EXA2011

Report of Contributions

Contribution ID: **0** Type: **not specified**

Registration

Monday, 5 September 2011 08:30 (1 hour)

Contribution ID: **1** Type: **not specified**

Opening of the Conference

Monday, 5 September 2011 09:30 (30 minutes)

Presenter: Prof. WIDMANN, Eberhard (Stefan Meyer Institute)

Contribution ID: **2** Type: **not specified**

Closing of the Conference

Friday, 9 September 2011 15:20 (10 minutes)

Primary author: Dr MARTON, Johann (Stefan Meyer Institute)

Presenter: Prof. WIDMANN, Eberhard (Stefan Meyer Institute)

Session Classification: Contributions III

Contribution ID: **4** Type: **Poster**

Preliminary results of a new study for the missing-mass spectra from reactions C(p, K0(short)) and C(p, Lambda) at 10 GeV / c.

Tuesday, 6 September 2011 16:45 (20 minutes)

A missing-mass spectra has been studied for the different channel of reactions as: 'p' (p,K^0_s), C (p,K^0_s), 'p'(p,pK^0_s), C(p,pK^0_s) , 'p'(p, Λ), C(p, Λ),'p'(p, K^+)Λ, C(p,K^+)Λ and so on. There are statistically small peaks (3-4 S.D.) which are observed by this method on mass range of K^0(498), Λ(1520), ϕ(1020), Σ (2040), ^3H, ^4He and so on. A good test of the method is observed the well known resonances for Σ^+(1385) and K^{*+}(890). Statistically significant peaks were identified from reactions C(p,pK^0_s) and p (p, Λ)$\pi^-\gamma$ over a mass range of 11.36 (7.3 S.D.) and 3.2 GeV/c^2 (6. S.D.), which were interpreted as hyper-nucleus ^{12}B and (K^-ppn) state predicted from kaon cluster model.

Primary author: Dr ASLANYAN, Petros (Joint Institute for Nuclear Research LHEP)

Presenter: Dr ASLANYAN, Petros (Joint Institute for Nuclear Research LHEP)

Session Classification: Poster Session

Track Classification: Strangeness in Matter

Contribution ID: **5** Type: **Poster**

The efficiency of STS-CBM-ROOT for reconstructions of Lambda and Sigma+(1385) hyperons from the experimental and the UrQMD data in p+C reaction at 10 GeV/c

Tuesday, 6 September 2011 16:45 (20 minutes)

This experimental data for events with Λ hyperons in p+C reaction at 10 GeV/c is compared to the UrQMD model as a first step that there will be one of basis for study of multi strange hyperons and exotica productions with high statistics in heavy nucleus collisions . The experimental data with Λ hyperons was used as generator for GEANT - STS-ROOT what have been obtained on base of stereo photo from the 2-m propane bubble chamber with 4π geometry for p + C reaction at momentum 10 GeV /c . By using of the STS-ROOT software for CBM (FAIR) with this experimental data we obtained efficiencies of reconstruction for Λ and $\Sigma^{*+}(1385) hyperons. The experimental data was compared with the UrQ$
$2 GeV/c$(p_min= $0.6 GeV/c) and$Z_v$<4 cm . These analysis will allow to develop of new criteria, trigger ,methods and algorithms for effective study of exotic resonances and CBM properties with strangeness .

Primary author: Dr ASLANYAN, Petros (Joint Institute for Nuclear Research LHEP)

Co-authors: Mr KRYSHEN, Evgeny (GSI); Dr VASILIEV, Iouri (GSI); Dr FRIESE, Volker (GSI)

Presenter: Dr ASLANYAN, Petros (Joint Institute for Nuclear Research LHEP)

Session Classification: Poster Session

Track Classification: Instrumentation

Contribution ID: **6** Type: **Oral Presentation**

History and Overview

Monday, 5 September 2011 10:00 (30 minutes)

Primary author: Prof. HAYANO, Ryugo S. (The University of Tokyo)

Presenter: Prof. HAYANO, Ryugo S. (The University of Tokyo)

Session Classification: 20 Years of Antiprotonic Helium

Contribution ID: **19** Type: **Oral Presentation**

Physics with Highly Charged Ions

Monday, 5 September 2011 17:25 (30 minutes)

The future international accelerator Facility for Antiproton and Ion Research (FAIR) encompasses 4 scientific pillars containing, at this time, 14 approved technical proposals worked out by more than 2000 scientists from all over the world. They offer a wide range of new and challenging opportunities for atomic physics research in the realm of highly-charged heavy ions and exotic nuclei. As one of the backbones of the Atomic, Plasma Physics and Applications (APPA) pillar, the Stored Particle Atomic Physics Research Collaboration (SPARC) has organized tasks and activities in various working groups for which we will present a concise survey on their current status.
The new project is promising the highest intensities for relativistic beams of stable and unstable heavy nuclei, combined with the strongest available electromagnetic fields, for a broad range of experiments. This will then allow the extension of atomic-physics research across virtually the full range of atomic matter, i.e. concerning the accessible ionic charge states as well as beam energies. For atomic physics (AP), one of the major research fields served by FAIR, the scientific program and the R&D projects at the current ESR and the future NESR storage rings will concentrate on two central research areas: correlated electron dynamics including production of electron-positron pairs in strong ultra-short electromagnetic fields and fundamental interactions between electrons and heavy nuclei – in particular the interactions described by Quantum Electrodynamics, QED. It is further considered to use atomic physics techniques to determine properties of stable and unstable nuclei and to perform tests of predictions of fundamental theories besides QED.
In order to reach the desired physics objectives, a large number of diverse experimental installations will be available, each equipped with novel and sophisticated instrumentation. Within the SPARC collaboration the atomic physics community has formed twelve experimental and one theoretical working groups to advance the development and construction of the project.

Primary author: STÖHLKER, Thomas (GSI and HI Jena)

Presenter: STÖHLKER, Thomas (GSI and HI Jena)

Session Classification: Exotic Atoms and Atomic Physics

Contribution ID: **20** Type: **Oral Presentation**

FLAIR

Monday, 5 September 2011 18:15 (20 minutes)

Primary author: Dr QUINT, Wolfgang (GSI)

Presenter: Dr QUINT, Wolfgang (GSI)

Session Classification: Exotic Atoms and Atomic Physics

Contribution ID: **21** Type: **Oral Presentation**

Confinement of antihydrogen for 1000 seconds (ALPHA Experiment)

Monday, 5 September 2011 14:00 (30 minutes)

Atoms made of a particle and an antiparticle are unstable, usually surviving less than a microsecond. Antihydrogen, made entirely of antiparticles, is believed to be stable, and it is this longevity that holds the promise of precision studies of matter-antimatter symmetry. We have recently demonstrated trapping of antihydrogen atoms by releasing them after a confinement time of 172 ms [1]. A critical question for future studies is: how long can anti-atoms be trapped? Here we report the observation of anti-atom confinement for 1000 s, extending our earlier results by nearly four orders of magnitude [2]. Our calculations indicate that most of the trapped anti-atoms reach the ground state. Further, we report the first measurement of the energy distribution of trapped antihydrogen which, coupled with detailed comparisons with simulations, provides a key tool for the systematic investigation of trapping dynamics. These advances open up a range of experimental possibilities, including precision studies of CPT symmetry and cooling to temperatures where gravitational effects could become apparent.

[1] G. Andresen et al. (ALPHA Collaboration), Nature (London) 468, 673 (2010).

[2] G. Andresen et al. (ALPHA Collaboration), Nature Physics (London) 7, 558 (2011) [arXiv:1104.4982].

Primary author: Prof. FUJIWARA, Makoto C. (TRIUMF/Universityof Calgary)

Presenter: Prof. FUJIWARA, Makoto C. (TRIUMF/Universityof Calgary)

Session Classification: Antihydrogen

Contribution ID: **23** Type: **Oral Presentation**

Producing Colder Antihydrogen

Monday, 5 September 2011 14:30 (30 minutes)

ATRAP continues to pursue the idea, enunciated back in 1987, to trap enough cold antihydrogen atoms for precise spectroscopic comparisons of antihydrogen and hydrogen atoms. Embedded electron cooling and adiabatic cooling methods have been developed to cool millions of antiprotons to
below 3 K, to facilitate the production of cold antihydrogen.

Primary author: Prof. GABRIELSE, Gerald (Harvard University)

Presenter: Prof. GABRIELSE, Gerald (Harvard University)

Session Classification: Antihydrogen

Track Classification: Antihydrogen

Contribution ID: **26** Type: **Oral Presentation**

New Experiments in Neutron Physics

Tuesday, 6 September 2011 09:00 (35 minutes)

Primary author: ABELE, Hartmut (Vienna University of Technology)

Presenter: ABELE, Hartmut (Vienna University of Technology)

Session Classification: Precision Experiments I

Track Classification: Precision Experiments

Contribution ID: **29** Type: **Oral Presentation**

g-2 of the Muon

Tuesday, 6 September 2011 11:00 (30 minutes)

Primary author: JUNGMANN, Klaus (KVI Groningen)

Presenter: JUNGMANN, Klaus (KVI Groningen)

Session Classification: Precision Experiments II

Track Classification: Precision Experiments

Contribution ID: **30** Type: **Oral Presentation**

Quantum Vacuum Magnetic Birefringence

Tuesday, 6 September 2011 09:35 (35 minutes)

The measurement of quantum vacuum magnetic birefringence is one of the ultimate experimental tests of Quantum electrodynamics. After a brief introduction to the theoretical aspects, I will present the status of the BMV (Birefringence Magnétique du Vide) experiment which is set up at the Toulouse High Magnetic Field Laboratory.
Such novel attempt to search for the effect of magnetic fields on the propagation of photons in vacuum is based on very intense pulsed magnetic fields and a very sharp optical Fabry-Perot cavity to increase the optical path in the magnetic field region. Our last results show a sensitivity better than 10^-19 T^_-2 /sqrt(Hz), which is the best ever achieved as far as magnetic birefringence is concerned.

Primary author: Prof. RIZZO, Carlo (Université Paul Sabatier, Toulouse, France)

Presenter: Prof. RIZZO, Carlo (Université Paul Sabatier, Toulouse, France)

Session Classification: Precision Experiments I

Contribution ID: **31** Type: **Oral Presentation**

The TRIμP Facility

Friday, 9 September 2011 11:30 (20 minutes)

Primary author: Dr WILLMANN, Lorenz (KVI, University of Groningen)

Presenter: Dr WILLMANN, Lorenz (KVI, University of Groningen)

Session Classification: Facilities and Experiments II

Track Classification: Instrumentation

Contribution ID: **39** Type: **Oral Presentation**

Strangeness Physics at SIS

Wednesday, 7 September 2011 12:10 (20 minutes)

Primary author: FABBIETTI, Laura (TUM)

Presenter: FABBIETTI, Laura (TUM)

Session Classification: Strangeness in Matter II

Contribution ID: **46** Type: **Oral Presentation**

Theory of kaonic deuterium in view of SIDDHARTA

Thursday, 8 September 2011 11:15 (30 minutes)

I analyse the impact of the recent measurement of kaonic hydrogen X rays by the SIDDHARTA collaboration on the allowed ranges for the kaon-deuteron scattering length in the framework of non-relativistic effective field theory.

Primary author: MEISSNER, Ulf-G. (University of Bonn)

Presenter: MEISSNER, Ulf-G. (University of Bonn)

Session Classification: Hadron Physics II

Contribution ID: **52** Type: **Oral Presentation**

Antiprotons at CERN

Friday, 9 September 2011 11:00 (30 minutes)

During more than 10 years of regular operation, CERN's Antiproton Decelerator (AD) has supplied the successful physics program with low-energy antiproton beams at 5.3 MeV kinetic energy. For the medium and long-term future, several options exist for upgrades and consolidation of the facility as well as for extension of the physics program. One of these, the recently approved ELENA ring, is a small post-decelerator to be installed in the existing AD building. ELENA will bring the antiproton energy down to around 100keV and with the help of the built-in electron cooler greatly increase beam density and intensity thereby increasing the number of trapped antiprotons by up to two orders of magnitude.

Primary author: Mr ERIKSSON, Tommy (CERN)

Presenter: Mr ERIKSSON, Tommy (CERN)

Session Classification: Facilities and Experiments II

Contribution ID: **53** Type: **Oral Presentation**

The Facility for Antiproton and Ion Research

Thursday, 8 September 2011 17:20 (30 minutes)

Primary author: Prof. ROSNER, Günther (FAIR)

Presenter: Prof. ROSNER, Günther (FAIR)

Session Classification: Symposium ”Creativity-Innovation - the Seed for Frontier Science”

Track Classification: Facilities and Experiments

Contribution ID: **56** Type: **Oral Presentation**

Future directions in kaonic atom physics

Tuesday, 6 September 2011 14:30 (30 minutes)

A brief summary of state-of-the-art analyses of kaonic atom data will be presented, showing good consistency between the various experiments of 30-40 years ago. Correlations between depths of real antikaon-nucleus potentials and the corresponding radii provide a link between phenomenology and 'microscopic' antikaon-nucleon interaction in the nuclear medium. Further studies of the latter hold promise to enhance our understanding of two- and many-nucleon absorption processes. Time is ripe also for additional studies of possible p-wave contributions to kaonic atoms. The merit of new experiments will also be discussed.

Primary author: Prof. FRIEDMAN, Eliahu (Racah Institute of Physics, the Hebrew University)

Presenter: Prof. FRIEDMAN, Eliahu (Racah Institute of Physics, the Hebrew University)

Session Classification: Kaonic Atoms

Track Classification: Kaonic Atoms

Contribution ID: **57** Type: **Oral Presentation**

Hypernuclear Physics at PANDA

Thursday, 8 September 2011 11:45 (20 minutes)

Hypernuclear research will be one of the main topics addressed by the PANDA experiment at the planned Facility for Antiproton and Ion Research FAIR at Darmstadt, Germany. A copious production of double Lambda-hypernuclei at a dedicated internal target in the stored antiproton beam is expected, which will enable the high-precision gamma-spectroscopy of double strange systems for the first time.
In addition to the general purpose PANDA setup, the hypernuclear experiments require an active secondary target of alternating silicon and absorber material layers and high purity germanium (HPGe) detectors. The design of the setup and the development of these detectors is progressing: a first HPGe crystal with a new electromechanical cooling system was prepared as a prototype gamma-detector and the properties of a silicon strip detector for use in the secondary target were studied.
Simultaneously to the hardware projects, detailed Monte Carlo simulations were performed to predict the yield of particle stable hypernuclei, and a procedure for double hypernuclei identification by their decay particle detection was developed.

Primary author: Dr ACHENBACH, Patrick (KPH, University of Mainz)

Presenter: Dr ACHENBACH, Patrick (KPH, University of Mainz)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **58** Type: **Oral Presentation**

A new facility for fundamental physics: the high-intensity ultracold neutron source at the Paul Scherrer Institute

Friday, 9 September 2011 11:50 (20 minutes)

on behalf of the UCN Project Team

The first ultracold neutrons (UCN) have been produced at the Paul Scherrer Institute's (PSI) new UCN source in December 2010. The design goal is to exceed the currently available UCN densities by a factor 50 to 100 and to use these neutrons for fundamental physics experiments, most prominently the search for a neutron electric dipole moment (nEDM) or the precise determination of the lifetime of the free neutron.
The PSI UCN source is based on neutron production via spallation of 590 MeV protons on lead, followed by neutron thermalization in heavy water and subsequent cooling in a solid deuterium crystal to cold and finally ultracold neutron energies below about 300 nano-eV.
Central to UCN production at PSI are: Using the full 1.3 MegaWatt proton beam for optimal neutron production; Growing and maintaining of a suitable (ortho-) deuterium crystal for the superthermal UCN production at a temperature of 5 K in immediate vicinity of the spallation target; Low-loss storage and efficient guiding of the UCN from production to 3 experimental areas over several meters through the radiation shield.
The authorities' approval for full facility operation is now expected for June 2011. The full installation is being prepared for UCN production and performance optimization. The setup of the nEDM apparatus was finished and the experiment is awaiting data taking with UCN.
An overview of the completed UCN source and the first measurements of ultracold neutrons at this new facility will be presented.

