8th International Conference on Nuclear Physics at Storage Rings - STORI'11

Report of Contributions

https://agenda.infn.it/e/3329

Contribution ID: **0** Type: **Parallel Contribution**

PANDA experiment at FAIR

La nuova Facility for Antiproton and Ion Research (FAIR), in costruzione presso il laboratorio GSI di Darmstadt, è il frutto di un lavoro sinergico, del laboratorio insieme ad un ampia comunità scientifica internazionale. Questa attività ha permesso di consolidare ed espandere il panorama scientifico del laboratorio e di aumentarne il livello di internazionalità portandolo a diventare un centro di ricerca di interesse mondiale.
A FAIR saranno disponibili fasci primari di ioni dall'idrogeno all'uranio e fasci secondari di ioni radioattivi e di antiprotoni di caratteristiche uniche.
Il panorama scientifico offerto da questo nuovo centro di ricerca è ampio e spazia dalla fisica atomica alla fisica dei plasmi allo studio della materia nucleare studiata fino ad arrivare a condizioni estreme di densità. Gli antiprotoni invece, sono, per questo laboratorio, una novità assoluta e permetteranno di allargare il programma scientifico al settore della QCD non perturbativa attraverso la produzione di sistemi adronici strani e/o charmati. Questi verranno studiati all'interno del rivelatore PANDA (antiProton Annihilation at Darmstadt) installato su un apposito storage ring.
Lo stato del progetto ed un'ampia carrellata sul programma scientifico saranno l'argomento della presentazione.

Primary author: Dr GIANOTTI, Paola (LNF)

Presenter: Dr GIANOTTI, Paola (LNF)

Track Classification: Nuclear Physics

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

Panda at fair

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Primary author: Dr GIANOTTI, Paola (LNF)

Presenter: Dr GIANOTTI, Paola (LNF)

Contribution ID: **3** Type: **not specified**

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Primary author: Dr BIANCO, Stefano (LNF)

Presenter: Dr BIANCO, Stefano (LNF)

Contribution ID: **4** Type: **Plenary Contribution**

KAONIC HELIUM3 and 4 MEASUREMENTS BY THE SIDDHARTA EXPERIMENT AT DAFNE

Thursday, 13 October 2011 15:05 (25 minutes)

The SDDHARTA experiment (SIlicon Drift Detector for Hadronic Atom Research by Timing Application) has the aim to perform kaonic atoms X-ray
transitions measurements, with the goal to better understand aspects of
the low-energy QCD in the strangeness sector. The experiment combined the
excellent low-energy kaon beam generated at DAFNE, allowing to use gaseous targets, with excellent fast X-rays detectors: Silicon Drift Detectors.
SIDDHARTA was installed on DAFNE in autumn 2008 and took data till late
2009. In the framework of SIDDHARTA we have performed the kaonic helium
transitions to the 2 level (L-lines) measurements: for the first time in a
gaseous target for helium4 and for the first time ever for kaonic helium3.
The interest for such type of measurement is rather high, being it motivated by two reasons: the so-called “kaonic helium puzzle” (even if this was solved by KEK-PS E570 experiment, but a cross-check was mandatory) and some theoretical predictions of possible high energy shift (at the level of 10 eV). In this presentation the results for the measurements to the 2p level (L-series) for kaonic helium4 and kaonic helium3 are presented.

Primary author: Dr SIRGHI, Diana Laura (LNF)

Presenter: Dr SIRGHI, Diana Laura (LNF)

Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **5** Type: **Plenary Contribution**

Recent GRAAL Results on Nucleon Spectroscopy at 750-1500 MeV

Tuesday, 11 October 2011 15:20 (25 minutes)

New precise experimental data on total photo-absorption cross sections are given for hydrogen, deuterium and carbon nuclei in the energy range from 0.75 to 1.5 GeV (see Figure). Measurement was performed with the back scattered tagged gamma beam (GRAAL facility at ESRF) and large acceptance detector LAGRANgE. The hadron contribution was obtained subtracting the background from the total yield. It is found that total photo-absorption cross sections for the deuteron is in strong disagreement with the literature data [1]. Respectively, the free neutron total cross section evaluated by subtraction of the proton cross section from the deuteron one, taking into account the Fermi motion effect, is found to be quite different as compared with [1]. New results show that proton and neutron cross sections are equal to each other within 5% of experimental accuracy. Also we see about 30% difference between the carbon and proton (neutron) cross section in absolute scale (see Figure) which can not be explained by Fermi motion effect in studied energy region. Obtained results are discussed in frame of the MAID model taking into account available data on partial meson photo-production cross sections on free and bound nucleons.

1. C. S. Armstrong et.al., Nucl. Phys. B 41, 445 (1972).

Primary author: Prof. NEDOREZOV FOR THE GRAAL COLLABORATION, Vladimir (INR RAS Moscow Russia)

Co-authors: Mr LAPIK, Alexander (INR RAS Moscow Russia); Dr TURINGE, Andrey (INR RAS Moscow Russia); Mr RUDNEV, Nicolai (INR RAS Moscow Russia)

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Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **6** Type: **Plenary Invited**

Recent BESIII results

Thursday, 13 October 2011 09:00 (35 minutes)

The BESIII detector, built at the Beijing Electron Positron Collider II (BEPC-II), is a powerful facility to study physics in the energy range up to 4.6 GeV, with a broad research program covering charmonium physics, D-physics, spectroscopy of light hadrons and tau-physics. BESIII has started to take data in 2008 and it has already collected a statistics of 226*10^6 J/Psi and 106*10^6 Psi' events, the world largest data sample on these charmonium states. Based on these data, recent results will be here presented.

Primary author: Dr SPATARO, Stefano (TO)

Presenter: Dr SPATARO, Stefano (TO)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **7** Type: **Parallel Contribution**

Kaon-nuclei interaction studies at low energies (the AMADEUS experiment)

Thursday, 13 October 2011 17:40 (25 minutes)

The AMADEUS experiment [1,2] aims to perform dedicated precision studies in the sector of low-energy kaon-nuclei interaction at the DAFNE collider at LNF-INFN. In particular, the experiment plans to perform measurements of the so-called (very debated) deeply bound kaonic nuclei and, if existent, to measure their properties (binding energies and widths) by using the stopped kaons in cryogenic gaseous targets (3He and 4He). AMADEUS will measure all particles coming from negative kaons stopped in these targets, so performing a full study of the various interaction channels. Other important measurements proposed are the low-energy interactions of negative kaons in various targets. The kaon beam is ideal (low-energy kaons from the phi-decay at DAFNE), while a dedicated setup will be implemented in the central region of the KLOE detector.
The analysis of the existing KLOE data and dedicated Monte Carlo simulations, give the opportunity to check the reconstruction capability for sigma and lambda particles (expected to be present in the decay channels of the exotic states) and to study the hadronic interactions of K- with the 4He that fills the drift chamber.
The results of AMADEUS will give a boost to the sector of non-perturbative QCD in the strangeness sector.
The physics program, preliminary results from the analysis of KLOE data and future plans will be presented.

References:

[1] AMADEUS Letter of Intent, http://www.lnf.infn.it/esperimenti/siddharta/LOI_AMADEUS_March2006.pdf

[2] The AMADEUS collaboration, LNF preprint, LNF07/24(IR) (2007).

Primary author: Mr PISCICCHIA, Kristian (LNF)

Presenter: Mr PISCICCHIA, Kristian (LNF)

Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **8** Type: **Parallel Contribution**

Velocity determination of hydrogen clusters at a cluster-jet target

Tuesday, 11 October 2011 12:20 (25 minutes)

The prototype of the cluster-jet target station for PANDA has been built up at the University of Münster. This setup allows for systematic studies on the production of high density cluster-jet beams and their properties. One important parameter determining the performance of internal targets for storage ring experiments is the target thickness. In case of the cluster-jet targets the target thickness is closely related to the mean velocity of the clusters. In this contribution we will present a technique developed for the determination of the velocity distribution of the clusters. Results obtained with this method will be shown and compared to calculations based on different gas dynamic models for the gas flow through the nozzle of the cluster source. Furthermore we will present first results of an extension of this technique which allows for the determination of the mass distribution of the clusters.

Supported by EU (FP6 and FP7) and BMBF (06MS253I and 06MS9149I).

Primary author: Mr TÄSCHNER, Alexander (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany)

Co-authors: Prof. KHOUKAZ, Alfons (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany); Ms KÖHLER, Esperanza (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany); Mr ORTJOHANN, Hans-Werner (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany)

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Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **9** Type: **Plenary Contribution**

Absolute measurement of the differential cross section for pp elastic scattering at ANKE-COSY

Monday, 10 October 2011 15:40 (25 minutes)

Very little is known experimentally on proton-proton elastic scattering in the energy range from 1.6 to 2.8 GeV for centre-of-mass angles between about 10 and 30 degrees. The differential cross section data that do exist seem to fall systematically below the predictions of the SAID data analysis program. Measurements in this kinematical region are possible at the ANKE spectrometer, which is situated inside the COSY-Jülich storage ring. The fast proton that is scattered at small angles is registered in the Forward Detection system and the slow recoil proton emerging at large angles is measured in one of the Silicon Tracking Telescopes.

The ANKE collaboration and the COSY machine crew have jointly developed a very accurate method for determining the absolute luminosity in an experiment at an internal target position. The technique relies on measuring the energy losses due to the electromagnetic interactions of the beam as it passes repeatedly
through the target and this can be done by studying the Schottky spectrum. This powerful technique allows one to measure the absolute differential cross section for elastic pp scattering with high precision.

Preliminary results from this experiments will be presented.

