic Relativity Conference held in Greece in 2002 It includes several plenary lectures given by leading experts on brane world cosmology radiative space times detection of gravitational waves gamma ray bursts and quantum gravity There are a large number of contributed papers organized into three broad subject areas cosmology and brane gravity mathematical relativity and astrophysical relativity and the detection of gravitational waves Scientific and Technical Aerospace Reports ,1995 Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database

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Low Energy Antiproton Physics Introduction

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