Primary author: Dr LAUSS, Bernhard (Paul Scherrer Institute)

Presenter: Dr LAUSS, Bernhard (Paul Scherrer Institute)

Session Classification: Facilities and Experiments II

Track Classification: Facilities and Experiments

Contribution ID: **59** Type: **Oral Presentation**

Strangeness Physics at JLab

Wednesday, 7 September 2011 09:00 (30 minutes)

Lambda hypernucleus which contains s-quark in addition to normal u, d-quarks, is a powerful tool to study baryon interaction and structure of deep inside of nucleus.
In 80-90s, experiments of Lambda hypernuclei with meson beams were intensively performed at BNL and KEK.
Thanks to a high quality electron beam at JLab CEBAF, the study of hypernuclei with an electron beam started in 2000. This pilot experiment proved that it is possible to use electron beam to study hypernuclei, but many experimental challenges should be overcome to explore full potential of this method.
In this decade, many experimental improvements have been introduced and hypernuclear spectroscopy by the (e,e'K+) reaction is now established at JLab.
I will overview a brief history of the hypernuclear study at JLab and give a prospect of future plans.

Primary author: Prof. NAKAMURA, Satoshi N. (Tohoku Univ.)

Presenter: Prof. NAKAMURA, Satoshi N. (Tohoku Univ.)

Session Classification: Strangeness in Matter I

Track Classification: Strangeness in Matter

Contribution ID: **65** Type: **Oral Presentation**

A Double Kaonic Nuclear System, Kbar Kbar NN, to be formed in pp colisions

Wednesday, 7 September 2011 15:40 (20 minutes)

We have presented the idea that the simplest double-K nuclear cluster,K^-K^-pp, can be produced in the p+p −>K^+ +K^+ +Λ+Λ −>K^+ + K^+ + K^-K^-pp reaction, where Λ* is a quasi-bound K^-p state corresponding to Λ(1405). We have calculated the differential cross section for this process and found out that helped by a very large momentum transfer Q~ 1.8 GeV/c, a peak of K^-K^-pp cluster dominates in the mass spectrum when the cluster is a deeply bound and dense system. The incident proton energy for this process is around 7 GeV and increasing this energy enhances the cross section. We also found that the more bound system forms a more compact structure, and has a larger population. The K^- -K^- repulsion inside K^-K^-pp gives only a small change on the bound structure and the cross section.

Primary author: HASSANVAND, Maryam (Isfahan University of Technology; RIKEN Nishina Center)

Co-authors: YAMAZAKI, Toshimitsu (RIKEN Nishina Center, Wako, Saitama 351-0198, Japan); Prof. AKAISHI, Yoshinori (RIKEN Nishina Center, Wako, Saitama 351-0198, Japan)

Presenter: HASSANVAND, Maryam (Isfahan University of Technology; RIKEN Nishina Center)

Session Classification: Contributions II

Track Classification: Strangeness in Matter

Contribution ID: **67** Type: **Poster**

New veto detector for the pion beam at FOPI.

Tuesday, 6 September 2011 16:45 (20 minutes)

The aim of the current experiment is to study the K^+ K^- system in medium properties by using the π^- (1.7 GeV/c)+A⟶K^+ K^-+X reaction. The experiment with a pion beam poses specific requirements to the detectors and therefore the original FOPI setup needed modifications. The new hardware developments for this experiment include a new design of the veto detector. The main function of the veto detector is to exclude the off-axis particles. When charged particles penetrated off beam-axis it gives a veto to the data acquisition. The veto detector is located close to the target, where a strong magnetic field is produced by the solenoid (0.6 Tesla) [1]. The detector consists of 4 scintillators and forms together a disk-like structure with an external diameter of ~ 8 cm. Internally it confines the cross-section of the fiducial target volume to a circle with a diameter of 3 cm. For the readout the MPPC (S10931-100P) [2] were used. Advantages like the magnetic field insensitivity and the high gain in addition to the lower bias voltage make the MPPC an excellent choice to replace PMT. Within this report we describe the design and the pion beam test of the prototype veto detector system.

Primary author: AHMED, Gamal (Stefan Meyer Institute and Al-Azhar University Cairo)

Co-authors: MARTON, Johann (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); ZMESKAL, Johann (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); SUZUKI, Ken (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); GRUBER, Lukas (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); HARTMANN, Olaf (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); BÜHLER, Paul (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.); BRUNNER, Stefan (Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences,Vienna, Austria.)

Presenter: AHMED, Gamal (Stefan Meyer Institute and Al-Azhar University Cairo)

Session Classification: Poster Session

Track Classification: Instrumentation

Contribution ID: **68** Type: **Poster**

New data on production of element 115 isotopes in the reaction (Am-243)+(Ca-48)

Tuesday, 6 September 2011 16:45 (20 minutes)

Within the framework of the program of synthesis and study of the properties of the new elements a series of experiments were performed to produce the elements with odd atomic numbers 115 and 117 using of the Dubna gas-filled recoil separator.
First run was undertaken in 2003. In the reaction of the actinide target Am-243 and Ca-48 beam the two new elements with Z = 113 and 115 were produced for the first time. Three similar decay chains corresponding to the 3n-evaporation channel were observed. Each of them consists of five consecutive alpha decays and is terminated by spontaneous fission (SF) with a high energy release. A single differing shorter-lived decay chain of sequential alpha decays and terminated also by high-energy spontaneous fission corresponding to the 4n-evaporation channel was registered. The decay properties of the eleven new alpha- and SF-decaying nuclei observed in this experiment are consistent with expectations for consecutive decays originating from the parent isotopes 115-288 and 115-287.
Support for the assignment of the atomic numbers of all of the nuclei in the 115-288 decay chain was obtained in independent experiments performed in 2004 and 2005 in which a long-lived spontaneous fission activity, Db-268, was found to be chemically consistent with the fifth group of the periodic table.
Next bombardment with the purpose of synthesizing a new 117 element was made in 2009. The isotopes 117-293 and 117-294 were produced in fusion reactions between Ca-48 and Bk-249. Decay chains involving 11 new nuclei were identified.
The initially produced in these reactions isotopes of the elements 115 and 117 undergo alpha decay and are progenitors of genetically linked descendant alpha-decay products chains terminated by spontaneously fissioning isotopes of Db and Rg. Thus, 22 new isotopes were observed in these reactions. All of them can be grouped and characterized by four different (N-Z) values of 57, 58, 59 and 60. In the reaction Am-243 with Ca-48 two group decay chains were observed with (N-Z) equal to 57 and 58 that correspond to the 4n- and 3n-evaporation channels respectively. Other two decay chains with (N-Z) = 59 and 60 were observed in the reaction Bk-249 and Ca-48; these correspond to the 4n- and 3n-evaporation channels. Thus no overlapping chains and no coinciding nuclides were registered in these different reactions.
New set of experiments aimed at the synthesis and investigation of decay properties of the element 115 isotopes and their descendant alpha-decay products were performed in the period from October of 2010 up to and including March of 2011. The numbers of decay chains of the 3n-evaporation product and corresponding to (N-Z) = 58, the isotope 115-288, observed at the three Ca-48 energies (248, 243 and 240 MeV in the center of the target layer) were three, six, and twelve, respectively. Radioactive properties of nuclei in these decay chains originating from 115-288 are in full agreement with the data measured for them in the previous experiment performed in 2003.
In addition to twelve decay chains of parent nucleus 115-288 observed at the lowest projectile energy a decay chain of the 2n-evaporation product, isotope 115-289, was produced for the first time in this reaction. Decay properties of nuclei 115-289 (Ealpha=10.38+/-0.06 MeV, t=0.26 s), 113-285 (Ealpha=9.89+/-0.06 MeV, t=1.4 s), and Rg-281 (tSF=2.0 s) were measured to be in agreement with those previously determined for all these three isotopes in the experiment on the synthesis of element 117 in the reaction (Bk-249) + (Ca-48) = (117-293) + 4n where the isotope 115-289 was

observed after alpha decay of the parent nucleus 117-293. Thus, in this experiment two transformation chains with (N-Z) equal 58 and 59 were observed that sews tightly together all previous experiments. The nuclide 115-289 was produced in two cross bombardments that, together with the other assignment criteria accepted by IUPAC, such as radioactive properties, excitation function of the reaction and chemical identification of Db-268, provides an extra proof of discovery of elements 113, 115, and 117.

Primary author: Dr ABDULLIN, Farid (JINR Dubna)

Presenter: Dr ABDULLIN, Farid (JINR Dubna)

Session Classification: Poster Session

Contribution ID: **70** Type: **Oral Presentation**

Energy Level Displacement of Excited np State of Kaonic Deuterium In Faddeev Equation Approach

Tuesday, 6 September 2011 16:30 (15 minutes)

The energy level displacement of the excited np state
of kaonic deuterium is calculated in terms of the P-wave scattering length
of K^-d scattering. We solve the Faddeev equations for the amplitude of
K^-d scattering in the fixed centre approximation and derive the complex
P-wave scattering length of K^-d scattering in terms of
the S-wave and P-wave scattering lengths of anti-KN
scattering, which are calculated within SU(3) coupled-channel approach and
chiral Lagrangians with derivative meson-baryon couplings invariant under
chiral SU(3)xSU(3) symmetry. For the calculated width
Gamma_(2p) = 10.203 meV of the excited 2p state of kaonic
deuterium we obtain the yield Y_(K^-d) = 0.27% of X-rays for the K_(alpha)
emission line of kaonic deuterium.The obtained results can be used for the planning
of experiments on the measurements of the energy level displacement of the ground state of
kaonic deuterium, caused by strong low-energy interactions.

Primary author: Prof. IVANOV, Andrei (Atominstitut, TU Wien)

Co-authors: Prof. MARTON, Johann (SMI, Wien); Prof. FABER, Manfried (TU Wien,); Dr PITSCHMANN, Mario (University of Wisconsin-Madison); Prof. FAIFMAN, Mark (Kurchatov Institute, Moscow); Prof. TROITSKAYA, Natalia (State Polytechnic University of St. Petersburg)

Presenter: Prof. IVANOV, Andrei (Atominstitut, TU Wien)

Session Classification: Kaonic Atoms

Track Classification: Kaonic Atoms

Contribution ID: **71** Type: **Oral Presentation**

Microwave Spectroscopy of the Antiprotonic He-3 Hyperfine Structure

Monday, 5 September 2011 12:00 (20 minutes)

Antiprotonic helium is a neutral exotic atom, consisting of a helium nucleus, an electron and an antiproton. The interactions of the angular momenta and spins of these constituents cause a splitting within the principle states. The spin magnetic moment of the antiproton can be determined by comparing the measured hyperfine transition frequencies with three-body quantum electrodynamics (QED) calculations.
In 2009, for the first time these measurements were carried out with a state of antiprotonic He-3. Due to the helium nuclear spin, antiprotonic He-3 has a more complex hyperfine structure than antiprotonic He-4. Thus a comparison between theoretical calculations and the experimental results will provide a more stringent test of the theory. Two out of four super-super-hyperfine (SSHF) transition lines of the (n,L)=(36,34) state were observed. The measured frequencies of the individual transitions were in agreement with the current theoretical values within their estimated errors. The frequency difference between the two measured transitions also agrees with theoretical calculations. However, the experimental error for this difference which is crucial to be determined due to its proportionality to the antiproton magnetic moment is still very large compared to theory. Further measurements shall improve the statistics and thus reduce this discrepancy.

References:
S. Friedreich et al., Phys. Lett. B, 700 (2011) 1.
T. Pask et al., Phys. Lett. B, 678 (2009) 6.

Primary author: Ms FRIEDREICH, Susanne (SMI Vienna)

Co-authors: Mr DAX, Andreas (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan); Ms S\'OT\'ER, Anna (Max-Planck-Institut f\"{u}r Quantenoptik, Hans-Kopfermann-Strasse 1, D-85748 Garching, Germany); Mr JUH\'ASZ, Bertalan (Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Boltzmanngasse 3, A-1090 Vienna, Austria); Mr BARNA, D\'aniel (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan; KFKI Research Institute for Particle and Nuclear Physics, H-1525 Budapest, PO Box 49, Hungary); Mr HORV\'ATH, Desz\"o (KFKI Research Institute for Particle and Nuclear Physics, H-1525 Budapest, PO Box 49, Hungary; Institute of Nuclear Research of the Hungarian Academy of Sciences, H-4001 Debrecen, PO Box 51, Hungary); Mr WIDMANN, Eberhard (Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Boltzmanngasse 3, A-1090 Vienna, Austria); Mr CASPERS, Fritz (CERN, CH-1211 Geneva, Switzerland); Mr ZMESKAL, Johann (Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Boltzmanngasse 3, A-1090 Vienna, Austria); Mr TODOROKI, Koichi (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan); Mr HORI, Masaki (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan; Max-Planck-Institut f\"{u}r Quantenoptik, Hans-Kopfermann-Strasse 1, D-85748 Garching, Germany); Mr MASSICZEK, Oswald (Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Boltzmanngasse 3, A-1090 Vienna, Austria); Mr HAYANO, Ryugo (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan); Mr KOBAYASHI, Takumi (Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan)

Presenter: Ms FRIEDREICH, Susanne (SMI Vienna)

Session Classification: 20 Years of Antiprotonic Helium

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **72** Type: **Poster**

Induced Absorption and Annihilation in Hadronic Hydrogen Atoms

Tuesday, 6 September 2011 16:45 (20 minutes)

The lightest hadronic atoms ($\pi^- p$, $K^- p$, etc.) are of particular interest among the exotic atoms due to their simplest structure and unique possibility to give access to the fundamental properties of hadron-nucleon interaction at threshold energy. The essential distinction of hadronic atoms as compared with muonic hydrogen is a complex energy shift in the low angular-momentum states due to strong hadron-nucleon interaction. The corresponding states of hadronic atoms are unstable (non-stationary) and cannot be treated as normal asymptotic states of the scattering problem. The strong coupling between stable and unstable states leads to the induced absorption in the collisions of hadronic atoms with ordinary ones.

In this paper, we study the elastic scattering, Stark transitions, Coulomb de-excitation, and induced absorption or annihilation in the collisions of the hadronic hydrogen atoms in the excited states with ordinary hydrogen in the ground state. These processes have been described in a self-consistent manner in the framework of the close-coupling approach. The approach was generalized to include both the open (for pionic hydrogen) and closed (for kaonic and antiprotonic hydrogen) channels corresponding to non-stationary states. We have investigated the dependence of the collisional cross sections on the width of the non-stationary states in a wide range of its values.

For the first time the integral cross sections of the induced absorption, elastic scattering, and Stark transitions have been calculated for the excited states of pionic, kaonic and antiprotonic hydrogen atoms with the values of the principal quantum number $n = 2 - 8$ in a wide energy range including the cross sections of the induced absorption in kaonic and antiprotonic hydrogen below the corresponding ns thresholds. The present results are very important for the kinetics of atomic cascade in hadronic atoms.

This work has been partially supported by Russian Foundation for Basic Research (Grant No. 10-02-01096).

Primary author: Dr POMERANTSEV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Co-author: Dr POPOV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Presenter: Dr POMERANTSEV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Session Classification: Poster Session

Track Classification: Other exotic atoms and rare decays

Contribution ID: **73** Type: **Poster**

Direct Coulomb De-excitation as the Dominant Mechanism of Quenching the Metastable 2s-state of Muonic Hydrogen

Tuesday, 6 September 2011 16:45 (20 minutes)

The cross sections of the elastic, Stark and Coulomb de-excitation processes in the collisions of muonic hydrogen with hydrogen atom have been calculated in the close-coupling approach taking into account both the closed channels and vacuum polarization shifts of the ns states. In particular, the cross sections of the elastic $2s-2s$ scattering and Coulomb $2s-1s$ de-excitation below the $2p$ threshold which determine the destiny of a metastable $2s$ state in muonic hydrogen have been calculated for the first time. The convergence of the cross sections with increasing the number of the basis states has been investigated.