Primary author: Dr CHILADZE, David (High Energy Physics Institute, Tbilisi State University)

Presenter: Dr CHILADZE, David (High Energy Physics Institute, Tbilisi State University)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **10** Type: **Parallel Contribution**

Design and Performance of the Future Cluster-Jet Target for PANDA at FAIR

Tuesday, 11 October 2011 11:30 (25 minutes)

An internal cluster-jet target will be one of the two target
stations for the planned PANDA experiment at the antiproton accelerator
and storage ring HESR/FAIR.
Due to the significance of investigations of antiproton-nucleon interactions for PANDA,
hydrogen and deuterium are of largest interest as target material.
This type of target allows for a high and constant target
density at the interaction point as well as for the possibility
to vary the target density continuously during operation.
The prototype of the cluster-jet target has been built up in
complete PANDA geometry and set into operation at the University of Münster.
Using this prototype, important information on the future target
properties such as target beam dimensions and absolute target
thickness at the interaction point, i.e. 2m behind the nozzle, can be gained directly.
The design concept of the cluster generator for PANDA and the achieved performance will be presented.

Supported by EU (FP6 and FP7), BMBF (06MS253I and 06MS9149I) and GSI F&E

Primary author: Ms KÖHLER, Esperanza (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany)

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Presenter: Ms KÖHLER, Esperanza (Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **11** Type: **Plenary Contribution**

Excitation of the Delta(1232) isobar in deuteron charge exchange on hydrogen at 1.6, 1.8 and 2.3 GeV

Monday, 10 October 2011 16:35 (25 minutes)

Deuteron charge exchange break-up dp->{pp}n, where the final {pp} diproton system is at very low excitation energy and hence in the 1S_0 state, is a powerful tool to probe the spin-flip terms in the proton-neutron charge-exchange reaction. Recent measurements with the ANKE spectrometer at the COSY storage ring at 1.6, 1.8, and 2.3 GeV have extended this study into the pion-production regime in order to investigate the excitation of the Delta(1232) isobar in the dp->{pp}Delta^0 reaction. Values of the differential cross section and two deuteron tensor analysing powers, A_xx and A_yy, have been extracted in terms of the diproton production angle or Delta^0 invariant mass. These data can be interpreted in terms of the spin-longitudinal or spin-transverse contributions to the elementary np->pDelta^0 process. The results to be presented will also be compared to those obtained with the SPES-4 spectrometer at Saclay at 2 GeV, where only a single combination of A_xx and A_yy was measured.

Primary author: Mr MCHEDLISHVILI, David (High Energy Physics Institute of Tbilisi State University)

Presenter: Mr MCHEDLISHVILI, David (High Energy Physics Institute of Tbilisi State University)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **12** Type: **Plenary Contribution**

Precision measurement of the eta-mass at ANKE-COSY

Thursday, 13 October 2011 12:20 (25 minutes)

Measurements on the mass of the eta-meson performed at different experimental facilities over the last decade have resulted in very precise results but differ by up to 0.5 MeV/c2. In order to clarify this situation a new high precision measurement of the dp −> 3He eta reaction was conducted at the COoler SYnchrotron - COSY - of the Forschungszentrum Juelich using the ANKE magnetic spectrometer, with the aim to achieve a mass resolution of < 50 keV/c2 .
The main idea of this experiment is to measure at different excess energies, both the momenta of the circulating deuteron beam in COSY as well as the momenta of the emitted 3He nucleus. With the precise knowledge of these momenta the eta mass can be determined by pure kinematics. The method for determination of the eta mass, as well as results will be discussed in this presentation.
Supported by the COSY-FFE program.

Primary author: Mr GOSLAWSKI, Paul (Institut für Kernphysik, Westfälische Wilhelms-Universtität Münster, D-48149 Münster, Germany)

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Presenter: Mr GOSLAWSKI, Paul (Institut für Kernphysik, Westfälische Wilhelms-Universtität Münster, D-48149 Münster, Germany)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **13** Type: **Plenary Invited**

Performance and Perspectives of Hadron Storage Rings

Wednesday, 12 October 2011 09:00 (35 minutes)

Storage rings are used world-wide for various research topics and scientific applications. Next generation hadron storage rings are seeking for highest luminosity and precision. Advanced beam- and spin dynamics simulations are key tools to reach the required performance. In this presentation the performance of high-luminosity and resolution operation in the High-Energy Storage Ring HESR will be discussed and perspectives for high-precision of proposed storage rings for EDM (electric dipole moment) search presented.

Primary author: Dr LEHRACH, Andreas (IKP, FZ Jülich)

Presenter: Dr LEHRACH, Andreas (IKP, FZ Jülich)

Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **14** Type: **Parallel Contribution**

Internal targets for the PANDA Experiment

Friday, 14 October 2011 12:55 (25 minutes)

The requirements for the internal target of the PANDA experiment at the future antiproton storage ring HESR/FAIR are manifold and change according to the different physics investigated in the proposed experiments. The most severe limitation comes from the requirement of being a very thin (dilute) and localized clump of matter within the ultra-high vacuum of the storage ring. In case of a gaseous target material the use of even the thinnest windows is prohibited. A solution for that can be realized by a jet of nano- to microsized condensed matter particles (clusters, droplets or pellets) traversing the stored antiproton beam. Therefore, to exploit the capacities of the PANDA experiment to a maximum it is foreseen to provide both a cluster-jet as well as a pellet target which will be installed alternatively depending on the experimental program to be investigated.
In this presentation both targets for PANDA will be presented and discussed.

Primary author: Prof. KHOUKAZ, Alfons (University Münster)

Presenter: Prof. KHOUKAZ, Alfons (University Münster)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **16** Type: **Parallel Contribution**

Spin Filtering Experiment at COSY - First results

Tuesday, 11 October 2011 09:00 (25 minutes)

A stored polarized antiproton beam opens a wide area of new physical investigations. Even though there were several topical conferences since the 1980s, no method to provide a stored polarized antiproton beam could be established up to now. The PAX-Collaboration is investigating the method of spin filtering. A stored beam traverses a polarized gas target and builds up polarization by spin dependent attenuation. This method has been proven to work with protons at the Heidelberg TSR in 1992. In August/September 2011 the spin filtering method is repeated at Jülich COSY to commission the setup and detection system for a later first spin filtering experiment with antiprotons at the CERN-AD. The spin filtering method and first results of the COSY experiment will be presented.

Primary author: Dr OELLERS FOR THE PAX COLLABORATION, Dieter (INFN Ferrara)

Presenter: Dr OELLERS FOR THE PAX COLLABORATION, Dieter (INFN Ferrara)

Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **17** Type: **Parallel Contribution**

Synchrotron Oscillations Effects on Observations of an RF-solenoid Spin Resonance for a Polarized Deuteron Beam at COSY

Tuesday, 11 October 2011 10:35 (25 minutes)

The search for an electric dipole moment (EDM) using a polarized, charged-particle beam in a storage ring requires ring conditions that can maintain a longitudinal, and stable, polarization for times up to 1000 s. The EDM signal is a rotation of this polarization into the vertical direction as a consequence of the radial electric fields present in both electric and magnetic storage rings. A study is beginning at the COoler SYnchrotron (COSY) located at the Forschungszentrum-Jülich to examine the effects of emittance and momentum spread on the spin coherence lifetime. As these effects also appear in the properties of an RF-induced spin resonance, this study began by exciting the 1 − Gγ resonance with fixed and variable frequency RF-solenoid scans and a 0.97-GeV/c polarized deuteron beam. The scintillators from the EDDA detector were used with a thick carbon beam extraction target to provide a continuous record of the vertical polarization component. Subsequent model analysis of the data recorded for many different beam and solenoid conditions demonstrated through good agreement with the data that most of the observed effects originated in the time shift of deuterons passing through the solenoid as they underwent synchrotron oscillations inside first harmonic beam bunching. These effects are distinguishable from the effects of the spin tune spread that arises from finite emittance and momentum spread. The large change in beam bunch size and thus time shift between electron-cooled and uncooled beams produced very different vertical polarization responses to the RF-solenoid. This dependence created a sensitivity to the beam bunch shape that could be used to unfold that shape. The model, which does not include a detailed ring lattice, will be described along with a summary of phenomena observed during the experiment.

Primary author: Ms GUIDOBONI, Greta (University of Ferrara and INFN, 44100 Ferrara, Italy)

Presenter: Ms GUIDOBONI, Greta (University of Ferrara and INFN, 44100 Ferrara, Italy)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **18** Type: **Plenary Contribution**

Pion production in diproton reactions with polarized beams at ANKE-COSY

Monday, 10 October 2011 17:00 (25 minutes)

An experimental program to study near threshold pion production in the reactions pp->{pp}*s \pi^0 and pn->{pp}_s \pi^-, is undertaken at ANKE-COSY. The selection of the final proton pair {pp}_s in the 1S0 state, realized by cutting on the pair excitation energy E*{pp}<3 MeV, simplifies the theoretical analysis of the processes. The combined study of these reactions is motivated by the extension of Chiral Perturbation Theory ChiPT to pion production in NN collisions. The measurement of dSigma/dOmega, A_y^p and the spin-correlation coefficients A_{x,x} and A_{y,y} will provide a non-trivial test of the ChiPT predictions, and lead to the isolation of the strength parameter d of the four-nucleon-pion contact interaction in ChiPT.

Use of the polarized COSY beam and the ANKE polarized internal target allows one to conduct single and double polarisation experiments. The results of the measurement of dSigma/dOmega, A_y^p in the two processes, carried out with the polarized proton beam, will be reported. The first analysis of the recent double polarized measurement of A_{x,x} and A_{y,y} in pn->{pp}_s \pi^-, conducted with a polarized deuteron beam and a polarized hydrogen target, will also be presented.

Primary author: Dr DYMOV, Sergey (FZ-Juelich)

Presenter: Dr DYMOV, Sergey (FZ-Juelich)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **19** Type: **Parallel Contribution**

Status of the Storage Ring Design at FAIR

Tuesday, 11 October 2011 17:05 (25 minutes)

The large acceptance Collector Ring (CR) together with the High Energy Storage Ring (HESR) is the storage ring which will be realized in the Modularized Start Version (MSV) of the FAIR project [1]. It will be operated in three ion-optical modes, two of them providing fast pre-cooling of either antiprotons or RIBs. The CR design was recently adapted to the use as a pre-cooling ring for subsequent beam accumulation in the HESR. The third mode, namely the isochronous mode, is a special ion optical setting for mass measurement of exotic very short-lived nuclei. In this mode the CR will be operated as a Time-Of-Flight (TOF) spectrometer [2].
The latest results of the general storage ring concept at FAIR will be presented and future perspectives of the ring complex development will be discussed.

[1] FAIR project, http://www.gsi.de/fair
[2] A. Dolinskii et al., Nucl. Instr. and Meth. in Phys. Res. A 574, 207-212 (2007).

Primary author: Dr LITVINOV, Sergey (GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany)

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Presenter: Dr LITVINOV, Sergey (GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **20** Type: **Parallel Contribution**

Polarimeter and Spin Coherence Time Developments at COSY for a Storage Ring EDM Search

Tuesday, 11 October 2011 09:25 (25 minutes)

The Cooler Synchrotron (COSY) at Juelich offers an ideal environment for pursuing major feasibility questions associated with the possibility to search for electric dipole moments (EDM) on charged, polarized particles traveling in circulating beams. The first, whose analysis was completed in 2010, demonstrated that it is possible to correct for the geometric and rate systematic errors of a polarimeter mounted on an EDM ring to better than one part per million. Such a correction, which can be made in real time, requires a prior calibration of the sensitivity of the polarimeter to errors and the use of combinations of the measured counting rates as measures of the size of the error driving terms. This study also demonstrated the possibility to extract stored beam onto a thick target, thereby raising the efficiency of an EDM polarimeter to about 1% (particles used for a measurement divided by particles lost from the beam) with an effective analyzing power of at least 0.5. Second, the exploration of the use of higher order (sextupole) fields to reduce the decoherence of the required horizontally polarized beam has begun with the study of beam polarization manipulations using an RF solenoid. Already, coherence times of the order of minutes have been observed for electron-cooled deuteron beams.

Primary author: Dr STEPHENSON, Edward (Indiana University Center for Exploration of Energy and Matter)

Co-authors: Dr ONDERWATER, Gerco (KVI, Groningen, The Netherlands); Prof. LENISA, Paolo (University of Ferrara, Ferrara, Italy)

Presenter: Dr STEPHENSON, Edward (Indiana University Center for Exploration of Energy and Matter)

Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **21** Type: **Plenary Invited**

Internal Experiments at COSY-Juelich

Monday, 10 October 2011 14:30 (35 minutes)

The COoler SYnchrotron COSY at the Forschungzentrum Juelich accelerates protons and deuterons with momenta up to 3.7 GeV/c. COSY is the machine for hadron spin physics on a world-wide scale. In combination with internal polarized Hydrogen and Deuterium targets, the availability of electron and stochastically cooled polarized proton and deuteron beams allows for precision measurements.

The talk will highlight selected recent results from the ongoing spin physics program at COSY ring using the internal ANKE facility.

Primary author: Dr KACHARAVA, Andro (Institute for Nuclear Physics (IKP) FZ-Juelich)

Presenter: Dr KACHARAVA, Andro (Institute for Nuclear Physics (IKP) FZ-Juelich)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **22** Type: **Parallel Contribution**

Experiments with stored highly-charged ions at ISOLDE: TSR@HIE-ISOLDE proposal

Friday, 14 October 2011 10:10 (25 minutes)

Stored in heavy-ion storage rings, secondary beams enable a wide range of nuclear physics experiments. Such experiments profit, e.g., from high resolving power and excellent quality of cooled beams, from high revolution frequencies, which allows to "recycle" exotic nuclei, from ultra-high vacuum conditions, which allows to preserve high atomic charge states, from low background conditions, etc. These are some of the reasons, that a variety of novel ideas has been proposed in the recent years in addition to the well-established scientific programs on in-ring mass and half-life measurements [1,2].

However, many suggested experiments require stored, highly-charged exotic nuclei at relatively low energies of a few MeV/u. Therefore, it is of interest to explore the possibility of installing a storage ring at an ISOL facility, which naturally delivers low-emittance low-energy beams. To be more specific, we propose to store HIE-ISOLDE beams in a storage ring, where we would like to perform precision experiments. For this purpose we suggest to employ the Test Storage Ring (TSR) presently in operation in Heidelberg [3]. The running of the TSR will be stopped soon and it will be possible to move and install the TSR at HIE-ISOLDE facility. The physics cases include nuclear- and atomic physics experiments. A few examples of proposed studies are listed below:

- beta decay of highly-charged ions;
- astrophysical reactions;
- one- and two-nucleon transfer reactions;
- search for long-lived isomeric states;
- dielectronic recombination on exotic nuclei;
- clean isomeric beams;
- feasibility studies for beta-beam project.

In this contribution we will present the proposal, outline the physics cases and give the present status of the project.

[1] B. Franzke, H. Geissel & G. Münzenberg, Mass Spectrom. Rev. 27 (2008) 428
[2] X.L. Tu et al., Phys. Rev. Lett. 106 (2011) 112501.
[3] Ion Storage Ring TSR, http://www. mpi-hd.mpg.de/blaum/storage-rings/tsr/index.en.html

Primary authors: Prof. BLAUM, Klaus (Max-Planck-Institut für Kernphysik, Heidelberg); Prof. WOODS, Phil (University of Edinburgh, Edinburgh); Prof. RAABE, Riccardo (K.U.Leuven, Leuven); Prof. BLUMENFELD, Yorick (CERN, Geneva); Dr LITVINOV, Yuri (GSI, Darmstadt)

Presenter: Dr LITVINOV, Yuri (GSI, Darmstadt)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **23** Type: **Plenary Contribution**

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

Monday, 10 October 2011 17:25 (25 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.

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Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **24** Type: **Plenary Contribution**

"Optical"spin rotation phenomenon and spin-filtering of antiproton (proton, deuteron) beams in a nuclear pseudomagnetic field of a polarized nuclear target: the possibility of measuring the real and imaginary spin-depended part of the coherent zero-angle scattering amplitude

Tuesday, 11 October 2011 17:55 (25 minutes)

Despite long-lasting study and seeming simplicity, the investigation of two- and three-particle interactions is still a topical problem. Because these investigations are very important, the experiments with antiproton, proton and deuteron interactions are included in scientific programs of modern accelerators COSY, GSI and LHC.
For study of these interactions, polarization observables sensible to different mechanism of interaction is of particular interest as well as the differential reaction cross-section. Modern storage rings with a long lifetime of a beam permit one to carry out qualitatively new experiments with polarized beams and targets. Particularly, in the spin-filtering experiments [1] of antiprotons (protons, deuterons), it is possible to measure the spin-dependent part of a forward scattering amplitude [1-3]. Moreover, it is possible to measure the real part of a coherent elastic amplitude of proton (antiproton, deuteron) scattering at zero angle when the plane formed by the target polarization vector and the beam momentum direction lies in the orbit pane of the beam and the angle between these two vectors differs from 0, π or $\pi/2$ [2]. Measurement of the spin-dependent part of a forward scattering amplitude is possible by measuring the lifetime of the unpolarized beam passing through a polarized internal target [2]. Direct measurement of the tensor part of the deuteron-proton interaction can be performed by measuring the lifetime of the unpolarized proton beam passing through a tensor polarized deuterium target [3]. Let us note that in the considered methods with a deuteron beam or a target, the magnitude of the observable polarization effects depends on behavior of the wave functions of the deuteron ground state at small distances, which is important for studying non-nucleonic degrees of freedom in the nucleus.
The influence of high-frequency (g-2) spin precession in a ring is one of the problems we encounter in spin rotation measurements in a storage ring. In this regard, attention should be drawn to the EDM experiments based on freezing the horizontal spin motion, i.e., forcing the particles'spin to always point along the direction of motion thus cancelling the (g-2) precession [1]. Applying this method and polarized targets, the "optical"spin rotation phenomenon in a nuclear pseudomagnetic field of a polarized nuclear target can be observed, which is beneficial for the investigation of spin-depended interactions in the above experiments.

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Primary author: Mr ROUBA, Anatoli (Research Institute for Nuclear Problems)

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Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **25** Type: **Parallel Contribution**

Test of Time-Reversal Invariance at COSY

Tuesday, 11 October 2011 11:35 (25 minutes)

Time-reversal symmetry is one of the most fundamental symmetries in nature. CP-violation phenomena, which can be regarded as equivalent to T-violation provided that CPT is conserved, have been observed in the $K0$ and B systems. Currently all observed CP phenomena appear to be consistent with the standard model (SM) predictions. However, it is well known that in the SM this CP violation is many orders of magnitude too small to account for the apparent asymmetry between matter and anti-matter in the Universe.

The current upper limit for (parity-conserving) time-reversal non-invariance was obtained through measuring the total cross sections of a polarized neutron beam incident on a Holmium target. However, the interpretation of such data at a fundamental level is difficult due to the use of a complex nuclear targets. The theoretical understanding of measurements with a polarized proton beam and a deuterium target would certainly be much cleaner.

In order to improve the Holmium limit by an order of magnitude, the parity-conserving time-reversal violating observable $A_{y,xz}$ in proton-deuteron forward scattering would have to be measured with an accuracy of 10^{-6}. Such a measurement is planned as an internal target transmission experiment, requiring the use of a polarized proton beam and a tensor polarized deuterium target. In this experiment the COSY ring would serve simultaneously as accelerator, ideal forward spectrometer, and detector.