The obtained cross sections are used as the input data in the detailed studies of the atomic cascade kinetics. The new version of the extended standard cascade model taking into account the initial distributions in the quantum numbers and kinetic energy. In the wide density range a number of characteristics of the atomic cascade have been calculated and compared with the known experimental data: the relative yield of K_α-line, the arrival population of $2s$-state, the population of the $2s$ metastable fraction (i.e. muonic atom in $2s$-states with kinetic energy below $2p$ threshold), the yield of high-energy (0.9 keV) component of the $1s$ muonic hydrogen, and the lifetime of the metastable $2s$ fraction.

The results of the present study prove that the direct Coulomb de-excitation is the dominant mechanism of quenching the metastable $2s$ fraction. This mechanism quantitatively explains the formation of the hot $1s$ muonic hydrogen and leads to the perfect agreement of the calculated and experimental values for lifetime of the metastable $2s$ fraction.

This work has been partially supported by Russian Foundation for Basic Research (Grant No. 10-02-01096).

Primary author: Dr POPOV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Co-author: Dr POMERANTSEV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Presenter: Dr POPOV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Session Classification: Poster Session

Track Classification: Other exotic atoms and rare decays

Contribution ID: **74** Type: **Oral Presentation**

Kinetic Energy Distributions of Muonic and Pionic Hydrogen Atoms

Friday, 9 September 2011 14:20 (20 minutes)

The exotic hydrogen-like atoms are formed in a highly excited atomic states after slowing down and Coulomb capture of negatively charged particles (muon, pion, etc.) in hydrogen media. The further evolution of their initial distribution in quantum numbers and kinetic energy depends on the complicated interplay of the radiative transitions and collisional-induced processes during the so-called atomic cascade.

In this report we present the kinetic energy distributions of muonic and pionic hydrogen atom at the instant of the radiative transitions from np-states to the ground state or the charge-exchange reaction (in the case of pionic hydrogen). These distributions were calculated within the improved version of the extended cascade model at different values of the target density. In this model, we used the new differential and integral cross sections for collisional transitions between different atom states with the values of the principal quantum number $n = 2 - 12$ calculated in the framework of the close-coupling approach.

The initial n, l, E-distributions are taken into account and in this cascade model lead to a very good agreement with the experimental data at very low target density. The results of the present cascade calculations allow us for the first time to explain the observed kinetic energy distribution of pionic atoms at the instant of the pion charge-exchange reaction. In particular, our results explain the high-energy components around 105 eV and 209 eV (due to Coulomb transitions 5-3 and 3-2, respectively) and are in a very good agreement with the experimental weights of these components.

This work has been partially supported by Russian Foundation

for Basic Research (Grant No. 10-02-01096).

Primary author: Dr POPOV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Co-author: Dr POMERANTSEV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Presenter: Dr POPOV, Vladimir (Institute of Nuclear Physics, Moscow State University)

Session Classification: Contributions III

Track Classification: Other exotic atoms and rare decays

Contribution ID: **75** Type: **Oral Presentation**

Kaonic 3He and 4He X-ray measurements in SIDDHARTA

Tuesday, 6 September 2011 15:30 (20 minutes)

An energy shift of the 2p level of kaonic 3He and 4He atoms is recently studied in theory and experiment. A theory predicting deeply bound kaonic nuclear states estimates a significant energy shift in kaonic 3He or 4He. The SIDDHARTA experiment measured the kaonic 3He and 4He 3d-2p X-ray transitions at the DAFNE e+e- collider. The strong interaction shifts of the kaonic 3He and 4He 2p state were determined precisely. The world's first observation of kaonic 3He was performed. In addition, a possible isotope effect between 3He and 4He was obtained. In this talk, the results of kaonic 3He and 4He X-ray measurements in the SIDDHARTA experiment will be presented, as well as future plans.

Primary author: Dr ISHIWATARI, Tomoichi (SMI)

Presenter: Dr ISHIWATARI, Tomoichi (SMI)

Session Classification: Kaonic Atoms

Track Classification: Kaonic Atoms

Contribution ID: **77** Type: **Poster**

Total pbar He-3 and pbar He-4 cross sections at low and intermediate energies

The preparation of an intense beam of polarized antiprotons is
{\it the} crucial point for the physics program proposed by the PAX
collaboration [1] at the future FAIR facility in Darmstadt.
A possibility to overcome this experimental challenge is seen in elastic
scattering of antiprotons off a polarized ^{1}H target [2].
Another possibility is to use the interaction of antiprotons with a polarized deuterium
target [3]. As was shown in Ref. [3] on the basis of the Glauber theory with elementary {$\bar{p}N$}
amplitudes taken from the J\"ulich models of the $\bar{N}N$ interaction [4], the $\bar{p}\vec{d}$
interaction could provide similar or even more effective polarization of the antiprotons
as the $\bar{p}p$ interaction. This conjecture can be checked at a planned AD
experiment [5]. The next step is to study scattering of antiprotons off a polarized ^{3}He
target. Since the polarization of the ^{3}He is carried mainly by the neutron,
the $\bar{p}n$ amplitudes are expected to dominate the spin observables of this reaction.
In the present work we calculate spin-dependent cross sections
of $\bar{p}$ ^{3}He interaction on the basis of an approach similar to that developed in Ref.~[3].
In order to check the validity of the Glauber approximation at low energies we calculated
also the $\bar{p}$ ^{4}He differential cross section at 600 MeV/c beam momentum
and its total annihilation cross section at 200 MeV/c and 600 MeV/c, where data are
available, and found good agreement with the measurements.
The calculated annihilaton cross section for $\bar{p}$ ^{3}He
is also in agreement with the available data [6] at 200 MeV/c.
The polarization efficiency for $\bar{p}$ ^{3}He is estimated within the
single-scattering approximation.

[1] V.~Barone {\it et al.} [PAX Collaboration], arXiv:hep-ex/0505054.
[2] F. Rathmann {\it et al.}, Phys.\ Rev.\ Lett. {\bf 94} (2005) 014801.
[3] Yu.N.~Uzikov, J.~Haidenbauer, Phys. Rev. C {\bf 79} (2009) 024617.
[4] T.~Hippchen, J.~Haidenbauer, K.~Holinde, V.~Mull, Phys. Rev. C {\bf 44} (1991) 1323.
[5] C.~Barschel {\it et al} [PAX Collaboration], arXiv:0904.2325[nucl-ex].
[6] F. Balestra {\it et al.}, Phys. Lett. B {\bf 215} (1988) 247.

Primary author: Dr UZIKOV, Yury (JINR Dubna)

Co-authors: Dr PRMANTAEVA, Bekzat (L.N. Gumilev Eurasian National University, Astana, Kazakhstan); Dr HAIDENBAUER, Johann (Institute for Advanced Simulation, Forschungszentrum J\"ulich,)

Presenter: Dr UZIKOV, Yury (JINR Dubna)

Track Classification: Hadron Physics

Contribution ID: **78** Type: **Oral Presentation**

Antiprotonic Helium Structure and Spectroscopy.

Monday, 5 September 2011 10:50 (30 minutes)

From the discovery of metastable states in the antiprotonic helium [1, 2] a spectacular progress has been achieved in precision spectroscopy of He^+pbar atoms [3, 4]. This talk will be devoted to advances in theory, which is an indispensable constituent for studying properties of antiproton and (!) electron via the spectroscopy of antiprotonic helium. Particularly, the following topics will be discussed:
1) An overview of theoretical methods to treat metastable states in the antiprotonic helium atom;
2) Fine and hyperne structure of the 3He^+pbar and 4He^+pbar atoms and determination of the antiproton magnetic moment [5];
3) Present status of theoretical studies of ro-vibrational transitions [6];
4) Near future perspectives in theory and improved determination of the electron-to-proton mass ratio.

References:
[1] M. Iwasaki et al. Phys. Rev. Lett. 67 1246 (1991).
[2] T. Yamazaki et al. Nature, 361 238 (1993).
[3] M. Hori, et al. Phys. Rev. Lett. 96, 243401 (2006).
[4] T. Pask, et al. Phys. Lett. B 678, 55 (2009).
[5] V.I. Korobov and Zh.-X. Zhong, Phys. Rev. A 80, 042506 (2009).
[6] V.I. Korobov, Phys. Rev. A 77, 042506 (2008).

Primary author: Dr KOROBOV, Vladimir (Joint Institute for Nuclear Research)

Presenter: Dr KOROBOV, Vladimir (Joint Institute for Nuclear Research)

Session Classification: 20 Years of Antiprotonic Helium

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **79** Type: **Oral Presentation**

Measurement of Pionic 121Sn Atom at RI Beam Factory

Monday, 5 September 2011 17:05 (20 minutes)

We are going to report preliminary experimental results in our recent pilot experiment performed in October 2010 for spectroscopy of pionic 121Sn atom in the RI beam factory, RIKEN. We have taken the excitation spectrum of the 122Sn(d,3He) reaction near the pion emission threshold.

Presently, elaborate analysis is on-going and the preliminary spectrum observes a distinct structure of peaks in the bound state region, which is a candidate of the first observation of the pionic 121Sn atom.

Primary author: Dr ITAHASHI, Kenta (RIKEN)

Co-authors: Dr KAMEDA, Daisuke (RIKEN); Prof. BERG, Gerog P.A. (University of Notre Dame); Prof. GEISSEL, Hans (GSI); Prof. WEICK, Helmut (GSI); Mr MATSUBARA, Hiroaki (Osaka University); Dr TAKEDA, Hiroyuki (RIKEN); Dr SUZUKI, Ken (Stefan Meyer Institute for Subatomic Physics); Dr MIKI, Kenjiro (The University of Tokyo); Mr TODOROKI, Koichi (The University of Tokyo); Dr YOSHIDA, Koichi (RIKEN); Dr TSUKADA, Kyo (Tohoku University); Mr NAKAMURA, Masaki (RIKEN); Dr INABE, Naohito (RIKEN); Prof. HAYANO, Ryugo S. (The University of Tokyo); Mr ITOH, Satoshi (The University of Tokyo); Dr MICHIMASA, Shin'ichiro (Osaka University); Dr OTA, Shinsuke (The University of Tokyo); Mr KAWASE, Shoichiro (The University of Tokyo); Mr NOJI, Shumpei (The University of Tokyo); Mr NISHI, Takahiro (The University of Tokyo); Prof. UESAKA, Tomohiro (RIKEN); Dr KUBO, Toshiyuki (RIKEN)

Presenter: Dr ITAHASHI, Kenta (RIKEN)

Session Classification: Exotic Atoms and Atomic Physics

Track Classification: Other exotic atoms and rare decays

Contribution ID: **80** Type: **Oral Presentation**

Energy dependence of K^- -"pp" effective potential derived from coupled-channel Green's function

Wednesday, 7 September 2011 16:20 (20 minutes)

A new experimental search for K^-pp via the ^{3}He(in-flight K^-, n) reaction is planned (J-PARC E15 experiment). We have theoretically discussed the expected inclusive and semi-exclusive spectra for the J-PARC E15 experiment within the framework of the K^-pp single-channel distorted-wave impulse approximation (DWIA) using Green's function method by employing the phenomenological K^--"pp" (complex) effective potential[1,2,3].

In the single-channel DWIA framework, the spectrum shape can be understood by the "moving pole" picture[3]; the pole position of the K^-pp bound state in the complex energy plane changes with the energy along the real axis, and its trajectory determines the spectrum shape. Therefore, the bound-state peak generally deviates from the standard Breit–Wigner type. Moreover, a cusp-like peak may appear at the $[K^-pp] \to \pi\Sigma N$ decay threshold energy in some cases, depending on the K^-pp binding energy.

In this talk, we would like to focus on the the energy dependence of the imaginary part of the K^--pp" effective potential which governs the trajectory of moving pole. In the phenomenological potential used so far, its imaginary part strength is assumed to be proportional to the phase space suppression factor for decay channels[3]. Here, the single channel K^--pp" effective potential is derived from the model using coupled-channel (K^-p)p-($\pi \Sigma)N Green's function, and the validity of the phenomenological one is discussed.

References:

1. T. Koike and T. Harada, Phys. Lett. B652, 262 (2007).
2. T. Koike and T. Harada, Nucl. Phys. A804 (2008) 231.
3. T. Koike and T. Harada, Phys. Rev. C80(2009) 055208.

Primary author: Dr KOIKE, Takahisa (RIKEN Nishina Center)

Co-author: Prof. HARADA, Toru (Osaka Electro-Communication Univ.)

Presenter: Dr KOIKE, Takahisa (RIKEN Nishina Center)

Session Classification: Contributions II

Track Classification: Strangeness in Matter

Contribution ID: **81** Type: **Oral Presentation**

Recent results on K^- multinucleon absorption by FINUDA

Wednesday, 7 September 2011 09:30 (20 minutes)

The knowledge on K^- absorption by light nuclei is still rather incomplete because of the lack of experimental data, but has recently gained a fresh boost. New precision experiments have been performed, mainly with the aim of finding signatures of multibaryon strange aggregates (dubbed "bound kaonic nuclear clusters"), which could be formed following the absorption of the kaon. According to some theoretical approaches [1] these aggregates are expected to be narrow enough to be observable through their non-mesonic decay.

The real existence of bound nuclear kaonic clusters is still a controversial matter, being investigated applying several theoretical approaches [2]. A few experimental indications for their presence have been recently collected, but alternative explanations in terms of simpler processes giving similar signatures have been suggested as well [3]. Only a thorough experimental description of the absorption process, by a complete study of the final state features, may help ruling out misinterpretations.

Up to now, one of the most precise experiments dedicated to the study of the K^- absorption dynamics is FINUDA, which operated at DAΦNE, LNF. The study of K^- absorption reactions on one and few nucleons has been one of its main research topics [4]. An overview of the results achieved by FINUDA in the study of multinucleon kaon absorption, investigated through final states composed by hyperons and nucleons or light nuclei, will be presented.