An openable storage cell and holding magnetic field system have recently become available at the low beta section of the COSY ring where the PAX studies are undertaken. Much more stable beam conditions can be achieved here than elsewhere in the ring. Using the large acceptance PAX detector system, in addition to performing a measurement of $A_{y,xz}$, it is also possible to search for violation of time-reversal invariance in differential observables.

The current status of the preparations for this experiment will be presented.

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Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **26** Type: **Plenary Invited**

Strangeness production on the neutron

Thursday, 13 October 2011 09:35 (35 minutes)

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\begin{document}

\begin{center}
\textbf{\large Strangeness production on the neutron}\\[3ex]
Colin Wilkin*\\[2ex]
Physics and Astronomy Department, UCL, London WC1E 6BT, UK\\[2ex]
\end{center}

In order to fully understand strangeness production in nucleon-nucleon collisions, it is crucial to obtain data with a neutron beam or target to complement the mass of results that are already available in the proton-proton sector. Such information is also important for the modelling of K^+ production in pA and AA-induced reactions. The challenge of getting proton-neutron data is being tackled in two different ways at the ANKE facility of the COSY-J\"ulich storage ring.

Inclusive momentum spectra of K^+ produced at small angles in proton-proton and proton-deuteron collisions have been measured at four beam energies, 1.826, 1.920, 2.020, and 2.650~GeV. After making corrections for Fermi motion and shadowing, the data to be presented indicate that strangeness production is much weaker in pn- than in pp-induced reactions, especially in the near-threshold region.

The precision achievable in a deuteron/proton comparison is very limited unless the production in pn collisions dominates. The situation is far cleaner if one carries out K^+p coincidence studies. Measurements were made in the Spring of $pd \to K^+pX$, where a slow recoiling proton was detected in one of the silicon tracking telescopes. This enables the CM energy in quasi-free pn collisions to be determined on an event-by-event basis. Below the threshold for Σ production, only Λ production is possible and these data will allow the total cross sections for the $pn \to K^+\Lambda n$ reaction to be extracted over a range of excess energies and to be compared with the well established $pp \to K^+\Lambda p$ measurements. The conditions of this experiment will be presented and analysed.

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Primary author: Prof. WILKIN, Colin (University College London)

Presenter: Prof. WILKIN, Colin (University College London)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **27** Type: **Plenary Contribution**

The eta -> pi+ pi- pi0 decay with WASA-at-COSY

Tuesday, 11 October 2011 17:30 (25 minutes)

Recently, a large statistics sample of approximately 3*10^7 decays of the eta meson have been collected with the WASA detector at COSY using the
pd ->3He reaction at beam kinetic energy 1 GeV. This data are being used to study the not so rare eta decays involving charged pions, like pi+ pi- pi0 . This decay proceeds mainly via a strong isospin violating contribution, where the decay width is proportional to the light quark mass difference squared, (md - mu)^2. Preliminary results of the analysis are presented.
Supported by BMBF, Wallenberg Foundation and Uddeholms Forskarstipendium.

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Presenter: Mr ADLARSON, Patrik (Uppsala Universitet)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **28** Type: **Parallel Contribution**

Spin control by RF fields

Tuesday, 11 October 2011 10:10 (25 minutes)

The first experiments to apply RF fields for resonant beam depolarization and spin flip at the VEPP-2M storage ring were
carried out more than 30 years ago.
Later this technique was used at VEPP-2M in the experiment for comparison of electron and positron anomalous magnetic moments.
Recently, interest in RF spin control has appeared at proton
machines. This paper describes a general approach for consideration
of RF influence on spin dynamics at electron (positron) and hadron
accelerators. Some practical applications of RF fields are
discussed.

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Presenter: Prof. SHATUNOV, Yuri (Budker Institute of Nuclear Physics)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **29** Type: **Plenary Contribution**

Numerical investigations of the WASA pellet target operation and proposal of a new technique for the PANDA pellet target

Tuesday, 11 October 2011 14:55 (25 minutes)

The conventional nozzle vibration technique of the hydrogen micro-droplet generation that is supposed to be used for internal pellet target production for the future PANDA experiment at the international FAIR facility in Darmstadtfor is described. The operation of this technique has been investigated by means of
detailed computer simulations. Results of calculations for the geometry and operation conditions of the WASA pellet generator are presented and discussed. We have found that for every given pellet size, there is a set of operation parameters where the efficiency of the WASA hydrogen pellet target operation is
considerably increased. Moreover, the results of presented computer simulations clearly show that the future PANDA pellet target setup can be realized with the use of much smaller (and cheaper) vacuum pumps than those used at present in the WASA hydrogen pellet target.
To qualitatively improve the PANDA hydrogen pellet target performance we have proposed the use of a novel flow focusing method of Gan˜a´n-Calvo and Barreto combined with the use of conventional vacuum injection capillary. Possibilities of this approach for the PANDA pellet target production have been also explored by means of computer simulations. The results of these simulations show that the use of this new approach looks very promising and in particular, there is no need here to use of expensive ultra-pure hydrogen to prevent nozzle clogging or freezing up due to impurities and it will allow simple, fast, smooth and a wide range of change of pellet sizes in accordance with requirements of different experiments at the PANDA detector.
We also propose and describe the idea of a new technique to break up a liquid microjet into microdroplets using a process of liquid jet evaporation under pulsed laser beam irradiation. This technique should be experimentally checked before it may be used in the design of the future PANDA pellet target setup.

Primary author: Prof. VARENTSOV, Victor (FAIR/ITEP)

Presenter: Prof. VARENTSOV, Victor (FAIR/ITEP)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **30** Type: **Plenary Contribution**

Measurement of π 0 decays with the WASA detector at COSY

Monday, 10 October 2011 17:50 (25 minutes)

The decay of the π 0 meson into an electron–positron pair is heavily suppressed in the Standard Model (SM) with an expected branching ratio of 6 × 108 . The decay is therefore sensitive to contributions from physics beyond the SM. Recently, the KTeV collaboration at Fermilab has performed a precise measurement of the π 0 ⟶ e+ e− decay branching ratio using a data sample of 800 events. The result is three standard deviations above the SM value. This has triggered speculations of e.g. a contribution from a light vector boson responsible for the annihilation of a hypothetical light dark matter particle. In one scenario a new light vector boson U (mass 10 − 100 MeV) is weakly coupled to the π 0 . This boson is expected to decay into a lepton pair and hence gives an extra contribution to the π 0 ⟶ e+ e branching ratio. The aim for WASA-at-COSY is to confirm the KTeV measurement. The status of the analysis is presented and prospects for a measurement at the KTeV sensitivity are discussed.

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Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **31** Type: **Parallel Contribution**

Spin dynamics in storage ring electric-dipole-moment experiments

Spin dynamics in electric-dipole-moment (EDM) experiments performed in storage rings is considered. If the frozen spin method [1] is used, the spin rotation in the horizontal plane is almost canceled by an appropriate radial electric field. General equations describing the spin dynamics are derived. Characteristic features of the spin behavior for different initial beam polarizations are shown. Advantages and disadvantages of any initial beam polarization are discussed.

Field distortions and misalignments of magnets bring systematical errors imitating the EDM effect. First-order systematical errors do not vanish when one averages the main fields. These errors can be eliminated with clockwise and counterclockwise beams. Second-order systematical errors (or geometrical phases) are caused by the noncommutativity of spin rotations. These errors may not be canceled with clockwise and counterclockwise beams. Methods of their elimination are considered. Systematical errors originated from the gravity and rotation of the Earth are evaluated.

Peculiarities of the spin dynamics in the deuteron EDM experiment caused by the tensor electric and magnetic polarizabilities of the deuteron [2] are discussed. The EDM, the tensor electric polarizability, and main systematical errors condition different spin behaviors [3].

Methods of keeping the spin coherence [4] are considered.

The work is supported by the BRFFR (Grant No. Ф10D-001).

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http://www.bnl.gov/edm/deuteron_proposal_080423_final.pdf

Primary author: Dr SILENKO, Alexander (Research Institute for Nuclear Problems)

Presenter: Dr SILENKO, Alexander (Research Institute for Nuclear Problems)

Track Classification: Accelerator Physics

Contribution ID: **32** Type: **Plenary Contribution**

Weak decay of Lambda–hypernuclei

Thursday, 13 October 2011 15:30 (25 minutes)

The information coming from the study of the Lambda-hypernuclei weak decay channels complements the knowledge of strange nuclear systems obtained by both missing mass and gamma-ray spectroscopy measurements. Lambda-hypernuclei decay through both the mesonic weak decay (MWD) processes:

AΛZ ⟶A(Z+1) + pi- (Γpi-) (1)
AΛZ ⟶(A)Z + pi0 (Γpi0) (2)

and the non-mesonic weak decay (NMWD) processes:

AΛZ ⟶(A-2)Z-1 + p + n (Γp) (3)
AΛZ ⟶(A-2)Z + n + n (Γn) (4)
AΛZ ⟶(A-3)Z'+ N + N + N (Γ2) (5)