References

[1] Y. Akaishi and T. Yamazaki Phys. Rev. C 65 (2002), 044005;
T. Yamazaki and Y. Akaishi, Nucl. Phys. B535 (2002), 70
[2] N.V. Shevchenko, A. Gal, J. Mares, Phys. Rev. Lett. 98 (2007), 082301
J. Mares, E. Friedman, A. Gal, Nucl. Phys. A 770 (2006) 84
A. Dote', T. Hyodo, W. Weise, Phys. Rev. C (2009), 014003
W. Weise, H. Hartle, Nucl. Phys. A 804 (2008) 173
[3] V.K Magas, E. Oset, A. Ramos, H. Toki, Phys. Rev. C 74 (2006), 025206
V.K. Magas, E. Oset, A. Ramos, Phys. Rev. C 77 (2008), 065210
[4] FINUDA Collaboration, M. Agnello et al., Phys.Rev.Lett. 94 (2005), 212303
FINUDA Collaboration, M. Agnello et al., Phys. Lett. B 654 (2007), 80
FINUDA Collaboration, M. Agnello et al., Phys. Lett. B 669 (2008), 229

Primary author: Dr FILIPPI, Alessandra (INFN Torino)

Presenter: Dr FILIPPI, Alessandra (INFN Torino)

Session Classification: Strangeness in Matter I

Track Classification: Strangeness in Matter

Contribution ID: **82** Type: **Oral Presentation**

Recent results on the K-(stop) + A -> Sigma+/- + pi-/+ + A reaction with FINUDA

Wednesday, 7 September 2011 15:00 (20 minutes)

on behalf of the FINUDA Collaboration

The presentation deals with the study of the
$K^-_{stop}A \to \Sigma^{\pm}\pi^{\mp}A'$ reaction, which is
studied on light nuclei, $A = {}^{6,7}Li$, ${}^{9}Be$, ${}^{13}C$ and ${}^{16}O$.
Final Σ's and π's are detected by using the FINUDA spectrometer,
which operated at the DAΦNE e^+e^- facility (LNF). The $\Sigma^{\pm}$
hyperons are reconstructed via the $n\pi^{\pm}$ decay with the
neutrons detected by TOFONE, a large volume plastic scintillator array.
The two final $\pi^{\pm}$ mesons are reconstructed by means of the tracking
device of FINUDA, which consists of 5 position sensitive layers. Final
$\Sigma^{\pm}\pi^{\mp}$ pairs are selected by requiring a proper topology
for the $n\pi^{\pm}$ correlated pairs, where the $n\pi^{\pm}$ pairs are
requested to have $\Sigma^{\pm}$ invariant mass. \\
The $\Sigma^{\pm}\pi^{\mp}/K^-_{stop}$ emission rates are reported as a
function of A. These rates are discussed in comparison with previous
experimental findings \cite{katz} \cite{vander-velde} and with the existing
theoretical issues \cite{staronski} \cite{ohnishi}. They are also used to
calculate the γ ratio ($\gamma = \Sigma^+\pi^-/\Sigma^-\pi^+$)
which strongly increases when the kaon is absorbed on an in-medium proton
instead of a free proton. This effect is closely related to the sub-threshold
behavior of the $\bar{K}N$ interaction. \\
The momentum spectra of prompt pions and free sigmas are also discussed as
well as the $\Sigma^{\pm}\pi^{\mp}$ missing mass behavior. These spectra
are discussed in detail rather than the invariant masses. In this
case, the $\Sigma^{\pm}\pi^{\mp}$ channel is filled by two resonances $\Sigma(1385)$
and $\Lambda(1405)$ as well as by the $\Sigma^{\pm}\pi^{\mp}$ quasi-free reaction
whose phase space develops in the same region as the two
resonances \cite{oset}.\\

PACS:21.45.-v, 21.80.+a, 25.80.Nv

\begin{thebibliography}{9}
\bibitem{katz}
P.~A.~Katz et al., Phys.\ Rev.\ {\bf D1 } (1970) 1267.
\bibitem{vander-velde}
C.~Vander Velde-Wilquet et al., Nuovo Cim.\ {\bf A39 } (1977) 538.
\bibitem{staronski}
L.~R.~Staronski and S.~Wycech, J.\ Phys.\ {\bf G13} (1987) 1361.
\bibitem{ohnishi}
A.~Ohnishi, Y.~Nara, V.~Koch, Phys.\ Rev.\ {\bf C56 } (1997) 2767.
\bibitem{oset}
D.~Jido, E.~Oset and T.~Sekihara, Eur.\ Phys.\ Jour.\ {\bf A47} (2011) 42.
\end{thebibliography}

Primary author: Dr PIANO, Stefano (INFN Trieste)

Presenter: Dr PIANO, Stefano (INFN Trieste)

Session Classification: Symmetries; Contributed Talks

Track Classification: Strangeness in Matter

Contribution ID: **83** Type: **Poster**

Collisional transitions between HFS states of antiprotonic 3He in the presence of microwave radiation

Recently, the first experimental results for laser-microwave-laser spectroscopy of the hyperfine structure of antiprotonic 3He were published [1]. Along with the
measurements of hyperfine splitting of the levels and relevant fundamental properties of antiproton, such experiments can provide an interesting information on collisional transitions and interaction of antiprotonic helium with a medium. In this paper we consider collisional effects on the HFS states transitions of antiprotonic 3He in the presence of microwave radiation. A theoretical description of these effects involves two parts: (i) calculations of the elementary collision characteristics (cross sections, transition rates, collisional shifts and broadening of spectral lines) vs. energy and an average of these values over thermal motion, and (ii) analysis of the time evolution of the HFS states density matrix. Similar problems were already considered for HFS transitions in antiprotonic 4He [2,3]. We use here the same approach for antiprotonic 3He with 8 HFS states instead of 4 for 4He. The parameter of the quadruple interaction strength was taken from the fitting [3] of the results to the experimental data for 4He [4].
Using the model interaction between antiprotonic and ordinary helium atoms, we solve quantum close-coupling equations in the subspace of eight HFS states of antiprotonic 3He. From the obtained S-matrix we calculate elastic and inelastic cross sections, transition rates, collisional shift and broadening of M1-spectral lines depending on collision energy. Averaging over thermal motion gives a temperature dependence of these values. The second part of the problem was considered starting from the quantum master equation [5] for the density matrix of the eight HFS states. The relaxation matrix in the master equation is expressed in terms of the calculated elementary collision characteristics. Time dependence of the density matrix was obtained by a numerical solution of the master equation within “secular” and “rotating wave” approximations.
From the calculations we conclude that partial rates of the single spin-flip transition between HFS states in antiprotonic 3He are about 10^6 1/s at the density 3*10^{20} 1/cm^3 and the temperature 6 K, whereas effective relaxation rate with consideration for the kinetics is greater, at least, by factor 2. Collisional shifts of the M1 spectral lines at the same conditions are about 3 kGz, i.e., far less than achieved accuracy of measurements [1] as well as of the theoretical 3-body calculations [6]. Collisional broadening of the lines is calculated to be less than 0.5 MGz. The total width at T=350 ns is about 2.4 MGz allowing for non-additive collisional and Fourier broadenings. Maximum value of the value (peak/total -1) in the 3He target is less by half as compare with
4He at the same delay time T between the two laser pulses.

This work was supported in part by the joint RFBR-ASF grant No. 09-02-91000 and by the RFBR grant No. 10-02-01096.

[1] S. Friedreich, et al. Phys. Lett. B 700 (2011) 1.
[2] G. Ya. Korenman and S.N.Yudin, J. Phys. B 39 (2006) 1473.
[3] G.Y. Korenman and S.N. Yudin, Hyperfine Interact. 194 (2009) 29.
[4] T. Pask et al., J. Phys. B 41 (2008) 081008.
[5] K. Blum, Density Matrix Theory and Applications, Chapter 7. Plenum, New York and London (1981).
[6] V.I. Korobov, Phys. Rev. A 73 (2006) 022509.

Primary author: Mr YUDIN, Sergei (Institute of Nuclear Physics, Moscow State University)

Co-author: Prof. KORENMAN, Grigory (Institute of Nuclear Physics, Moscow State University)

Presenter: Mr YUDIN, Sergei (Institute of Nuclear Physics, Moscow State University)

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **84** Type: **Poster**

Calculation of Cascade Processes rates and Simulation of the Transitions in Kaonic 4He atom

Tuesday, 6 September 2011 16:45 (20 minutes)

Calculation of Cascade Processes rates and Simulation of the Transitions in Kaonic 4He atom

S.Z. Kalantari, Sh. Sanaye Hajari and M. Dayyani Kelisani

Department of Physics Isfahan University of Technology, Isfahan, 8415683111, Iran

Investigation of cascade processes of kaonic atoms is very important to analyze theoretical and experimental studies of K-nucleon strong interaction in low energies. Several experiments have been carried out to detect precisely the x-ray yields of K-p, K-d and K4He atoms [1-4]. We studied the x-ray yields of K-p and K-d atoms previously [5-7]. In this paper we have calculated the cascade processes rates in K4He atoms by a full-quantum mechanical approach, then the cascade processes and x-ray yields in liquid and gaseous helium targets are simulated by Monte-Carlo method.
After K4He atom formation, it is ionized by internal Auger effect, then the K-alpha+ starts the cascade processes from a new n, l distribution. Therefore in order to start the simulation, the initial n, l distribution in K4He atom formation and then in K-alpha+ ion are needed. For this purpose we have used a time dependent perturbation theory to calculate K4He formation atom and internal Auger process. We have shown that the initial n states of K4He and K-alpha+ have a broad distribution around n=29 and n=25, respectively. Then the rates of the cascade processes for K-alpha+ atom are calculated. For this purpose we have used time dependent perturbation theory without any semiclassical approximations or any free parameters. For the full-quantum mechanical calculations, analytical and numerical voluminous calculations should be done for many transitions. The values of the cascade processes rates are compared with each other and their effects are analyzed. Then the calculated rates were used in our code for simulating the cascade processes.
Number of the absorption in low l levels, Stark mixing, x-ray yields and other kinds of transitions are calculated by our simulation. Comparing the simulated x-ray yields in gaseous and liquid helium targets gives some interesting results which are presented in the conference.
Finally, we have compared the density dependence of x-ray yields for K4He with K-p and K-d results. The calculated relative L-series x-ray yields are also compared with the results of KEK-E570 experiment [3].

References:
[1] T.M. Ito et al., Phys. Rev. C 58, 2366 (1998).
[2] G. Beer et al., Phys. Rev. Lett. 94, 212302 (2005).
[3] S. Okada et al., Phys. Lett. B 653, 381 (2007).
[4] M. Bazzi et al., Phys. Lett. B 681, 310 (2009).
[5] M. Raeisi and S.Z. Kalantari, Phys. Rev. A 79, 012510 (2009).
[6] S.Z. Kalantari and M. Raeisi, Phys. Rev. C 81, 014608 (2010).
[7] M. Raeisi and S.Z. Kalantari, Phys. Rev. A 82, 042501 (2010).

Primary author: Prof. KALANTARI, Seyed Zafarollah (Isfahan University of Technology)

Co-authors: Mr DAYYANI KELISANI, Mohsen (Isfahan University of Technology); Mr SANAYE HAJARI, Shahin (Isfahan University of Technology)

Presenter: Prof. KALANTARI, Seyed Zafarollah (Isfahan University of Technology)

Session Classification: Poster Session

Track Classification: Kaonic Atoms

Contribution ID: **85** Type: **Oral Presentation**

The PANDA Physics Program

Thursday, 8 September 2011 09:00 (30 minutes)

The PANDA experiment is one of the major projects at the upcoming FAIR facility in Darmstadt, Germany. It will study hadron physics by using antiproton-proton and antiproton-nuclear interactions in the momentum range of 1.5 GeV/c to 15 GeV/c with a 4π state-of-the-art detector. The purpose is to learn about fundamental aspects of the strong interaction in the transition region between perturbative QCD and nuclear phenomena. PANDA covers a broad physics program ranging from hadron spectroscopy and structure, baryon-antibaryon production, hadron properties in nuclei to hypernuclei.
This paper will review the PANDA physics program.

Primary authors: MARCELLO, Simonetta (University of Turin); Prof. JOHANSSON, Tord (Uppsala University)

Presenter: MARCELLO, Simonetta (University of Turin)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **86** Type: **Poster**

Density effects in antiprotonic helium revisited

Tuesday, 6 September 2011 16:45 (20 minutes)

The density shift and broadening of E1-transition lines in antiprotonic helium atoms at helium target pressure of 1 bar and temperatures about 6K are of the order of several ppm, same as the leading relativistic and spin corrections [PRL84,2350(2000)], and needed to be taken into account. To reduce the systematic uncertainty of experimental data, the current spectroscopy measurements of antiprotonic helium spectra by the ASACUSA collaboration are being performed at much lower helium densities and temperatures; however, at the higher level of experimental accuracy achieved recently the density effects prove to be still of importance. We report the numerical results for the density shift and broadening of one-photon transition lines for a wide range of helium target temperatures, obtained with an interaction potential calculated ab initio.

We also present the extension of the semi-classical method used above to the evaluation of the density shift and broadening of two-photon as well as of magnetic M1 transition lines, of interest for high precision spectroscopy of antiprotonic helium and, possibly, other exotic atoms.

Primary author: Prof. BAKALOV, Dimitar (Bulgarian Academy of Sciences)

Presenter: Prof. BAKALOV, Dimitar (Bulgarian Academy of Sciences)

Session Classification: Poster Session

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **87** Type: **Oral Presentation**

Hyperfine spectroscopy of simple systems in external magnetic field

Friday, 9 September 2011 14:00 (20 minutes)

The response of the hyperfine spectra of simple atoms and molecules such as the antiprotonic helium atom and the molecular ion HD+ to external magnetic fields is investigated, and transition lines are singled out that are particularly insensitive to the size and polarization of the external field or, on the contrary, particularly sensitive to the characteristics of the particles.

Primary author: Prof. BAKALOV, Dimitar (Bulgarian Academy of Sciences)

Presenter: Prof. BAKALOV, Dimitar (Bulgarian Academy of Sciences)

Session Classification: Contributions III

Track Classification: Other exotic atoms and rare decays

Contribution ID: **88** Type: **Oral Presentation**

Neutron spectra from the Kbar + d break-up reaction and the shape of the Lambda(1405) resonance.

Wednesday, 7 September 2011 16:00 (20 minutes)

Coupled channels Faddeev equations are being solved for the Kbar+d break-up reaction in the Kbar-N-N<->pi-Sigma-N three-body system. The main aim is to calculate the neutron spectra for fixed incident kaon energy - a really observable quantity, which is directly related to the shape of the Lambda(1405) state,as opposed to the widely used hypothetical curves, such as sub-threshold Kbar-p amplitudes or pi-Sigma cross sections.
We plan to investigate the effect of different Kbar-N interaction models on this spectrum, basically using interaction types introduced in [1] and further developped in subsequent papers of N.V.Shevchenko, e.g. [2].

[1] J.Revai, N.V.Shevchenko
Isospin mixing effects in the low-energy Kbar-N - pi-Sigma interaction
Phys. Rev. C 79, 035202 (2009)
[2] N.V.Shevchenko
One- versus two-pole Kbar-N - pi-Sigma potential: Kbar-d scattering length
arXiv: 1103.4974

Primary author: Dr REVAI, Janos (Joint Institute for Nuclear Research)

Presenter: Dr REVAI, Janos (Joint Institute for Nuclear Research)

Session Classification: Contributions II

Track Classification: Strangeness in Matter

Contribution ID: **89** Type: **Oral Presentation**

Momentum dependence of hadronic production of the phi-meson and the in-medium phi-width in nuclear matter

Wednesday, 7 September 2011 11:50 (20 minutes)

Information on the properties of the ϕ meson in the nuclear environment has been derived from its production in proton collisions with C, Cu, Al, and Au nuclear targets. The experiment was carried out with 2.83~GeV protons at the Cooler Synchrotron COSY, with the ϕ being detected via its K^+K^- decay using the ANKE magnetic spectrometer. The measured dependence of the production cross section on the nuclear mass number has been compared with calculations within three different nuclear models. These suggest a significant broadening of the width of the ϕ in medium relative to the vacuum value of 4.3~MeV/c^2. The ANKE results in the available momentum range of $0.6 < p_\phi < 1.6$ GeV/c will be discussed and compared with data from photoproduction experiments on various nuclei at slightly higher momenta.

Primary author: Dr HARTMANN, Michael (Forschungszentrum Jülich)

Presenter: Dr HARTMANN, Michael (Forschungszentrum Jülich)

Session Classification: Strangeness in Matter II

Track Classification: Strangeness in Matter

Contribution ID: **90** Type: **Oral Presentation**

The PANDA detector at FAIR

Friday, 9 September 2011 10:00 (30 minutes)

The PANDA experiment is one of the key projects at the future FAIR facility, which is currently under construction at GSI, Darmstadt. It will be located at the HESR storage ring that will deliver antiproton beams of unrivalled intensity and quality
within a momentum range of 1.5 GeV/c and 15 GeV/c. Measurements will be performed with a fixed-target setup using frozen hydrogen and heavier nuclei as internal targets. The experiment will yield high luminosities of up to 2 × 10³² cm ⁻² s⁻¹. PANDA will address a variety of topics centered around a deeper understanding of strong QCD by means of hadron spectroscopy in the charm quark sector. Amongst others, this includes the search for exotic states in the charmonium region, the interaction of charm hadrons with the nuclear medium or the study of double-hypernuclei.

To cover the broad physics program, the PANDA apparatus has to serve as a multi-purpose detector. It employs a target spectrometer surrounding the interaction point and a forward spectrometer covering small forward angles. For the momentum analysis of charged particles a solenoid and a dipole magnet are used in the central and the forward part, respectively. The overall detector design aims at fully exclusive measurements. Therefore, it possesses a high detection capability for both charged and neutral particles over the full solid angle. Both spectrometers are equipped with adequate detector sub-systems for particle tracking, calorimetry and particle identification. Due to the high beam intensities all detector sub-systems must withstand a large radiation dose and exhibit high rate capability.

The presentation will give an overview to all basic parts of the PANDA apparatus
and describe the status of the ongoing detector development. Moreover, the experimental conditions will be summarized which define very challenging technical requirements on the individual subsystems. Besides the discussion of main detector sub-systems, an outline of the overall detection concept of PANDA will be given.
It includes a very sophisticated concept for the data acquisition and trigger conditions based on self-triggering at lowest hardware level.

Primary author: Mr WÜRSCHIG, Thomas (HISKP, Uni Bonn)

Presenter: Mr WÜRSCHIG, Thomas (HISKP, Uni Bonn)

Session Classification: Facilities and Experiments I

Track Classification: Facilities and Experiments

Contribution ID: **91** Type: **Oral Presentation**

Pion Production in Antiproton-Nucleus Interactions

Wednesday, 7 September 2011 16:40 (20 minutes)

The upcoming FAIR Facility provides unique possibilities to study nuclear structure. With the availability of antiprotons as probes, independent information on the properties of exotic nuclei can be achieved. A corresponding experimental setup is proposed by the Antiproton Ion Collider (AIC) at FAIR@GSI, allowing to perform colliding-beam antiproton-nucleus experiments. The focus of our research is twofold: first to find a consistent theoretical description of the interactions of antiprotons with beta-stable and unstable nuclei leading to elastic scattering and particle production and second to utilize these processes for nuclear structure studies. Both topics are of interest in themselves. The antiproton-nucleus interaction is dominated by annihilation reactions where the major component leads on average to five pions. In the energy regime of interest, these processes are well described microscopically by hadronic models. We use antinucleon-nucleon interactions from the Paris model and the Bonn model. Both models are based on the G-parity transformed nucleon-nucleon amplitudes but treat the coupling to the annihilation channels in a different manner. We pay particular attention to the coupling to the two-meson exit channels by treating them explicitly while the other reaction channels are taken into account globally by effective interactions. The nuclear structure input, i.e. ground state densities, single particle wave functions and spectral distributions are treated microscopically by HFB calculations. The antiproton-nucleus optical potential is obtained within a folding approach using the free-space antiproton-nucleon T-matrix and nuclear HFB densities. Meson production is described by annihilation on the target nucleons described by wave functions and spectral densities obtained from self-consistent calculations. An interesting method, particular well suited for the AIC, is to use the produced pions from the annihilation process as probes for nuclear structure studies. The pion-nucleon interaction is described by an extended Kisslinger optical-potential combined with higher resonances beyond the Delta(1232)-state. First results for elastic antiproton-nucleus cross sections and pion production cross sections are presented for nuclei along isotopic chains. The cross sections show a pronounced sensitivity on the nuclear density distributions and single particle wave functions.

Primary author: LOURENCO, Stefanie (University of Gießen)

Co-authors: Prof. LENSKE, Horst (Institut fuer Theoretische Physik, Justus-Liebig Universitaet Giessen, Germany); Prof. WYCECH, Slawomir (Soltan Institute for Nuclear Studies, Warsaw, Poland)

Presenter: LOURENCO, Stefanie (University of Gießen)

Session Classification: Contributions II

Track Classification: Hadron Physics

Contribution ID: **93** Type: **Oral Presentation**

Influence of muon cascade and μ-molecule formation on the μCF process kinetics in deuterium

Friday, 9 September 2011 15:00 (20 minutes)

The kinetics of muon-catalyzed-fusion processes (μCF) in pure deuterium D2 gas has been studied with regard to the epithermal effects of muonic dμ-atoms accelerated during the cascade.
For this purpose the kinetic energy distribution of dμ atoms in the 1S-state has been calculated using the modified quantum-classical Monte Carlo cascade method developed in [1]. This calculation has confirmed that most dμ atoms are not thermalized.
Hence the collisions of such epithermal dμ atoms with deuterium molecules D2 lead to non-resonant formation of ddμ molecules [2] with high rates as compared to for thermalized dμ. However, another process of non-resonant formation may also occur in the presence of non-thermalized dμ-atoms. In parallel with the resonant formation of the ddμ molecule in the weakly bound ro-vibronic (J=v=1) state, the non-resonant formation in the same ddμ-state is also possible. But in this case the emitted Auger electron of the D2 molecule can carry away the released energy only for dμ-atomic collision energies e>I, where I denotes the ionization potential of the D2 molecule. The calculated formation rates in the above-threshold energy region are about one order of magnitude higher than previously obtained in [2].
We have investigated the role of the epithermal non-resonant ddμ formation process described above for μCF in D2 gas. The time spectra of dd-fusion neutrons have been calculated by means of Monte Carlo simulations [3]. It has been shown that similarly to the peak revealed in experiments on μCF in HD mixtures [4], non-resonant ddμ formation by non-thermalized dμ-atoms in the D2 target can also be directly observed in the neutron time spectra at very short initial times, before the complete thermalization of dμ atoms.

References
[1] M.P. Faifman, and L.I. Men'shikov, Proc. Int. Conf. MCF-07, Dubna, June 18-21, p.233 (2007).
[2] M.P. Faifman, Muon Cat. Fus. 4 (1989) 341.
[3] A. Adamczak, M. Faifman, Eur. Phys. J. D. 51 (2009) 341.
[4] D.V. Balin et. al. Phys. El. Part. At. Nucl., 42, (2011) 185.

Primary author: Dr FAIFMAN, Mark (Research Coordinative Center "MUCATEX")

Co-author: Dr ADAMCZAK, Andrzej (Institute of Nuclear Physics of Polish Academy of Sciences)

Presenter: Dr FAIFMAN, Mark (Research Coordinative Center "MUCATEX")

Session Classification: Contributions III

Track Classification: Other exotic atoms and rare decays

Contribution ID: **94** Type: **Oral Presentation**

Atomic parity violation

Every atom is exotic. It is merely a (very good) approximation that an atom is dominated by the electromagnetic interaction. According to the electroweak theory of particle physics, the heavy Z0 neutral gauge boson mediates interactions in atoms that violate parity.
Ever since the creation of the field in the early 70s, this atomic parity violation has been an important low-energy test of the Standard Model. In my talk, I review the status of atomic parity violation, the theoretical atomic and particle physics aspects, and the ongoing efforts to improve the state-of-the-art results obtained with cesium.

Primary author: Prof. TIMMERMANS, Rob (KVI, Groningen)

Presenter: Prof. TIMMERMANS, Rob (KVI, Groningen)

Track Classification: Precision Experiments

Contribution ID: **95** Type: **Oral Presentation**

Exotic Atoms in Flight

Thursday, 8 September 2011 12:05 (30 minutes)

The precision spectroscopy and decay properties of exotic atoms, such as antihydrogen and true muonium provide important tests of quantum electrodynamics as well as fundamental symmetries of the Standard Model. The production mechanisms for such exotic atoms are also of great interest, since they have important implications for analogous phenomena in hadron physics. For example, the production of relativistic antihydrogen has led to a new method for computing hadronization at the amplitude level in color-confining quantum chromodynamics using the off-shell T-matrix for quarks and gluons and the boost-invariant light-front wavefunctions of hadrons. Conversely, the application of Dirac's front form; i.e., light-front quantization, provides a Lorentz-frame-independent description of atoms in flight and unexpected insights into the Lorentz-boost properties of atomic wavefunctions. The front-form also provides frame-independent relativistic Hamiltonian methods for solving perturbative and non-perturbative problems in QED. I will also discuss other QED/QCD analogs such as nuclear-bound quarkonium – heavy quark-antiquark states bound to hadrons and nuclei through the QCD van der Waals interaction – and "atomic alchemy" – the conversion of muonic atoms to electronic atoms – the atomic analog of exclusive flavor-changing B-meson weak decay. The unambiguous renormalization scale-setting procedure of QED provides the key for setting the renormalization scales for processes in QCD, independent of the choice of renormalization scheme: the "principal of maximal conformality". The analysis of QED scattering amplitudes which are sensitive to the Coulomb phase has led to the discovery of analogous quark rescattering effects in QCD, including nonzero factorization-breaking phenomena such as the pseudo-T-odd Sivers effect in polarized-proton semi-inclusive deep inelastic lepton scattering reactions. Finally, I will discuss how the use of light-front quantization resolves the apparent 10^{120} discrepancy between properties of the QED vacuum and the measured cosmological constant.

Primary author: Prof. BRODSKY, Stanley J. (SLAC and Stanford University)

Presenter: Prof. BRODSKY, Stanley J. (SLAC and Stanford University)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **96** Type: **Oral Presentation**

Collisional Processes of Antiprotonic Helium

Monday, 5 September 2011 11:40 (20 minutes)

We shall review the current status of the theory of collisional processes of antiprotonic helium. The following questions will be discussed:

1. Formation and cascade transitions of exotic atoms. Primary populations of metastable states of antiprotonic helium.
2. Collisional quenching of metastable antiprotonic helium.
3. Shift and broadening of E1 spectral lines in antiprotonic helium.
4. Effects of collisions on M1 transitions of HFS states in the resonance microwave field.
5. Effective annihilation rates for long-lived states of antiprotonic helium ions in ultra-low-density target.

This work was supported in part by the joint RFBR-ASF grant No. 09-02-91000 and by the RFBR grant No. 10-02-01096.

Primary author: Prof. KORENMAN, Grigory (Institute of Nuclear Physics, Moscow State University)

Presenter: Prof. KORENMAN, Grigory (Institute of Nuclear Physics, Moscow State University)

Session Classification: 20 Years of Antiprotonic Helium

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **97** Type: **Oral Presentation**

Coupled-channel properties of Lambda(1405) and K-pp production in p + p -> K+ + X reactions

Tuesday, 6 September 2011 16:10 (20 minutes)

Formation of K^-pp in high-energy $p+p$ collision is an elementary doorway step to excite kaonic nuclear clusters in nuclei. The K^-pp system has a structure of Λ^*-p, where Λ^* is $\Lambda(1405)$ embedded in the system. We have investigated theoretically how coupled-channel properties of $\Lambda(1405)$ change inside the quasi-bound system, K^-pp, by using "generalized optical potentials" which have an advantage to understand physical meanings of the reaction process. The mass spectrum of Λ^* changes its shape drastically from that of $\Lambda(1405)$ in free space when the binding of Λ^*-p increases on the order of 50 MeV.

Taking the change of the Λ^* property above-mentioned into account, we have calculated the reaction cross section of $p+p \to K^+ + X$ for $X = K^-pp = \Lambda^*$-p at incident $T_p = 2.5 - 3.0$ GeV in the energy region of DISTO. It is seen that the strength and the shape of X excitation spectra are largely affected by the property change of Λ^*, depending on T_p in this energy region of near $\Lambda(1405)$-production threshold. This strength behavior is an interesting theoretical problem to be clarified toward a new production means of kaonic nuclear clusters not only in the $p+p$ reaction but also in p-nucleus and heavy-ion reactions.

Primary author: Prof. AKAISHI, Yoshinori (RIKEN)

Co-author: Prof. MYINT, Khin Swe (Mandalay University)

Presenter: Prof. AKAISHI, Yoshinori (RIKEN)

Session Classification: Kaonic Atoms

Track Classification: Strangeness in Matter

Contribution ID: **98** Type: **Oral Presentation**

Consistency of Lambda-Lambda hypernuclear events

Wednesday, 7 September 2011 10:10 (20 minutes)

The recent determination of Lambda-nucleon spin-dependent interaction matrix elements in Lambda hypernuclei [1] from comprehensive measurements of gamma ray transitions [2] provides accurate estimates of Lambda-Lambda separation energies in double-Lambda hypernuclei across the nuclear p shell.

Here we outline a shell-model approach [3] to evaluate the consistency of the world emulsion data on double-Lambda hypernuclei [4] in terms of the uniquely identified Lambda-Lambda-6He event [5]. The implications of this study on whether or not the H dibaryon [6] is stable against strong decays, with mass below twice the Lambda mass, will be discussed in the light of recent lattice gauge searches [7].

References

[1] D.J. Millener, Nucl. Phys. A 835 (2010) 11;
see also D.J. Millener, arXiv:1011.0367 [nucl-th], and references therein.

[2] H. Tamura, et al., Nucl. Phys. A 835 (2010) 3.

[3] A. Gal, D.J. Millener, to be published in Phys. Lett. B (arXiv:1104.3429).

[4] S. Aoki et al. [KEK-E176], Nucl. Phys. A 828 (2009) 191;
K. Nakazawa [KEK-E373], Nucl. Phys. A 835 (2010) 207;
K. Nakazawa, H. Takahashi, Prog. Theor. Phys. Suppl. 185 (2010) 335,
and references therein.

[5] H. Takahashi, et al., Phys. Rev. Lett. 87 (2001) 212502.

[6] R.L. Jaffe, Phys. Rev. Lett. 38 (1977) 195, 617 (E).

[7] S.R. Beane, et al. [NPLQCD], Phys. Rev. Lett. 106 (2011) 162001;
T. Inoue, et al. [HALQCD], Phys. Rev. Lett. 106 (2011) 162002.

Primary author: Prof. GAL, Avraham (Hebrew University, Jerusalem, Israel)

Co-author: Dr MILLENER, David John (Brookhaven National Laboratory, USA)

Presenter: Prof. GAL, Avraham (Hebrew University, Jerusalem, Israel)

Session Classification: Strangeness in Matter I

Track Classification: Strangeness in Matter

Contribution ID: **99** Type: **Oral Presentation**

Synthesis of antihydrogen atoms in a CUSP trap

Monday, 5 September 2011 15:20 (30 minutes)

ASACUSA collaboration has been making a path to realize high precision microwave spectroscopy of ground-state hyperfine transitions of antihydrogen atom in flight for stringent test of the CPT symmetry. Recently, we have succeeded in synthesizing our first cold anithydrogen atoms employing a CUSP trap.
It is expected that synthesized antihydrogen atoms in the low-field-seeking states are preferentially focused along the cusp magnetic field axis whereas those in the high-field-seeking states are not focused, resulting in the formation of a spin-polarized antihydrogen beam.

We report the recent results of antihydrogen atom synthesis and beam production developed with the CUSP trap.

Primary author: Dr KURODA, Naofumi (University of Tokyo)

Co-authors: Prof. MOHRI, Akihiro (RIKEN); Dr JUHÁSZ, Bertalan (SMI); Mr KIM, Chanhyoun (University of Tokyo); Prof. WIDMANN, Eberhard (SMI); Prof. LODI-RIZZINI, Evandro (INFN Brescia); Dr IMAO, Hiroshi (RIKEN); Dr TORII, Hiroyuki A. (University of Tokyo); Dr HIGAKI, Hiroyuki (Hiroshima University); Mr TANAKA, Kazuo (University of Tokyo); Mr MICHISHIO, Koji (Tokyo University of Science); Mr FUJII, Koki (University of Tokyo); Prof. VENTURELLI, Luca (INFN Brescia); Dr LEALI, Marco (INFN Brescia); Dr CORRADINI, Maurizio (INFN Brescia); Ms OHTSUKA, Miki (University of Tokyo); Dr ZURLO, Nicola (INFN Brescia); Dr MASCAGNA, Valerio (INFN Brescia); Prof. YAMAZAKI, Yasunori (RIKEN); Dr KANAI, Yasuyuki (RIKEN); Dr MATSUDA, Yasuyuki (University of Tokyo); Prof. NAGASHIMA, Yasuyuki (Tokyo University of Science); Dr ENOMOTO, Yoshinori (RIKEN); Dr NAGATA, Yugo (RIKEN)

Presenter: Dr KURODA, Naofumi (University of Tokyo)

Session Classification: Antihydrogen

Track Classification: Antihydrogen

Contribution ID: **100** Type: **Oral Presentation**

Sub-Doppler two-photon laser spectroscopy of antiprotonic helium

Monday, 5 September 2011 11:20 (20 minutes)

We review the latest results of precision spectroscopy of antiprotonic helium, and the determination of the antiproton-to-electron mass ratio carried out by the ASACUSA collaboration of CERN.