The channel (5) is indicated as two-nucleon induced (2N) decay and refers to the interaction of the Λ with a couple of strongly correlated nucleons; Z' stands for Z, Z−1 or Z−2 depending on the particular nucleons combination. The FINUDA experiment performed a complete analysis of the charged particles (pi− and p) spectra following the MWD and
NMWD of 5ΛHe, 7ΛLi, 9ΛBe, 11ΛB, 12ΛC, 13ΛC, 15ΛN and 16ΛO hypernuclei.
MWD spectra and decay rates have been obtained for 7ΛLi, 9ΛBe, 11ΛB and 15ΛN, for the first time and compared with previous measurements and calculations. The spin-parity assign-ment Jp(15ΛNg.s.) = 3/2+ was made for the first time and the results have been published[1].
The FINUDA Collaboration also analyzed the proton energy spectra of 5ΛHe, 7ΛLi, 9ΛBe, 11ΛB, 12ΛC, 13ΛC, 15ΛN and 16ΛOwith good resolution (deltap/p=2% FWHM for protons of 80 MeV) and with a detection threshold of 15 MeV. All measured spectra showed a similar behaviour, i.e. a bump at about 80 MeV, roughly at the energy expected from reaction
(3)(with an incertitude of about 10 MeV due to several nuclear structure and interaction effects). The bump is quite well defined in the high energy portion, whereas at low energies it is blurred in a continuum generated by FSI, superimposed to the 2N-induced NMWD contribution. With very simple hypotheses and a model–independent method the contributions from FSI and 2N-induced NMWD were disentangled, providing a value of Γ2N/Γp of 0.43±0.25 and Γ2N/(ΓNMWD of 0.24±0.10 [2]. This method was recently improved with the further detection of a neutron, from which we determined the value of Γ2N/ΓNMWD with an error reduced of a factor about two respect to the previous FINUDA determination [2]. In fact, in spite of the low statistics, we determined the value of Γnp/Γp=0.39±0.16stat+0.04sys−0.03sys and Γ2N/ΓNMWD=0.21±0.07stat
+0.03sys−0.02sys. The value is in agreement, within the errors, with previous evaluations, model dependent or not, and with theoretical calculations [3].

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Primary author: Dr BUFALINO, Stefania (TO)

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Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **33** Type: **Plenary Contribution**

Present status of Rare-RI Ring project in RIKEN RI Beam Factory

Wednesday, 12 October 2011 11:50 (25 minutes)

We would like to present current status of Rare-RI Ring Project in RIKEN RI Beam Factory (RIBF). Rare-RI Ring consists of long injection line, septum magnets, fast-response kicker magnet and cyclotron-like storage ring. Main purpose of the Rare-RI Ring is to measure mass of unstable nuclei related to R-process, which are located very neutron rich side. Basic idea of the Rare-RI Ring and principle of mass measurements have been already described in Ref.[1]. SHARAQ spectrometer [2] will be used as a part of the injection line. The cyclotron-like storage ring will consist of recycling 24 sector magnets used in heavy-ion synchrotron TARNII. In the half of the sector magnets, we will put n-value and trim-coils to adjust isochronous field. According to our simulation, expected isochronicity is less than 10-6 with large emittance of the beam (~50 π-mm-mrad). Individual injection [3] is another important issue for the Rare-RI Ring. To perform the individual injection, fast response in kicker magnet is necessary. Very recently, we succeeded to excite the kicker magnet in ~400 ns after we improved response of cylatron trigger. This fast response allows us to inject RI beams with 200 A MeV, that is almost yield optimum energy for RI beams in RIBF.

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[2] S. Shimoura, NIMB 266 (2008) 4131.
[3] I. Meshkov et al., NIMA 523 (2004) 262.

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Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **34** Type: **Plenary Contribution**

Present status of storage rings at HIRFL

Wednesday, 12 October 2011 11:15 (35 minutes)

In this paper, present status of storage rings CSRm and CSRe at HIRFL in Institute of Modern Physics is introduced. During 3 years operation and upgrading, the performance of CSR is getting ready for high level physics experiments including nuclear physics related to high precision mass measurement, hardron cancer therapy and atomic physics research. In addition, further enhancements of the facility are undergoing including Schottky mass spectrometer and stochastic cooling in CSRe, upgrading of the injector will be introduced.

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Presenter: Prof. YUAN, You Jin (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **35** Type: **Plenary Invited**

PAX - The Road towards Polarized Antiprotons

Friday, 14 October 2011 09:35 (35 minutes)

The international collaboration PAX (Polarized Antiproton eXperiments) pursues the goal to establish "spin-filtering" (SF) as a method to produce an intense stored beam of polarized antiprotons to be used subsequently in internal experiments. SF repeatedly exploits the spin-dependent interaction of a stored beam with a polarized hydrogen target, thereby slowly building up polarization in the beam. SF has been shown to work for protons in FILTEX (FILTer EXperiment) at TSR (Heidelberg). PAX is in the process to commission all necessary equipment at COSY (FZ Juelich), where a proton SF-measurement will be performed in this autumn. The corresponding measurement with antiprotons is foreseen at CERN/AD, making use of the tested equipment and the experience gained at COSY.
A status report of the project, which is strongly endorsed by the hadron physics community(see NuPECC LRP 2010) and supported by an ERC AdG (Polarized Antiprotons), will be given.

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Presenter: Prof. STROEHER, Hans (Forschungszentrum Juelich Germany)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **36** Type: **Plenary Contribution**

First observation of the heavy hyper-hydrogen isotope 6ΛH

Thursday, 13 October 2011 16:25 (25 minutes)

The replacement of a nucleon with a Λ hyperon leads to the production of Λ-hypernuclei. These strange systems are more stable than ordinary nuclei due to the compression of the nuclear core and to the addition of an extra binding energy from the Λ hyperon, which plays the so called "glue-like"role, being free from the Pauli blocking effect. In this respect, Λ-hypernuclei are better candidates than normal nuclei to exhibit large neutron excess and neutron halo phenomena. The study of hypernuclei with high N/Z values can give information on baryon-baryon interaction and on the behaviour of hyperons in a medium with a much lower density than for ordinary hypernuclei. Moreover the role of the three-body ΛNN force, related to the coherent Λ–Σ coupling, can be investigated.
Great interest exists for the possible existence of 6ΛH (N/Z=4). Theoretical calculations [1] predict the existence of a stable single-particle state with a binding energy of 5.8 MeV from the 5H + Λ threshold when the Σ–Λ coupling is considered, while without this term the state would be very close to the 4ΛH + 2n threshold, with a binding energy of 4.4 MeV, as initially predicted by Majling [2]. Production rates have not yet been evaluated theoretically.
Experimentally, 6ΛH can be produced by the two-step Double Charge Exchange (DCX) mechanism: K- + p –> Λ + π0; π0 + p –> n + π+ on a 6Li target. The experimental observation of the production of such a neutron-rich hypernucleus would be the most evident example of the glue-like role of the Λ hyperon, being the 5H core above the 3H+2n emission threshold.
The FINUDA experiment, dedicated to the study of spectroscopy and decay of Λ-hypernuclei produced by means of the (K-stop, π-) Strangeness Exchange reaction at DAΦNE, the INFN Frascati φ-factory, studied the production of 6ΛH: with a partial data sample an upper limit of (2.5+-0.4) 10-5/K-stop at 90% C.L. [3] was obtained by analyzing the DCX π+ momentum. Considering the final data sample of the experiment it is now possible to perform a more accurate identification of the production, by requiring the coincidence of the π- coming from the mesonic decay of the hypernucleus: three events have been observed which can be attributed to the 6ΛH hypernucleus production and decay. The hypernuclear mass evaluated from the events is ~5801.4 MeV/c2, which would indicate the absence of a significant Λ–Σ coupling term contribution. The production rate is actually under evaluation: the preliminary indication is of the order of 10-6/K-stop. This is the first observation of 6ΛH.

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Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **37** Type: **Plenary Contribution**

Implementation of Silicon Detector Arrays in the UHV environment of Storage Rings *)

Wednesday, 12 October 2011 12:40 (25 minutes)

The presented work focuses on the implementation of complex and highly granular detector arrays in the UHV environment of a storage ring. The concept to be presented here was borne out when designing the detection system for the upcoming project "EXotic nuclei studied in Light ion induced reactions (EXL)"at the New Experimental Storage Ring (NESR) as a part of the future FAIR facility. By means of kinematically complete measurements in inverse kinematics, EXL provides for studying many physics phenomena in unstable nuclei. The crucial part of EXL is the 2π recoil particle detector ESPA. This detector array will consist of telescope-like segments which, depending on the different angular ranges, house pairs of double-sided silicon strip detectors (DSSDs) for particle tracking and identification, and the subsequent thick Si or Si(Li) detectors and/or CsI scintillator crystals for the spectroscopy and precise full-energy determination of high-energy particles. The innermost DSSDs are common for all the segments and will be arranged in a spherical configuration.

The major technical challenge is to install a large number of detector channels with the correlated front-end electronics, connectors and cables, and possibly cooling circuits at the beam-target interaction region of the NESR where the need of an UHV below the order of 10−10 mb requires low-outgassing and bakeable materials. For the implementation of all detectors in the NESR environment, a new differential pumping concept was envisaged where the storage ring UHV is maintained inside the innermost sphere of DSSDs which is acting as a vacuum barrier to an outer volume, with less stringent constraint in vacuum quality, containing the subsequent layers of detectors and unbakeable and thus outgassing electronic components. Since the vacuum barrier serves at the same time the purpose of an active window it enables the detection of recoil particles varying from protons to alphas down to about 100 keV energy, as required for the measurement at low momentum transfer.

The development, construction and testing of a prototype active vacuum window was carried out at GSI, Darmstadt, with a DSSD sensor of 19×19 mm2 active area. The PCB for the read-out of this detector was designed from aluminum nitride ceramic, chosen for its low outgassing, high thermal conductivity and thermal expansion close to that of silicon. After baking, vacuum separation better than six orders of magnitude was achieved, with the UHV side reaching down to the 10−10 mbar pressure region. The PCB-DSSD system was able to withstand bake-out cycles with unchanged spectroscopic performance. The chosen materials proved to be clean of any UHV disturbing contaminants. Currently, a larger DSSD of 64×64 mm2 active area is built up and tested, which forms already an essential part in the setup for an EXL-type predecessor experiment to be performed at the ESR storage ring at GSI. Details on detector design and performance will be discussed in this presentation.