Primary author: Dr HORI, Masaki (Max-Planck Institute for Quantum Optics)

Presenter: Dr HORI, Masaki (Max-Planck Institute for Quantum Optics)

Session Classification: 20 Years of Antiprotonic Helium

Track Classification: 20 Years of Antiprotonic Helium

Contribution ID: **102** Type: **Poster**

Field Ionization of Antihydrogen in Rydberg States

\documentclass{article}

\addtolength{\textheight}{-10mm}
\addtolength{\topmargin}{-5mm}

\pagestyle{plain}

\def\title#1{\begin{center}#1\end{center}}

\def\author#1{\centerline{\small{\textsc{#1}}}}

\def\address#1#2{\begin{center}\small\emph{#1}\\E-mail: \texttt{#2}\end{center}}

\def\refname{{\small References}}

\begin{document}
\title{\textsc{Field Ionization of Antihydrogen in Rydberg States}}

\author{V.~S.~Melezhik}

\address{Bogoliubov Laboratory of Theoretical Physics, \\ Joint Institute for Nuclear Research, \\ 141980 Dubna, Moscow Region, Russia}{melezhik@theor.jinr.ru}

\bigskip

\small

In experiments on antihydrogen formation the ionization of the
antihydrogen atoms in Rydberg states by external fields becomes an actual
problem \cite{Enomoto}.

To analyze the ionization rates we apply the computational scheme
developed earlier for some problems of the muon-catalyzed fusion
such as muon sticking to helium \cite{1} and the stripping of the muon from helium ions
\cite{2,3}. Particularly, deexcitation and ionization rates of highly
excited muonic helium stimulated by strong magnetic field were calculated \cite{2}.
This approach was also used for for analyzing the
laser-stimulated formation of antihydrogen atoms \cite{4}.

Here we suppose to discuss the dependence of the ionization rates of the
antihydrogen from the Rydberg states on the parameters of the external
fields.

\begin{thebibliography}{5}\footnotesize
\bibitem{Enomoto} Y.~Enomoto et. al. Phys. Rev. Lett. {\bf 105} 243401
(2010)
\bibitem{1}V.S. Melezhik, Hyp. Interac. {\bf 101/102}, 365 (1996)
\bibitem{2}
V.S. Melezhik and P. Schmelcher, Phys. Rev. {\bf 59}, 4264
(1999).
\bibitem{3}
V.S. Melezhik, Hyp. Interac. {\bf 138}, 202 (2001)
\bibitem{4}
V.S. Melezhik, Hyp. Interac. {\bf 193}, 329 (2009)

\end{thebibliography}

\end{document}

Primary author: Prof. MELEZHIK, Vladimir (BLTP JINR Dubna)

Presenter: Prof. MELEZHIK, Vladimir (BLTP JINR Dubna)

Track Classification: Antihydrogen

Contribution ID: **103** Type: **Oral Presentation**

Neutron Bound beta- Decay- BOB

Tuesday, 6 September 2011 11:30 (20 minutes)

J.McAndrew, S.Paul, M. Berger, R. Emmerich, R. Engels,T.Faestermann,
P. Fierlinger, M. Gabriel, E. Gutsmiedl,F. J. Hartmann, R. Hertenberger, A. Röhrmoser, S.Ruschel, J Schön, W.Schott, U.Schubert, D.Simon, A.Trautner, Th. Udem, A. Ulrich

The bound neutron beta-decay(BOB) into a hydrogen atom and an electron antineutrino is investigated. The hyperfine-state population of the monoenergetic hydrogen atoms yields the neutrino left-handedness or a possible right-handed admixture and possible small scalar and tensor contributions to the weak force. The BOB H(2s) hyperfine states are separated with a Lamb shift spin filter. The monoenergetic 326 eV BOB H(2s) atoms are detected either by quenching
yielding Lyman-alpha photons, or charge exchanging into H^- ions within a 1 mbar argon cell. A first experiment is planned at the FRM2 high thermal neutron flux beam reactor SR6 through-going beam pipe, where the H^- coming from BOB H(2s) and H(1s), being 10 eV different in kinetic energy, are to be separated with a MAC- E filter. This should be possible because the Doppler broadened BOB H atom energy width due to the thermal motion of the decaying neutrons is reduced by suppressing axially moving neutrons with absorbing traps built into SR6 on both sides. The 10 eV H^- energy difference between charge exchanged H(2s) and H(1s) which were produced by a proton beam from a plasma source traversing a cesium cell, has been measured with an electric counter field mockup setup. A MAC- E filter is being built. Furthermore, the BOB branching ratio to the three- body decay should be obtained. In a second experiment at the ILL high flux beam reactor H6- H7 through-going beam tube, the BOB H(2s) hyperfine state population is to be measured.

Primary author: Dr MCANDREW, Josephine (TU Munich)

Co-author: Dr SCHOTT, Wolfgang (TU Munich)

Presenter: Dr MCANDREW, Josephine (TU Munich)

Session Classification: Precision Experiments II

Track Classification: Other exotic atoms and rare decays

Contribution ID: **104** Type: **Oral Presentation**

Determination of the Ds0*(2317) Width with the PANDA Detector

Thursday, 8 September 2011 10:30 (15 minutes)

The Ds0*(2317) meson which was discovered at BaBar in 2003 has the interesting properties of a surprisingly narrow width and a mass just below the DK threshold. Different theoretical models try to explain the nature of its properties. A precise knowledge of the width is an important criterion to evaluate these models. However, only an upper limit of 3.8 MeV is known so far.

A suitable method to determine the width of particles which are significantly narrower than the experimental mass resolution is to measure the production cross section as a function of the center of mass energy. The shape of this excitation function allows deducing the width.

At PANDA, the measurement of the production cross section will be possible in antiproton-proton collisions. The PANDA experiment at the future FAIR facility is designed to combine precisely adjustable beam momenta and high luminosities which make it an excellent tool for this kind of measurement.

We will present the experimental procedure to determine the width of the Ds0*(2317) meson with the PANDA detector as well as an outlook on the achievable precision and how it is influenced by external parameters.

Primary author: Dr MERTENS, Marius C. (Forschungszentrum Jülich)

Presenter: Dr MERTENS, Marius C. (Forschungszentrum Jülich)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **106** Type: **Oral Presentation**

Charm Physics at Belle

Thursday, 8 September 2011 09:50 (20 minutes)

Belle experiment at the KEKB factory, originally dedicated to studies of B mesons, was proved to be a great place also for studying charm physics. The QCD motivated measurements of spectroscopy, decays and production of charmed and charmonium states were succesfully performed at Belle and initiated a lot of theoretical work. In particular, recent discoveries of charmonium-like resonances indicate a renaissance of the $c\bar{c}$ spectroscopy. These so called XYZ states do not fit the conventional $c\bar{c}$ spectrum described, so far successfully, by the quark models. This suggests that some of them might be exotic and could realize an unproved area of QCD predictions.

Primary author: Dr BRODZICKA, Jolanta (INP Krakow)

Presenter: Dr BRODZICKA, Jolanta (INP Krakow)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **107** Type: **Oral Presentation**

Quarkonia studies at CMS

Thursday, 8 September 2011 09:30 (20 minutes)

Using the 2010 data set of proton-proton collisions at a centre-of-mass energy of 7 TeV the CMS experiment has performed a wide range of measurements of quarkonia states which are being updated and extended with new data. This talk will summarize the CMS results on the differential cross sections and spin alignment of charmonium and bottomium states and compare them with other measurements and theoretical predictions. Results on B to J/psi and B to psi(2S) fractions and on the relative production cross section for X(3872) will also be shown. Finally a short comparison with quarkonia measurements in lead-lead collisions will be presented.

Primary author: ADAM, Wolfgang (HEPHY Vienna)

Presenter: ADAM, Wolfgang (HEPHY Vienna)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **108** Type: **Oral Presentation**

K^- nuclear quasi-bound states in a chirally motivated coupled-channel approach

Wednesday, 7 September 2011 14:40 (20 minutes)

The contribution reports on our recent study [1] of the interaction of antikaons with nuclear systems within an SU(3) chiral approach combined with coupled-channel T-matrix resummation techniques [2,3,4]. The K^- meson self energy operator is constructed from in-medium subthreshold K^-N scattering amplitudes derived within a chirally motivated model, which accounts for new SIDDHARTA data [5]. It is shown for the first time how to incorporate the strong energy and density dependence of the K^-N scattering amplitudes at and below threshold into self consistent evaluation of the K^- nuclear potential. This strong energy and density dependence of the scattering amplitudes leads to a deep K^- potential V_{K} in the nuclear medium, with the depth -ReV_{K}(ρ_{0}) of order 100 MeV, although the potential is shallow at threshold.
Consequences for dynamical calculations of K^- nuclear quasi-bound states, for their binding energies and widths, are reported and discussed. The decay width induced by non mesonic K^-NN absorption and the role of p-wave K^-N subthreshold amplitudes associated with Σ(1385) are studied, as well. The calculated binding energies and widths are compared with the results of refs.[6,7,8].

[1] A. Cieplý, E. Friedman, A. Gal, D. Gazda, J. Mareš, arXiv:1102.4515 [nucl-th],
subm. Phys. Lett. B.
[2] A. Ramos, E. Oset, Nucl. Phys. A 671, 481 (2000).
[3] B. Borasoy, R. Nissler, W. Weise, Eur. Phys. J A 25, 79 (2005),
Phys. Rev. Lett. 94, 213401 (2005).
[4] A. Cieplý, J. Smejkal, Eur. Phys. J A 43, 191 (2010).
[5] G. Beer et al. [SIDDHARTA Collab.] , arXiv :0247548 [nucl-ex].
[6] J. Mareš, E. Friedman, A. Gal, Nucl. Phys. A 770, 84 (2006).
[7] D. Gazda, E. Friedman, A. Gal, J. Mareš, Phys. Rev. C 76 (2007) 055204,
ibid. 77 (2008) 045206.
[8] W. Weise, R. Haertle, Nucl. Phys. A 804 (2008) 173.

Primary author: Dr MARES, Jiri (Nuclear Physics Institute)

Presenter: Dr MARES, Jiri (Nuclear Physics Institute)

Session Classification: Symmetries; Contributed Talks

Track Classification: Strangeness in Matter

Contribution ID: **109** Type: **Poster**

Investigating In-medium Lambda Production in Pion Induced Reactions

Tuesday, 6 September 2011 16:45 (20 minutes)

One of the central questions in studying the characteristic of nuclear matter for both, experiment and theory, is the presence of in-medium effects which manifest in the change of hadron properties. Strange particles are essential probes to study in-medium effects of hadrons produced in collisions between nuclei at energies close to the respective nucleon-nucleon production thresholds.
The direct method to investigate the threshold behaviour is the use of pion beams to study the reactions like pi + N -> Y + K, involving a Y hyperon and K meson.
The experiment with secondary pion beam was performed by the FOPI collaboration at the GSI using C, Al, Cu, Sn and Pb nuclear targets at beam momentum of 1.15 GeV/c. The FOPI system is assembled at the SIS accelerator, covering complete range of beam energies (0.1 to 2.0 GeV per nucleon) and nearly full solid angle. The main goal of that experiment was to measure the in-medium cross section of the reaction pi- + p -> Lambda + K0.
The in-medium inclusive cross section for the production of K0 mesons has been evaluated and published by M. L. Benabderrahmane et al., Phys. Rev. Lett. 102 (2009) 182501.
We have worked on the investigation of inclusive Lambda production and we plan to determine a statistical limit on correlated Lambda and K0 pairs. In order to find modifications of hadronic properties, it is also necessary to do the detailed comparison with theoretical model predictions.
Considering already obtained results and our analysis, the expectations for Lambda particle will be pointed out in this work.

Primary author: CAREVIC, Ivana (University of Split)

Co-authors: Prof. DZELALIJA, Mile (University of Split); Dr HARTMANN, Olaf (SMI, Vienna)

Presenter: CAREVIC, Ivana (University of Split)

Session Classification: Poster Session

Track Classification: Strangeness in Matter

Contribution ID: **110** Type: **Oral Presentation**

Lorentz invariance on trial in the weak decay of rubidium atoms

Tuesday, 6 September 2011 10:10 (20 minutes)

The invariance of the laws of physics under Lorentz transformations is one of the most fundamental principles underlying our current understanding of nature. In theories trying to unify the Standard Model with quantum gravity, this invariance may be broken, and dedicated high-precision experiments at low energy could be used to reveal such suppressed signals from the Planck scale.

In the framework of the TRImP (Trapped Radioactive Isotopes: micro-laboratories for fundamental Physics) program at KVI, we will test Lorentz invariance searching for a dependence of the decay rate of spin-polarized 80Rb nuclei on the daily, sidereal or deliberate re-orientation of the spin. Observation of such a dependence would imply a breakdown of Lorentz invariance.

Primary author: Dr MUELLER, Stefan E. (KVI)

Presenter: Dr MUELLER, Stefan E. (KVI)

Session Classification: Precision Experiments I

Track Classification: Precision Experiments

Contribution ID: **111** Type: **Oral Presentation**

Theory of antikaon-nucleon interactions in the age of SIDDHARTA

Thursday, 8 September 2011 15:30 (30 minutes)

An updated review on Kbar-N interactions is given within the theoretical framework of chiral SU(3) dynamics. The coupled-channels equations are solved with special emphasis on the constraints provided by the new kaonic hydrogen data from the SIDDHARTA measurements. Precision fits to K-p threshold and scattering data are performed and a new value of the complex K-p scattering length is deduced. Next-to-leading order terms in the chiral SU(3) meson-baryon effective Lagrangian are discussed as well as implications for subthreshold extrapolations of the K-p amplitude.
(Work performed in cooperation with T. Hyodo and Y. Ikeda, Tokyo Institute of Technology).

Primary author: Prof. WEISE, Wolfram (Physics Department, TU Munich)

Presenter: Prof. WEISE, Wolfram (Physics Department, TU Munich)

Session Classification: Symposium "Creativity-Innovation - the Seed for Frontier Science"

Track Classification: Creativity-Innovation - the Seed for Frontier Science

Contribution ID: **112** Type: **Poster**

Neutral Kaon Production in p+p and p+Nb Collisions with HADES

Tuesday, 6 September 2011 16:45 (20 minutes)

Kaon interaction with baryonic matter is characterized by a repulsive potential according to common belief. However, the values of the measured potential are not yet consistent with each other [1,2]. We analyze the kaon in-medium behavior employing K0s's identified with the HADES detector in p+p and p+Nb collisions at 3.5 GeV kinetic beam energy. The comparison of the K0s differential cross sections in p+Nb and p+p collisions provides access to the in-medium kaon potential at normal nuclear matter density. The distinctive feature of our measurements is a high-statistics sample of kaons with low transverse momenta (pt < 100 MeV/c), ensuring the sensitivity to the nuclear matter effects. We present the data analysis method and first results.
[1]M.L. Benabderrahmane et al. (FOPI), Phys.Rev.Lett.102, 182501 (2009)
[2]G. Agakishiev et al. (HADES), Phys.Rev.C 82:044907 (2010)

Primary author: CHEN, Jia-Chii (TU München, Excellence Cluster Universe)

Presenter: CHEN, Jia-Chii (TU München, Excellence Cluster Universe)

Session Classification: Poster Session

Track Classification: Strangeness in Matter

Contribution ID: **113** Type: **Oral Presentation**

Pionic hydrogen and deuterium

Monday, 5 September 2011 17:55 (20 minutes)

The ground-state level shifts and broadenings of the hydrogen isotopes caused by the strong interaction have been determined by using a high-resolution crystal spectrometer. From these parameters are derived the pion-nucleon and pion-deuteron scattering lengths and the threshold production and absorption strength of pions in nucleon-nucleon reactions. Muonic hydrogen reveals properties in the de-excitation cascade of such electrically neutral exotic atoms, the understanding of which is essential for analysis of the data. Experimental results are discussed in the context of recent theoretical efforts within the approach of chiral perturbation theory and atomic cascade calculations.
*for the PIONIC HYDROGEN collaboration

Primary author: GOTTA, Detlev (Forschungszentrum Jülich)

Presenter: GOTTA, Detlev (Forschungszentrum Jülich)

Session Classification: Exotic Atoms and Atomic Physics

Track Classification: Other exotic atoms and rare decays

Contribution ID: **114** Type: **Poster**

Strangeness production at finite temperature and baryon density in an effective relativistic mean field model

Tuesday, 6 September 2011 16:45 (20 minutes)

We study the strangeness production at finite temperature and density nuclear matter by means of an effective relativistic mean-field model with the inclusion of the full octet of baryons, the Delta-isobars degrees of freedom and the lightest pseudoscalar and vector mesons. These last particles are considered taking into account of an effective chemical potential and an effective mass depending on the self-consistent interaction between baryons. The analysis is performed by requiring the Gibbs conditions on the global conservation of baryon number, electric charge fraction and net strangeness. In this context, we study the influence of the kaon-nucleon interaction in the determination of the different meson ratios and in the strangeness production.