*) This work was supported in part by BMBF (06DA9040I) and HIC for FAIR

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Nasser (KVI, Groningen, The Netherlands); Prof. EGELHOF, Peter (GSI Darmstadt, Germany); Dr ILIEVA, Stoyanka (GSI Darmstadt, Germany); Prof. KRÖLL, Thorsten (TUD, Darmstadt, Germany)

Presenter: Dr STREICHER, Branislav (KVI, Groningen, The Netherlands)

Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **38** Type: **Plenary Invited**

Precursor experiments to search for permanent electric dipole moments (EDMs) of protons and deuterons at COSY

Friday, 14 October 2011 09:00 (35 minutes)

COSY with its polarized beams, including new hardware (like a low-beta section and a Siberian snake), and the available target and detector systems is very close to function not only as a test-bench for the ongoing EDM related investigations on polarimetry, spin coherence time, etc., but it could be also utilized as is for precursor experiments, providing a directly measured solid number (i.e., systematic errors under control) for the upper limit of the EDM of protons and/or deuterons. In order to pursue high precision EDM studies, eventually leading to a new dedicated machine at Juelich, a new collaboration called JEDI (Juelich Electric Dipole moment Investigations) is presently being set up. The talk will present a number of ideas that could be carried out at COSY in terms of such precursor experiments.

Primary author: Dr RATHMANN, Frank (Forschungszentrum Jülich)

Presenter: Dr RATHMANN, Frank (Forschungszentrum Jülich)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **39** Type: **Parallel Contribution**

Phi-meson production on nuclei and in-medium phi-meson width

Tuesday, 11 October 2011 14:30 (25 minutes)

The production of phi-mesons in collisions of 2.83 GeV protons with C, Cu, Ag and Au nuclear targets has been measured with the ANKE magnetic spectrometer at the Cooler Synchrotron COSY. The phi was detected at small angles via its K+K- decay branch. The measured target mass dependence of the production cross section can be related to the in-medium phi width. Comparisons with three model calculations suggest a significant broadening of this width relative to the vacuum value of 4.3 MeV. The ANKE results in the momentum range 0.6-1.6 GeV/c will be presented and compared with findings from other experiments.

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Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **40** Type: **Plenary Contribution**

The many facets of dielectronic recombination studies at heavy ion storage rings

The resonant process of dielectronic recombination (DR) is a powerful spectroscopic tool that is utilized for many applications, e.g. for precision QED studies, astrophysics, benchmarks of state-of-the-art relativistic atomic theories or lifetimes measurements [1].
A relatively new use of DR is the deduction of nuclear properties such as nuclear spin, magnetic moment, change in the charge distribution and, potentially, the lifetime of long-lived nuclear states (isomers) from the dielectronic resonance spectra [2,3]. In the present contribution an overview of the many facets of DR studies at heavy ion storage rings will be given.
Special emphasis will be placed on the application of DR for nuclear properties. A decisive advantage of this new methodology over established methods (e.g. laser based techniques) is the free choice of charge state. For the present case of Li-like highly charged ions one decisively benefits from the simple atomic configuration with a single valance electron outside the closed K-shell. The interpretation of the atomic spectra with respect to the nuclear parameters is enabled on a full QED level [3,4].
Only very recently, our collaboration at the ESR storage ring of GSI has proven the feasibility of DR studies with in-flight synthesized Li-like radioisotopes (234Pa88+, 237U89+) [5,6]. The DR approach at heavy ion storage rings is very efficient and can be performed with just 10^3 - 10^4 stored ions and lifetimes of the nuclide down to roughly 10 s.

[1] A. Müller, Adv. At. Mol. Opt. Phys. 55, 293 (2008).
[2] M. Lestinsky et al, Phys. Rev. Lett. 100, 033001 (2008).
[3] C. Brandau et al, Phys. Rev. Lett. 100, 073201 (2008).
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[5] C. Brandau et al, J. Phys.: Conf. Ser 194, 012023 (2009).
[6] C. Brandau et al, Hyperf. Int. 196, 115 (2010).

Primary author: Dr BRANDAU, Carsten (ExtreMe Matter Institut (EMMI) and Research Division, GSI Helmholtzzentrum für Schwerionenforschung)

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Track Classification: Nuclear Physics

Contribution ID: **41** Type: **Plenary Contribution**

Experiments with heavy, highly charged ions –Status of the HITRAP project

Monday, 10 October 2011 11:55 (25 minutes)

At the GSI accelerator complex, using the universal linear accelerator UNILAC and the synchrotron SIS, highly-charged ions up to U92+ are produced by passing a 400 MeV/u beam through a gold foil stripping off all or nearly all electrons. The HITRAP facility is built to decelerate those ions to almost rest and to provide them to the experiments.
In a number of commissioning beam times, the deceleration in the ESR, the extraction, bunching and deceleration to 0.5 MeV/u has been shown. The remaining steps, deceleration to 6 keV/u and cooling in a cryogenic Penning trap are ongoing and will be discussed.
Precision experiments for atomic and nuclear physics purpose are being prepared and range from laser spectroscopy on stored ions, collision experiments with complete kinematic analysis to high precision mass measurements on single highly charged ions. The status of those will be discussed in the contribution.

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Presenter: HERFURTH, Frank (GSI)

Session Classification: Nuclear Physics I

Contribution ID: **42** Type: **Plenary Contribution**

Search for the 4He-eta bound state with WASA-at-COSY

Tuesday, 11 October 2011 15:45 (25 minutes)

We conduct a search for the 4He-eta bound state with WASA-at-COSY facility, via a measurement of the excitation functions for the dd -> 3-He p pi- reaction, where the outgoing p-pi pairs originate from the conversion of the eta meson on a nucleon inside the He nucleus. In June, 2008 first measurements of the excitation functions for the dd -> 3He p pi reaction were performed. In the experiment we used a slowly ramped COSY deutron beam, scanning the range of momenta corresponding to the variation of the excess energy for the 4He-eta system from - 60 MeV to 20 MeV.
The final results from the analysis will be presented.

Primary author: Mr KRZEMIEN, Wojciech (Jagiellonian University)

Presenter: Mr KRZEMIEN, Wojciech (Jagiellonian University)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **43** Type: **Plenary Contribution**

What can be learned from light meson decays

Thursday, 13 October 2011 10:35 (25 minutes)

The WASA facility is a 4π detector system, designed to study the hadronic production and the decays of light mesons. A high density pellet target combined with the high intensity beams of the Cooler Synchrotron COSY provide luminosities which allow studies of rare processes.

The WASA-at-COSY physics program focuses on the investigation of light meson decays with the aim of performing precision tests of Chiral Perturbation Theory and to scrutinize symmetries and symmetry breaking mechanisms in hadronic systems using rare decays. Additionally, hadron structure is studied through form factors. Contributions to dark matter searches are made by studying very rare leptonic decay modes of light pseudo scalar mesons.

The light meson decay program at the WASA facility at COSY will be outlined and some highlights of π^0, η and ω decay studies will be presented.

Primary author: Dr REDMER, Christoph Florian (Department of Physics and Astronomy, Uppsala University)

Presenter: Dr REDMER, Christoph Florian (Department of Physics and Astronomy, Uppsala University)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **44** Type: **Parallel Contribution**

Production of Xi hyperons in the storage ring HESR in PANDA

Thursday, 13 October 2011 17:15 (25 minutes)

The most recent developments in the field of the Strong Interaction Physics led the High Energy Community to investigate very rare reactions (production of strange baryons, formation of heavy quark systems?) using quite rare projectiles like antiprotons or kaons (1,2). Since these reactions have in general very low cross section, they require very intense beams to produce high statistics and it is mandatory to avoid as much as possible to waste the projectiles. In order to obtain high quality beams, projectiles are sometimes stored in rings and targets are located inside the ring pipe. As an example the FAIR project (3) foresees to accumulate the antiprotons inside the High Energy Storage Ring (HESR) and to put some targets inside the beam pipe to produce reactions at each passage of the antiproton bunch. The transmitted beam is re-cooled and re-focused after each target crossing. This technique, which recovers the transmitted beam, puts some severe constraints on the target design.
In the frame of the production of hypernuclear reactions, the PANDA Collaboration planned to produce Xi hyperons and Doubly Strange systems using antiprotons at 3GeV/c inside HESR. The 2-target set-up includes a solid diamond target to be located within the beam pipe. Sizes and densities of the target, together with the antiproton beam profile, will play a crucial role in the hyperon production rate, beam losses and background on the detector. To maximize the former effect and minimize the latter ones the width and thickness has been evaluated to be of the order of some micron. Some prototypes of the target have been constructed and their mechanical and thermal properties are under test.
After a short review of the physics items that will be investigated in the hypernuclear section of the experiment (production and spectroscopy of doubly strange hypernuclei, double hypernuclei , doubly strange exotic atoms…), the characteristics of the antiprotons facility will be presented. The results of the feasibility study concerning the effects of the antiproton interactions with the solid target and the optimization of material and sizes will be also reported together with the expected rates of the production of stopped hyperons per day.

(1) K.Szymanska et al., Acta Phys. Pol. B 41, 285 (2010)
(2) K. Tanida et al. Hyperfine Interact. 193, 81 (2009)
(3) F. Iazzi, Few-Body Systems, vol. 43, no.1, pp. 97 (2008)

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Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **45** Type: **Plenary Contribution**

Study of pionless two-nucleon K^- absorption at rest by FINUDA

Tuesday, 11 October 2011 17:05 (25 minutes)

Data on two-nucleon K^- absorption in mesonless final states, $K^- + N + N \to YN$, are very scarce and dated. Most of the existing
capture rates have been inferred indirectly from mononucleonic absorptions, and only results for ^{4}He, ^{12}C, Ne and CF_3Br exist, obtained by
bubble chamber experiments [1]. The general understanding is that pionless two-nucleon K^- absorption could account for a fraction of all captures as large as 20\%.