Primary author: LAVAGNO, Andrea (Politecnico di Torino(PT-DIFIS))

Co-authors: PIGATO, Daniele (Politecnico di Torino); IAZZI, Felice (Politecnico di Torino)

Presenter: LAVAGNO, Andrea (Politecnico di Torino(PT-DIFIS))

Session Classification: Poster Session

Track Classification: Hadron Physics

Contribution ID: **115** Type: **Oral Presentation**

Performance of the PANDA GEM-TPC prototype

Friday, 9 September 2011 12:10 (20 minutes)

To face the challenges of the physics program in PANDA1, the cylindrical central tracker of the Target Spectrometer has to fulll the following requirements: A high vertex resolution (sigma~ 150 m; z 1 mm), high momentum resolution (1 %), minimal material budget (1% of radiation length), high rate capability, resistance against aging, etc. Due to the beam characteristics (L=2*10^32 cm^-2 s^-1, 2*10^ 7 pbar p annihilations s^-1), the TPC has to work in a continuous mode, i.e. without gating, which is another big challenge from the technical point of view. Due to the rather long electron drift time, tracks from up to 1000 events are superimposed inside the TPC at any given time. A Time Projection Chamber with Gas Electron Multiplier readout not only fullls all the requirements above, but furthermore provides very good dE/dx measurement also in the region of low momenta, which is necessary for particle identication. In addition, the successful long-term operation of GEM-Detectors for example at the COMPASS2 experiment shows that this kind of detector has excellent properties concerning high rate capability. Due to asymmetric eld conguration the GEM detectors have a high intrinsic suppression of ion back ow. Such properties enables a GEM-based TPC to operate in an ungated mode. A prototype GEM-TPC with a drift length of 72.78 cm and an outer diameter of 30 cm was designed and built by a collaboration of groups from GSI Darmstadt, HISKP Bonn, SMI Vienna, and TU Munchen. This prototype was made to t into the FOPI spectrometer at GSI were it is very useful to increase primary and secondary vertex resolutions. The progress and test results of a measurement campaign with the GEM-TPC prototype inside FOPI will be shown in this contribution.

Primary author: BERGER, Martin (TU-Muenchen)

Presenter: BERGER, Martin (TU-Muenchen)

Session Classification: Facilities and Experiments II

Track Classification: Instrumentation

Contribution ID: **116** Type: **Oral Presentation**

Spectrum of the muon decay in orbit

Friday, 9 September 2011 14:40 (20 minutes)

In a free muon decay, the daughter electron energy is limited to about half the muon mass. If the decaying muon is bound in an atom, the binding effects significantly distort the electron spectrum and increase the maximum energy to almost the full muon mass. A new theoretical determination of that spectrum will be presented. The high-energy electrons are a background in searches for the muon-electron conversion. Experimental plans for those searches will be discussed. Also the electron spectrum of an exotic muon decay with an emission of a majoron will be presented.
This talk is based on results obtained with D. Bryman, M. Dowling, X. Garcia i Tormo, and W. Marcia

Primary author: Prof. CZARNECKI, Andrzej (University of Alberta)

Presenter: Prof. CZARNECKI, Andrzej (University of Alberta)

Session Classification: Contributions III

Track Classification: Other exotic atoms and rare decays

Contribution ID: **117** Type: **Poster**

Improved positron loading for antihydrogen research

Tuesday, 6 September 2011 16:45 (20 minutes)

Positrons (e^+) for ATRAP antihydrogen studies are provided by a Surko-style room-temperature Penning trap with N_2 buffer gas. (e^+) emitted in radioactive decay of ^{22}Na are thermalized in a solid neon moderator. A short section of magnetic guide steers the e^+ to the axis of the Penning trap where interactions with N_2 molecules cool them into the bottom of the well where a rotating electric field compresses the accumulating cloud of e^+. e^+ are accumulated for approximately 30 s then accelerated by an electric field and launched into a magnetic guide that maneuvers the e^+ through a 15 degree bend and 5m of vacuum tube to a point 2m above the cryogenic Penning trap. The e^+ are mostly guided down the last 2m of the vacuum tube by the fringing field of the superconducting solenoid which houses the cryogenic Penning trap for antihydrogen research. The fringing field also radially compresses the e^+ so that they may pass through a 1.5mm diameter pumping restriction necessary to maintain the ultrahigh vacuum required for long term antimatter storage in the Penning trap. A barrier voltage is momentarily pulsed down to allow the e^+ into the Penning trap where collisions with electrons and synchrotron radiation rapidly cool the e^+. Additional accumulations are launched, guided and loaded into the cryogenic Penning trap to achieve the high numbers of e^+ required for antihydrogen experiments or lepton studies. Large number of e^+ (> $1x10^9$) can be loaded into the cryogenic Penning trap at a rate over $10^4 e^+$/s/mCi

Primary author: FITZAKERLEY, Daniel (York University)

Co-authors: MULLERS, A. (Johannes Gutenberg Universitat and Helmholtz Institut Mainz); STORRY, C.H. (York University); COMEAU, D. (York University); GRZONKA, D. (Forschungszentrum Jülich, IKP); HESSELS, E.A. (York University); GABRIELSE, G. (Harvard University); WALZ, J. (Johannes Gutenberg Universitat and Helmholtz Institut Mainz); BORBELY, J.S. (York University); WEEL, M. (York University); GEORGE, M.C. (York University); RICHERME, P. (Harvard University); KALRA, R. (Harvard University); MCCONNELL, R. (Harvard University); SEFZICK, T. (Forschungszentrum Jülich, IKP); OELERT, W. (Forschungszentrum Jülich, IKP); KOLTHAMMER, W.S. (Harvard University)

Presenter: FITZAKERLEY, Daniel (York University)

Session Classification: Poster Session

Track Classification: Antihydrogen

Contribution ID: **118** Type: **Poster**

Calibration of a GEM-TPC prototype for PANDA with Kr-83m

Tuesday, 6 September 2011 16:45 (20 minutes)

The main purpose of the PANDA experiment at the new international Facility for Antiproton and Ion Research (FAIR) is the high-precision spectroscopy of hadrons in the charm quark sector. This requires an excellent central tracker (CT) which provides an efficient reconstruction of charged particle trajectories and secondary vertices, high spatial and vertex resolution ($\sigma r\varphi$ ~ 150 μm, σz ~ 1 mm), good momentum ($\delta p/p$ ~ 1.5 %) resolution with minimal material budget (X/X0 ~ 1 %), high rate capability and an angular acceptance of almost 4π.
As one of the two proposed options for this CT, a cylindrical time projection chamber (TPC) could provide additional dE/dx measurements which are extremely useful for particle identification especially in the sub-GeV region. In order to operate in a continuous mode without gating and efficiently suppress ion backflow, a stack of GEM foils is used as an amplification stage instead of conventional multi-wire chambers.
To show the feasibility, a prototype TPC with an outer diameter of 300 mm and a drift length of 725 mm has been built and is being tested within the FOPI experiment at GSI Darmstadt since the end of 2010. It uses a triple GEM stack for the charge amplification. The readout plane of the detector has 10254 hexagonal pads of 1.5 mm outer radius which are read out using 42 front end cards based on the AFTER/T2K chip.
In order to perform an accurate pad-wise, as well as an absolute gain calibration, a 83m Kr source was chosen. Its gaseous form in combination with the rich conversion electron spectrum, mainly between 9 and 42 keV, makes it perfectly suitable for this purpose. Additionally the short half life of 1.83 h allows to resume normal detector operation after only a few hours. This method has already been used in various large drift chambers (e.g. HARP, ALICE, NA49) and has been performed on a prototype TPC for different gas mixtures and gain settings.
Details of the production process, the integration into the setup, the calibration method and first results will be presented.

Primary author: SCHMITZ, Roman (University of Bonn)

Presenter: SCHMITZ, Roman (University of Bonn)

Session Classification: Poster Session

Track Classification: Instrumentation

Contribution ID: **119** Type: **Oral Presentation**

Muonic hydrogen

Monday, 5 September 2011 16:35 (30 minutes)

Our recent measurement of the Lamb shift (2S-2P energy splitting) in muonic hydrogen [1] has created a puzzle. The value of the proton rms charge radius we deduce, Rp = 0.84184(67) fm, is ten times more accurate, but 4% smaller than the values deduced from both hydrogen spectroscopy and elastic electron scattering.
In addition, we have determined the 2S hyperfine splitting in muonic hydrogen from which the Zemach radius of the proton is determined. The Zemach radius is a measure for the magnetisation distribution inside the proton.

[1] R. Pohl, A. Antognini, F. Nez et al. (CREMA collaboration), Nature 466, 213 (2010).
[2] CREMA collaboration, in preparation.

Primary author: Dr POHL, Randolf (Max-Planck-Institut für Quantenoptik)

Presenter: Dr POHL, Randolf (Max-Planck-Institut für Quantenoptik)

Session Classification: Exotic Atoms and Atomic Physics

Track Classification: Other exotic atoms and rare decays

Contribution ID: **120** Type: **Oral Presentation**

Studying Hadrons in Matter with PANDA

Thursday, 8 September 2011 10:10 (20 minutes)

Possible modifications of hadron properties in nuclear matter is subject of extensive theoretical and experimental studies. So far experimental approaches have been limited to the light and strange quark sector. With the PANDA detector at the HESR at FAIR it will be possible to extend this kind of studies to the charm sector in antiproton-nucleus collisions. If the momentum of the incident antiprotons is properly selected, then they can annihilate with protons in the nucleus of a target atom and form charmed hadrons. The formed hadrons have relatively small momenta with respect to the nucleus and therefore act as a probe in the nuclear medium. In this talk I will discuss predicted effects on charmonium states and D mesons. In particular I will report on a study of the possibility to measure the J/Psi-nucleon dissociation cross-section with PANDA. This cross-section is relevant for the interpretation of the J/Psi suppression observed in high energy heavy ion reactions, a possible signature of the existence of a quark-gluon plasma.

Primary author: Dr BUEHLER, Paul (Stefan Meyer Institute)

Presenter: Dr BUEHLER, Paul (Stefan Meyer Institute)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **121** Type: **Oral Presentation**

Studies of the antikaon-nucleon interaction at DAFNE

Friday, 9 September 2011 13:40 (20 minutes)

The AMADEUS experiment [1] is the proposal presented at the DAFNE collider to investigate the antikaon-nucleon potential in the nuclear enviroment, and it is being preceded by the study of the hadronic interactions of K- in the 4He of the drift chamber of KLOE [2].

Studies on the field has a rather long story at DAFNE, starting with the DEAR and SIDDHARTA [3] experiment measuring the strong interaction in the kaonic hydrogen and other kaonic atoms.

The approach proposed by the AMADEUS experiment deals with one of the current hot topics in low-energy QCD, how deep is the antikaon-nucleon potential in the nuclear enviroment, and the possible existance of the kaonic clusters, where and antikaon plays glue-like role to bind nucleons forming deep states with a narrow width.

The intense theoretical debate between phenomenological optical potentials
included in the original prediction [4] of the deeply bound kaonic nuclear states and the more recent calculations
leading to larger widths and shallower potentials, and the different interpretations of the experimental results obtained so far (KEK, FINUDA, DISTO, etc) indicate the strong need of a dedicated experiment to the study of this scientific case.

The advantage of the AMADEUS proposal resides in the use of the large drift chamber of KLOE [5] and the almost full acceptance calorimeter, implemented with new devices around the interaction region to measure via missing mass and invariant mass the properties of the dibaryonic and trybarionic states when formed by the interaction of a stopped K- in light nuclei.
R&D work has already started to construct a dedicated target and trigger system for further improvements on kaon stopping efficiency and background suppression, taking, moreover, advantage of the high luminosity reached by the recently upgraded [6] DAFNE accelerator.

The AMADEUS collaboration is investigating the hadronic interactions of K- in the KLOE setup in the collected data from previous KLOE runs. Being the drift chamber composed mainly by helium, 0.1% of the K- should be stopped in the gas, giving an unique scenario to study the developed hadronic interactions in such an “active target”.
Results of the analysis of 2005 KLOE data are presented together with a study of the acceptancy of the spectrometer for such kind of evens using Monte Carlo.

[1] The AMADEUS collaboration, LNF preprint, LNF–07/24(IR) (2007).
[2] O. Vazquez Doce, presentation on 40th LNF Scientific Committee,
http://www.lnf.infn.it/committee/ (2010).
[3] Y. Akaishi and T. Yamazaki, Phys. Rev. C 65, 044005 (2002).
[4] M. Cargnelli et. al., Nucl. Phys. A 835, 27-34 (2010).
[5] M. Adinolfi et al., Nucl. Instr. Meth. A 488, 51-73 (2002).
[6] M. Zobov et. al., arXiv:0802.2667v1 [physics.acc-ph] (2008).

Primary author: Dr VAZQUEZ DOCE, Oton (LNF-INFN)

Presenter: Dr VAZQUEZ DOCE, Oton (LNF-INFN)

Session Classification: Contributions III

Track Classification: Strangeness in Matter

Contribution ID: **122** Type: **Oral Presentation**

Anti-kaons and Lambda (1405)

Tuesday, 6 September 2011 15:00 (30 minutes)

Properties and structure of the Lambda (1405) are interesting both in themselves and in the context of few-body and many-body nuclear states of anti-K mesons. One of the old problems is the place of Lambda (1405) in the quark models and related symmetries.

Another problem affecting the few body physics is related to the elastic anti-K nucleon scattering amplitude. The two approaches now put into practice of the few-body physics : the strong binding model and the chiral model approach are at this moment difficult to confirm or reject. This is related to one of old difficulties in this field – the kaon-nucleon amplitudes fixed in multichannel processes above the threshold become unstable when extrapolated below the threshold.
There are several, obvious, ways of improvement :
1) new precise experiments above the threshold
2) experiments related directly to the sub-threshold region
3) stabilization of the sub-threshold extrapolations of the semi- phenomenological models

I will try to compare several descriptions and discuss possible and perhaps impossible ways to study these points. Some chances of well known techniques will be discussed. In particular nuclear and radiative / atomic experiments. As far as the theory is concerned, I see a need to rely more on the analytical properties of the scattering amplitudes.

Primary author: WYCECH, Slawomir (Institute for Nuclear Studies)

Presenter: WYCECH, Slawomir (Institute for Nuclear Studies)

Session Classification: Kaonic Atoms

Track Classification: Kaonic Atoms

Contribution ID: **123** Type: **Oral Presentation**

Measuring the fall of antihydrogen: the AEGIS experiment at CERN

Monday, 5 September 2011 15:00 (20 minutes)

After the first production of cold antihydrogen by the ATHENA and ATRAP collaborations, second generation experiments are being performed for measuring the fundamental properties of this antiatom. AEGIS (Antimatter Experiment:Gravity, Interferometry, Spectroscopy) is an experiment with the goal of measuring the gravitational interaction between matter and antimatter with help of a pulsed, cold Antihydrogen beam. In AEGIS, antihydrogen will be produced by charge exchange reactions of cold antiprotons with positronium atoms excited in a Rydberg state(n>20).

In the first phase of the experiment, controlled acceleration by an electric field gradient (Stark acceleration) and subsequent measurement of free fall in a Moire deflectometer will allow a test of the gravity weak equivalence principle. In a second phase, CPT studies and detailed spectroscopy will become possible. In the present talk, after a general description, the present status of the experiment will be reviewed.

Primary authors: KELLERBAUER, Alban (MPI Heidelberg); DOSER, michael (cern)

Presenter: KELLERBAUER, Alban (MPI Heidelberg)

Session Classification: Antihydrogen

Track Classification: Antihydrogen

Contribution ID: **125** Type: **Oral Presentation**

Neutrinoless Double-Beta Decay

Tuesday, 6 September 2011 11:50 (30 minutes)

Neutrinoless double-beta decay provides a strong probe of physics beyond the standard model. The observation of such a decay would establish that the neutrino and anti-neutrino are the same particle - a so-called Majorana particle - and would help determine the absolute mass scale of the neutrino. In addition, it could provide insight into understanding lepton-number-violating processes, helping to illuminate causes of the observed matter-anti-matter asymmetry in the universe. The rarity of such a decay (current limits on the order of 10^22 - 10^25 years for various isotopes) underscores the need for large amounts of source material and ultra-radiopure detector components to maximize the potential signal to background. This talk will outline how different collaborations are addressing these experimental difficulties and present the current state-of-art of the field, as defined by recent and expected experimental results.

Primary author: Dr MARINO, Michael (TUM)

Presenter: Dr MARINO, Michael (TUM)

Session Classification: Precision Experiments II

Track Classification: Precision Experiments

Contribution ID: **126** Type: **Poster**

Energy dependence of KbarN interaction in nuclear medium

Tuesday, 6 September 2011 16:45 (20 minutes)

We have constructed effective separable meson-baryon potentials to match the equivalent chiral amplitudes with the parameters of the model fitted to the kaonic hydrogen and low energy K^-p reactions data [1]. When the $\bar{K}N$ system is submerged in nuclear medium the $\bar{K}N$ scattering amplitude and the final state branching ratios exhibit a strong energy dependence when going to energies below the $\bar{K}N$ threshold [2]. The observed behavior is related to the dynamics of the well known $\Lambda(1405)$ resonance as well as to a combined effect of in-medium Pauli blocking and kaon selfenergy. A sharp increase of $\bar{K}N$ attraction below the $\bar{K}N$ threshold provides a link between shallow $\bar{K}$-nuclear potentials based on the chiral $\bar{K}N$ amplitude evaluated at threshold and the deep phenomenological optical potentials obtained in fits to kaonic atoms data.
The energy and density dependence of the in-medium $R(K^-N \to \pi\Lambda)$ branching ratio has allowed us to explain the A-dependence of the Λ-hypernuclear production rates [3] measured by the FINUDA collaboration in the experiment with stopped kaons. Similarly, we demonstrate the impact of a subthreshold energy dependence of the in-medium $\bar{K}N$ amplitude on the characteristics of $\bar{K}$-nuclear states and on the construction of the K^--nuclear optical potential used to describe the kaonic atoms data [2, 4].

[1] A.Cieply and J.Smejkal, Eur. Phys. J. A43 (2010) 191
[2] A.Cieply, E.Friedman, A.Gal, and D.Gazda, J.~Mares, ArXiv:1102.4515[nucl-th]
[3] A.Cieply, E.Friedman, A.Gal and V.Krejcirik, Phys. Lett. B698 (2011) 226
[4] A.Cieply, E.Friedman, A.Gal, D.Gazda, and J.Mares, work in progress

Primary author: Dr CIEPLY, Ales (Nuclear Physics Institute, Řež)

Presenter: Dr CIEPLY, Ales (Nuclear Physics Institute, Řež)

Session Classification: Poster Session

Track Classification: Strangeness in Matter

Contribution ID: **128** Type: **Oral Presentation**

Hadron Physics at J-PARC

Friday, 9 September 2011 09:00 (30 minutes)

While the big earthquake happened in the last March in the east part of Japan had made significant damages to the J-PARC facilities, there are a lot of works ongoing at J-PARC to recover them as early as possible. We expect to have a beam early in the next year for commissioning. In this talk, I will summarize the hadron physics program to be carried out in near future at J-PARC including xi-hypernuclear spectroscopy, kaonic nuclei search, kaonic-atom X-ray measurement, search for qentaquark, hypernuclear gamma-ray spectroscopy, etc.

Primary author: Prof. NAGAE, Tomofumi (Kyoto University)

Presenter: Prof. NAGAE, Tomofumi (Kyoto University)

Session Classification: Facilities and Experiments I

Track Classification: Facilities and Experiments

Contribution ID: **129** Type: **Oral Presentation**

CP Violation at Belle

Wednesday, 7 September 2011 14:00 (20 minutes)

The Belle experiment at the KEK lab in Tsukuba, Japan, has accumulated a sample of about 770 million B-meson pair events between the years 1999 and 2010. This huge dataset allowed to establish CP violation in a number of B decays and in the interference between B mixing and some B decays. All CP-violating phenomena found at Belle are consistent with the Cabibbo-Kobayashi-Maskawa (CKM) mechanism, the only source of CP violation within the Standard Model of particle physics.

In this presentation I will briefly review the main measurements of CP violation in B meson decays and summarize the current status of the tests of the CKM mechanism.

Primary author: Dr SCHWANDA, Christoph (Institute of High Energy Physics, Austrian Academy of Sciences)

Presenter: Dr SCHWANDA, Christoph (Institute of High Energy Physics, Austrian Academy of Sciences)

Session Classification: Symmetries; Contributed Talks

Track Classification: Facilities and Experiments

Contribution ID: **131** Type: **Oral Presentation**

Strangeness Production in AA Collisions

Wednesday, 7 September 2011 09:50 (20 minutes)

We review the strangeness production data in heavy-ion collisions at energies arround the NN production threshold.
The dense nuclear matter environment produced in heavy-ion collisions provides unique opportunities to form strange few body systems. In search for those systems with strong decays special emphasis will be given to Λ p and Λ d correlations. Long lived weakly decaying ligh hypernuclei are accessible by the two body decay into a negative pion and a baryon. Results for p, d, t, ^{3}He, and $\alpha + \pi$ are reported.
The picture will be completed with the discussion of recent measurements of kaon flow over a wide impact parameter range for which comprehensive comparisons with state-of-the-art transport models will be shown.

Primary authors: Prof. HERRMANN, Norbert (Heidelberg University); LEIFELS, Yvonne (GSI)

Presenter: Prof. HERRMANN, Norbert (Heidelberg University)

Session Classification: Strangeness in Matter I

Track Classification: Strangeness in Matter

Contribution ID: **132** Type: **Oral Presentation**

Results from the kaonic hydrogen X-ray measurement at DAFNE and outlook to future experiments

Tuesday, 6 September 2011 14:00 (30 minutes)

The Kbar-N system at rest makes a sensitive testing ground for the understanding of strong interaction at low energies. At the DAFNE electron-positron collider of Laboratori Nazionali di Frascati we study X-ray transitions of kaonic atoms, taking advantage of the low-energy kaons produced by Phi-mesons decaying nearly at rest. In the SIDDHARTA (Silicon Drift Detector for Hadronic Atom Research by Timing Application) experimental program we are using X-ray spectroscopy of kaonic atoms to measure the strong interaction induced shift and width of the ground state. In this contribution we will report on the results for kaonic hydrogen and on preparations for an improved future experiment on kaonic deuterium.

Primary author: CARGNELLI, Michael (SMI Vienna)

Co-author: SIDDHARTA, Collaboration (various)

Presenter: CARGNELLI, Michael (SMI Vienna)

Session Classification: Kaonic Atoms

Track Classification: Kaonic Atoms

Contribution ID: **133** Type: **Oral Presentation**

CPT-symmetry studies with Antihydrogen

Monday, 5 September 2011 15:50 (20 minutes)

A number of approaches to physics beyond the Standard Model can accommodate minuscule violations of CPT invariance. Since CPT symmetry can be measured with ultrahigh precision, CPT tests offer an interesting phenomenological avenue to search for underlying physics. I discuss this line of reasoning in more detail, comment on the connection between CPT and Lorentz invariance, and review how CPT-symmetry breaking would effect the (Anti)hydrogen spectrum.

Primary author: LEHNERT, Ralf (Indiana University Center for Spacetime Symmetries)

Presenter: LEHNERT, Ralf (Indiana University Center for Spacetime Symmetries)

Session Classification: Antihydrogen

Track Classification: Antihydrogen

Contribution ID: **134** Type: **Oral Presentation**

Laudatio

Thursday, 8 September 2011 14:00 (15 minutes)

Presenter: RAUCH, Helmut (TU Vienna)

Session Classification: Symposium ”Creativity-Innovation - the Seed for Frontier Science”

Contribution ID: **135** Type: **Oral Presentation**

A love affair with quantum structures: from Moessbauer Effect to neutrino oscillations

Thursday, 8 September 2011 14:30 (30 minutes)

Presenter: HENNING, Walter F. (Argonne)

Session Classification: Symposium ”Creativity-Innovation - the Seed for Frontier Science”

Track Classification: Creativity-Innovation - the Seed for Frontier Science

Contribution ID: **136** Type: **Oral Presentation**

Toward Cold and Dense Antikaonic Nuclear Clusters

Thursday, 8 September 2011 15:00 (30 minutes)

Primary author: YAMAZAKI, Toshimitsu (RIKEN Nishina Center, Wako, Saitama 351-0198, Japan)

Presenter: YAMAZAKI, Toshimitsu (RIKEN Nishina Center, Wako, Saitama 351-0198, Japan)

Session Classification: Symposium "Creativity-Innovation - the Seed for Frontier Science"

Contribution ID: **137** Type: **Oral Presentation**

Giant Nuclear Systems and the Decay of the Vacuum in Supercritical Field

Thursday, 8 September 2011 16:20 (30 minutes)

Giant nuclear systems of the form U+U, U+Cm, etc. can be formed with life-times from 10-19 sec. to 10-21 sec. These life-times depend on mass transfer and energy loss. In such systems the e+e- -vacuum is overcritical and spontanous decay sets in. Paul Kienle has contributed with pioneering experiments to understand and verify many of the effects connected with these fundamental processes.
The vacuum structure for nucleons is different. In this case exists an upper potential well (the shell model) and a very deep lower well emerging out of the negative energy continuum. The lower well contains thousands of bound states. Holes in this lower well are bound antinucleons. This gives the possibility to create antinuclei like 4He-bar or 12C-bar, etc. directly out of
the vacuum. The recent discovery of 4He-bar gives first indications for support of these ideas.

Presenter: GREINER, Walter (FIAS)

Session Classification: Symposium "Creativity-Innovation - the Seed for Frontier Science"

Contribution ID: **138** Type: **Oral Presentation**

Super-heavy Elements in Nature

Thursday, 8 September 2011 16:50 (30 minutes)

Presenter: KUTSCHERA, Walter (Vienna University)

Session Classification: Symposium ”Creativity-Innovation - the Seed for Frontier Science”

Contribution ID: **139** Type: **Oral Presentation**

Paul Kienle: Life in Pictures

Thursday, 8 September 2011 17:50 (15 minutes)

Primary author: FABBIETTI, Laura (TU Munich)

Presenter: FABBIETTI, Laura (TU Munich)

Session Classification: Symposium "Creativity-Innovation - the Seed for Frontier Science"

Contribution ID: **140** Type: **Oral Presentation**

Latest results from HypHI

Wednesday, 7 September 2011 11:00 (30 minutes)

A hypernucleus, a nuclear bound system with strangeness, has been studied almost for six decades to obtain comprehensive understanding on the baryon-baryon interaction under the flavoured-SU(3) symmetry. Hypernuclei have been so far studied mainly by induced reactions of primary electron and secondary meson beams on the stable target materials. In these methods, an excellent resolution to look into details of the hypernuclear structure has been achieved, however, hypernuclei with extreme isospin and hypernuclei magnetic moments as well as exotic strangeness clusters can not be studied. Contrary, heavy ion induced reactions with the fixed target materials at the GSI SIS energies can open opportunities to study these subjects albeit the identification of them could be tough because of a large particle multiplicity. The HypHI project aims to perform the precise hypernuclear spectroscopy with stable heavy ion beams and rare isotope beams at GSI and towards the FAIR. The first HypHI experiment was already performed in 2009 at GSI, and the first results on Lambda Hyperons and hydrogen Lambda hypernuclei as well as the evidence for neutral strange two-body nuclei will be discussed.

Primary author: NAKAJIMA, Daisuke (GSI)

Co-author: Prof. SAITO, Takehiko (GSI)

Presenter: NAKAJIMA, Daisuke (GSI)

Session Classification: Strangeness in Matter II

Track Classification: Strangeness in Matter

Contribution ID: **141** Type: **Oral Presentation**

Search for Electric Dipole Moments at Storage Rings

Friday, 9 September 2011 09:30 (30 minutes)

An electric dipole moment (EDM) aligned with the spin of a fundamental particle violates both parity conservation and time reversal invariance, or, via the presumed CPT conservation, CP invariance. Standard Model predictions are much below current or anticipated experimental sensitivity levels; an observation within the next generation of searches will represent a new signature of CP violation and possibly contribute to our understanding of the matter-antimatter asymmetry of the universe.

This presentation outlines the possibility to use an electromagnetic storage ring to directly probe charged particles for an EDM at a sensitivity level approaching 10^-29 e.cm. Every sensitive electric dipole moment measurement proceeds in three steps: preparation of an intense highly polarized ensemble of particles; interaction of the EDM with a strong electric field for as long as possible; measurement of the spin evolution. For the storage ring technique, a polarized beam is accelerated and injected into the storage ring. Here the polarization is rotated to point along the momentum of the particles. While circling the ring the particles interact with a combination of a vertically oriented magnetic field and a radially oriented electric field. With a carefully controlled combination of electric and magnetic field strengths, the precession of the polarization caused by the interaction of the magnetic moment can be halted. The interaction between the EDM and the electric field causes the polarization to develop a vertical component, out of the ring plane.

The setup, status and R&D efforts of several experimental EDM searches based on the storage ring technique will be discussed, including those on the muon, proton and deuteron.

Primary author: Dr ONDERWATER, Gerco (KVI / University of Groningen)

Presenter: Dr ONDERWATER, Gerco (KVI / University of Groningen)

Session Classification: Facilities and Experiments I

Track Classification: Precision Experiments

Contribution ID: **142** Type: **Oral Presentation**

Physics topics at KLOE-2

Wednesday, 7 September 2011 14:20 (20 minutes)

The goal of the KLOE−2 experiment operating at the upgraded DAΦNE e+ e− collider is to collect an integrated luminosity of about 20 fb^−1 during 3-4 years of running. Measurements using the KLOE−2 apparatus equipped with the inner tracker, new scintillation calorimeters and the γγ taggers will allow to refine and extend the KLOE physics program on kaon physics and tests of fundamental symmetries as well as the quantum interferometry. Here the latest results from KLOE data analysis and perspectives at KLOE-2 will be presented.

Primary author: Mr SILARSKI, Michal (Jagiellonian University, Cracow, Poland)

Presenter: Mr SILARSKI, Michal (Jagiellonian University, Cracow, Poland)

Session Classification: Symmetries; Contributed Talks

Track Classification: Facilities and Experiments

Contribution ID: **145** Type: **Oral Presentation**

News from DISTO

Wednesday, 7 September 2011 11:30 (20 minutes)

DISTO data analysis on the exclusive pp->pLambdaK reaction at Tp=2.85 GeV showed a presence of a strange dibaryon with a mass M = 2267 MeV/c2 and a width Gamma = 118 MeV produced via pp->XK two body process. We study an energy dependence and an influence of N* resonances for the formation of this resonance.

Primary author: Dr SUZUKI, Ken (SMI Vienna)

Co-authors: Prof. MAGGIORA, Marco (Dipartimento di Fisica Generale ”A. Avogadro” and INFN, Torino, Italy); Prof. KIENLE, Paul (Excellence Cluster Universe, Technische Universität München, Garching, Germany); Prof. YAMAZAKI, Toshimitsu (Department of Physics, University of Tokyo, Tokyo, Japan)

Presenter: Dr SUZUKI, Ken (SMI Vienna)

Session Classification: Strangeness in Matter II

Track Classification: Strangeness in Matter

Contribution ID: **146** Type: **Oral Presentation**

Paul Kienle and the early days of FAIR

Thursday, 8 September 2011 14:15 (15 minutes)

Presenter: Prof. STÖCKER, Horst (GSI)

Session Classification: Symposium ”Creativity-Innovation - the Seed for Frontier Science”