The knowledge of the capture rates of such reactions is important as they represent the major background source in hypernuclear studies, as the phase space for the decay particles from produced hyperons overlaps with the spectra of hypernuclear formation pions and of the hypernuclear non-mesonic decay products [2,3]. Especially in case of rare decays, these reactions could give an overwhelming contribution, difficult to be separated from the searched signals. So, the knowledge of their occurrence rate is fundamental for correct background estimations.

At the DAΦNE ϕ-factory kaons from the ϕ decays were stopped in the FINUDA experiment in a series of thin targets, to perform hypernuclear spectroscopy studies as well as investigations on kaon absorption mechanisms on single and many nucleons. The pionless absorption reactions
$K^-A \to \Sigma^- pA'$ and
$K^-A \to \Lambda(\Sigma^-0)nA'$,
occurring on a (np) pair embedded in the A nucleus, were studied for some p-shell nuclei, namely ^{6}Li, ^{7}Li, ^{9}Be, ^{13}C and ^{16}O.
The Σ^- hyperons in the final states were reconstructed via their $n\pi^-$ decay mode, while the Λ's by means of their charged decay, the charged pions and protons being detected and identified by the FINUDA magnetic spectrometer. Neutrons, on the other hand, were detected by a large scintillator array completing externally the apparatus, featuring an efficiency of $\sim$ 10\%.

The emission rates for the mentioned reactions, as a function of the mass number A, were measured for the first time. In this presentation, they will be discussed and compared to the existing measurements and theoretical expectations, also in connection with the recent measurements of FINUDA of the analogous rates for single nucleon kaon absorptions,
$K^-_{stop}A \to \Sigma^\pm\pi^\mp A'$ [4].

References

[1] C. Vander Velde-Wilquet et al., Nuovo Cim. 39 (1977), 538, and references therein
[2] FINUDA Collaboration, M. Agnello et al., Phys. Lett. B698 (2011), 219
[3] FINUDA Collaboration, M. Agnello et al., Phys. Lett. B685 (2010) 247
[4] FINUDA Collaboration, M. Agnello et al., paper submitted to Phys. Lett. B (2011)

Primary author: Dr FILIPPI, Alessandra (TO)

Presenter: Dr FILIPPI, Alessandra (TO)

Session Classification: Hadron Physics II

Track Classification: Nuclear Physics

Contribution ID: **46** Type: **Plenary Contribution**

Status of the PANDA experiment at FAIR

Friday, 14 October 2011 12:05 (25 minutes)

PANDA is a next generation hadron physics detector planned to be operated at the future Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany. It will use intensive cooled antiproton beams with a momentum between 1.5 GeV/c and 15 GeV/c interacting with various internal targets. The PANDA detector is a state-of-the-art internal target detector at the HESR at FAIR allowing the detection and identification of neutral and charged particles almost in the whole solid angle. A PANDA physics program and the experimental set-up as well as a current status of the experiment are described in the report.

Primary author: Prof. VASILIEV, Alexander (IHEP-Protvino)

Presenter: Prof. VASILIEV, Alexander (IHEP-Protvino)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **48** Type: **Plenary Contribution**

Isomers in the Experimental Storage Ring at GSI

Monday, 10 October 2011 10:35 (25 minutes)

An experiment was undertaken to study stored and cooled 197Au projectile-fragmentation products in March 2009. First results from this have recently been published [1]. Using the SIS-FRS-ESR setup at GSI it was possible to observe metastable nuclear excitations (isomers) with energies up to 3 MeV, and half-lives extending to minutes or longer. This talk presents briefly the published results of the experiment, before discussing in depth a novel analysis technique which reveals new low-energy isomeric states in odd-A and odd-odd neutron-rich Z = 73 –76 nuclides. Because of "merging"and/or poor frequency resolution of traversing ions it can be impossible to distinguish ions with very close mass-to-charge ratios, which makes the study of these low-energy metastable states extremely taxing. The analysis technique to avoid this situation will be discussed together with the nuclear structure interpretation.

[1] M.W. Reed et al., Phys. Rev. Lett. 105 (2010) 172501

Primary author: Mr REED, Matthew (University of Surrey)

Co-authors: Dr CULLEN, Ian (University of Surrey); Prof. WALKER, Philip (University of Surrey); Dr LITVINOV, Yuri (GSI - Darmstadt)

Presenter: Mr REED, Matthew (University of Surrey)

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **49** Type: **Plenary Contribution**

Measurements of proton –induced reactions on ruthenium-96 in the ESR at GSI

Monday, 10 October 2011 11:30 (25 minutes)

Storage rings offer the possibility of measuring proton- and alpha-induced reactions in inverse kinematics. The combination of his approach with a radioactive beam facility allows, in principle, the determination of the respective cross sections for radioactive isotopes. Such data are highly desired for a better understanding of astrophysical nucleosynthesis processes like the p process.
A pioneering experiment has been performed at the Experimental Storage Ring (ESR) at GSI using a stable 96Ru beam at 9-11 AMeV and a hydrogen target. Stored and cooled bare ions may pick up a proton in the ESR whenever they cross the hydrogen jet. The products of the 96Ru(p,γ) reaction were detected by two Double Sided Silicon Strip Detectors (DSSSD) mounted in a pocket on the inside of the ESR. Each detector had 16 strips in X- and Y- direction. The efficiency for (p,γ) events was close to 100%. As the experiment was performed at energies of 9-11 AMeV, competing (p,n) and (p,α) reactions occured too and could not be neglected. These events have to be discriminated from the desired proton capture reactions based on the position on the DSSSD. An additional background component is elastic scattering of ruthenium ions on protons. A Multi-Wire Proportional counter (MWPC) allowed the detection of electron-pick-up reaction, hence a determination of the luminosity based on this well known reaction.
Monte-Carlo simulations of the experiment were made using the Geant4 code. In these simulations, the experimental setup is described in detail and all reaction channels can be investigated. Based on the Geant4 simulations, a prediction of the shape of different spectral components can be performed. A comparison of simulated predictions with the experimental results shows a good agreement and allows the extraction of the cross section.

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Presenter: Ms RASTREPINA, Ganna (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **50** Type: **Plenary Contribution**

Production of Heavy Baryons at the SuperB

Thursday, 13 October 2011 16:50 (25 minutes)

The SuperB accelerator will be an asymmetric heavy flavour factory where e+, e- beams will collide with a peak luminosity of 10^36 cm-2 s-1 at the Y(4S) resonance c.m. energy of 10.58 GeV. The B-Bbar meson pairs, produced with a B.R. > 96% from the decay of the Y(4S), will allow to measure the B-meson decay channels with unparalled precision.
The SuperB e+, e- beams are characterized, at the interaction region (I.P.), by transversal dimensions of only few microns. This fact could open the possibility to put very close to the I.P. a suitable shaped target to intercept the negative B mesons before their decay. As a result of the interaction of the slow negative B mesons with the nucleons of the target nuclei, baryons with beauty, as the LAMBDAb and the SIGMAb/SIGMA*B, can be produced with high cross section. A production rate in excess of 2000 heavy baryons per day per nucleon seems achievable. If confirmed, this would allow a systematic study of the properties of the heavy baryons with beauty (for which not so many data exist) and, furthemore, to investigate their interactions with nucleons in nuclei, a topic totally unexplored until now. The possibility to implement such a configuration on the SuperB will be discussed and the results of preliminary calculations presented.

Primary authors: Dr FELICIELLO, Alessandro (INFN Sezione di Torino); Prof. BRESSANI, Tullio (INFN Sezione di Torino and Dipartimento di Fisica Sperimentale Universita' di Torino); Dr LUCHERINI, Vincenzo (LNF)

Presenter: Dr LUCHERINI, Vincenzo (LNF)

Session Classification: Nuclear Physics III

Track Classification: Hadron Physics

Contribution ID: **51** Type: **Plenary Invited**

Hadron Physics at KLOE and KLOE-2

Monday, 10 October 2011 15:05 (35 minutes)

The KLOE experiment has collected 2.5 fb-1 at the peak of the phi resonance at the e+e- collider DAPHNE in Frascati. The whole data set includes 100 million eta's produced through the radiative decay phi −> eta gamma and tagged by means of the monochromatic recoil photon. Measurements of eta decay channels, such as pi+ pi- gamma, are in progress. We have also measured the branching ratio of the eta −> e+ e- e+ e- decay channel, never observed before, with a sample of about 360 events.

Pseudoscalar production at the phi-factory associated to internal conversion of the photon into a lepton pair allows the measurement of the form factor F(q1^2=M(phi)^2,q2^2>0) of pseudoscalar mesons in the kinematical region of interest for the VMD model. The only existing data on phi −> eta e+ e- are based on 213 events. At KLOE, a preliminary study of this decay has been performed on 739 pb-1 using the eta−>pi+pi-pi0 final state. Simple analysis cuts provide about 7000 signal events with very small residual background contamination.

From a sample of 240 pb-1 taken off the phi resonance, a preliminary analysis of the e+ e- −> e+ e- eta process, without tagging e+e- in the final state is presented. Using two different decay channels, eta −> pi+ pi- pi0 and eta −> pi0 pi0 pi0, the cross section of the process e+ e- −> e+ e- eta is extracted. The same data set has been
used to search for the f0(600) that can be produced in gamma-gamma interactions and observed in the reaction e+ e- −> e+ e- pi0 pi0. The preliminary pi0pi0 mass spectrum show an excess of events with respect to the expected background in the f0(600) mass region.

A new beam crossing scheme allowing for a reduced beam size and increased luminosity is operating at DAPHNE. The KLOE-2 detector is successfully rolled in this new interaction region and is ready to acquire collision data. At the moment, the detector is being upgraded with small angle tagging devices, to detect both high and low e+e- energy in e+ e- −> e+ e- X events. The inner tracker and small angle calorimeters are scheduled to be installed in a subsequent step, providing wider acceptance for both charged particles and photons. The main goal of KLOE-2
is to collect an integrated luminosity of about 20 fb^-1 in 2-3 years in order to refine and extend the KLOE physics programme.

Primary author: Dr GIOVANNELLA, Simona (LNF)

Presenter: Dr GIOVANNELLA, Simona (LNF)

Session Classification: Hadron Physics I

Track Classification: Hadron Physics

Contribution ID: **52** Type: **Plenary Contribution**

Exploiting di-muon production at PANDA

Tuesday, 11 October 2011 14:55 (25 minutes)

The physics program of the future PANDA experiment includes the investigation of the non-perturbative region of the QCD by mean of antiproton beams, eventually polarised, with a beam momentum up to 15 GeV/c. Part of the PANDA spectrometer is devoted to the muon identification, that allow to access many among those processes needed to probe the nucleonic structure. The high foreseen luminosity should allow to investigate the Drell-Yan (DY) production of muon pairs. This reaction is a unique tool to access the spin depending properties of the nucleon, and in particular its transverse degrees of freedom, by means of experimental asymmetries leading to the Transverse Momentum Dependent Parton Distribution Functions (TMD PDF's). Moreover, a scan across the J/psi mass region should allow a measurement of the phase between the strong and the electromagnetic amplitudes of the J/psi decay. The investigations on the azimuthal asymmetries, and on the J/psi scan expected in the PANDA scenario will be discussed in detail.

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Presenter: Dr DESTEFANIS, Marco (Universita' degli Studi di Torino and INFN)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **53** Type: **Plenary Contribution**

Feasibility Studies for the EXL Project at FAIR*

Tuesday, 11 October 2011 12:00 (25 minutes)

As part of the upcoming FAIR facility, the EXL (Exotic nuclei studied in Light-ion induced reactions at the NESR storage ring) project is proposed to capitalize on light-ion induced direct reactions in inverse kinematics by using storage ring techniques. This contribution presents the results of feasibility measurements performed at GSI, Darmstadt and Tübingen University for the EXL project.
In order to investigate the response of the DSSD (Double-Sided Silicon Strip Detector) to very low energy recoil protons, a detector test was performed at the 3 MeV Van de Graaff accelerator at Tübingen University. The proton beam with an energy around 500 keV was scattered by carbon and gold targets. After reducing the energy of the protons in a Mylar foil, low-energy protons were detected in a prototype detector for the EXL recoil detector array, namely a 300 μm thick 7.1×7.1 mm2 DSSD with 300 μm pitch. The results of the measurements will be presented.
In order to investigate the performance of a Si detector under realistic storage ring conditions, a measurement was carried out at the Experimental Storage Ring (ESR) of GSI. The stored 400 MeV/nucleon 40Ar beam was interacting with an internal hydrogen gas-jet target. An UHV compatible single-sided Si strip detector of 1 mm thickness and 40×40 mm2 area was mounted inside the UHV chamber around the internal gas-jet target to detect the recoil protons. The Si strip detector was read out in five groups of eight strips each. Energy deposition and position of the particles were obtained by the charge division method. Preliminary results of the target performance, the background condition of the detector for very low energy recoil protons, as well as the differential cross section for p+40Ar elastic and inelastic scattering will be presented.

*) This work was supported in part by BMBF (06DA9040I) and HIC for FAIR

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Presenter: Dr YUE, Ke (GSI, Darmstadt, Germany)

Session Classification: Nuclear Physics II

Contribution ID: **54** Type: **Plenary Contribution**

Extensive high precision studies of proton deuteron breakup reactions at COSY

Tuesday, 11 October 2011 16:40 (25 minutes)

The rich kinematical region in proton deuteron breakup reactions at low to intermediate energy offers a versatile laboratory for the chiral effective field theory, the modern theory of nuclear forces. Presently the spin structure of the three nucleon continuum exhibit disparate results when comparing experimental data to theoretical predictions based on two-nucleon potentials either with or without three nucleon interactions. The inclusion of three-nucleon forces in the calculations does not consistently improve the agreement between data and theory. Precise measurements of most of the spin observables over large areas of phase space would give necessary constraints for advancing the understanding of the strong interaction in this non-perturbative regime. To this aim we plan an experiment at the COSY cooler synchrotron and storage ring, measuring proton deuteron breakup reactions at proton beam energies from 30 to 50 MeV. This is an ideal energy range for testing the predictive power of chiral effective field theory and for providing a data base for the characterization of the non-vanishing contributions from the chiral three-nucleon force appearing at third and fourth order. Furthermore there are only few and limited polarization data available in this kinematical region.

The requirement for high precision measurements is met by the access to the newly installed PAX low-beta target section at COSY. The setup comprises an atomic beam source, a breit-rabi polarimeter and the design of a new multipurpose detection system, consisting of double sided silicon strip sensors in a barrel-type arrangement.
The five-dimensional phase space will be extensively explored both in the planning stage and for the final analysis of the experiment, using pre-calculated theoretical grids and the so called sampling method developed specifically for the investigation of three-particle final states. A close collaboration with the theory groups of IKP in Jülich and at Bochum and Bonn Universities is a precondition and has been initiated.

A brief overview of the field will be given. The PAX experimental setup will be described and theoretical predictions with sensitivity studies for specific spin observables will be presented.

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Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **55** Type: **Plenary Invited**

Development and characterization of microscopic liquid droplet internal target beams

Friday, 14 October 2011 11:30 (35 minutes)

The use of internal targets is a powerful method to investigate fundamental atomic and nuclear processes in a storage ring. We will present here the recent advances in the development of high density internal targets from a microscopic liquid droplet beam, by focusing on their characterization by using highly charged ions (HCI) in a storage ring. In particular, we will show that a liquid droplet target beam virtually behaves like a homogeneous gas jet target with respect to both energy loss and ion beam cooling. We will also present a first quantitative study on the cooling efficiency of HCI interacting with a dense hydrogen target. Major drawbacks of a liquid droplet target beam will be discussed, and possible current valid alternatives presented.

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Presenter: Dr GRISENTI, R. (JW Goethe-University Frankfurt am Main)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **56** Type: **Plenary Contribution**

Isomeric beams, LIfetimes and MAsses: The ILIMA project at FAIR

Tuesday, 11 October 2011 15:45 (25 minutes)

Nuclear physics experiments in heavy-ion storage rings have proven a high potential over the last decades [1,2]. The ILIMA collaboration (Isomeric beams, LIfetimes and MAsses), based on experiences with the GSI Experimental Storage Ring (ESR) and IMP cooler-storage ring (CSRe) aims at accurate measurement of masses, lifetimes and decay modes of nuclear isomers and ground states at the new FAIR facility, where the new super-conducting high-acceptance fragment separator Super-FRS will provide access to the most exotic nuclear species. These nuclides will be separated in flight and stored in dedicated storage rings, where their properties will be studied.

Two complementary techniques of isochronous mass spectrometry (IMS) and Schottky mass spectrometry (SMS) have been developed. The former one enables mass measurements with a relative mass accuracy of about 1*10^{-6} for nuclides with lifetimes below 0.1 ms. Whereas the latter one, applied to electron-cooled ions (cooling time requires about 1 s), allows reaching mass uncertainties of a few 10 keV only.

Both techniques require just a few particles for a successful measurement, and therefore give access to the nuclides with extremely small production yields. This has for instance been demonstrated by the accurate mass measurement of 208Hg [3], which has been achieved on a single stored hydrogen-like ion. The decay mode of a single ion can be characterised through accurate mass determination before and after the decay event [4].

The ILIMA collaboration is developing the next generation of experiments which inevitably demands new generation detection and analysis methods. In this contribution the present status of the project will be given. Also the planned future developments will be outlined.

[1] B. Franzke, H. Geissel and G. Münzenberg, Mass Spectr. Reviews 27 (2008) 428.
[2] Yu. A. Litvinov and F. Bosch, Rep. Prog. Phys. 74 (2011) 016301.
[3] L. Chen et al., Phys. Rev. Lett. 102 (2009) 122503.
[4] M.W. Reed et al., Phys. Rev. Lett. 105 (2010) 172501.

Primary authors: Prof. ILIMA, Collaboration (http://www.gsi.de/forschung/fair_experiments/NUSTAR/ilima_e.html); D
LITVINOV, Yuri (GSI Helmholtzzentrum für Schwerionenforschung)

Presenter: Dr LITVINOV, Yuri (GSI Helmholtzzentrum für Schwerionenforschung)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **57** Type: **Plenary Contribution**

Investigations of the charge symmetry conserving reaction dd -> 3Henpi^0 with WASA-at-COSY

Thursday, 13 October 2011 11:55 (25 minutes)

Investigations of charge symmetry breaking become one of the most important topics for the WASA detector at COSY. One of the planned studies concentrates on the charge symmetry forbidden dd ->alphapi^0 reaction. Experimental results will be compared with Chiral Perturbation Theory (ChiPT) predictions gaining information on the up and down quarks mass difference.
First steps toward a theoretical understanding of the dd->alphapi^0 reaction have been taken. It was found that the existing data are not sufficient for a precise determination of the parameters of the ChiPT and new data are required. These new data should comprise the measurement of the charge symmetry forbidden dd->alphapi^0 reaction and the charge symmetry conserving
dd -> 3Henpi^0 reaction. The measurement of the second reaction is necessary in order to study the relevance of initial and final state interaction, which strongly influence the results for the dd->alphapi^0 reaction.
Final experimental results of the investigation of the dd -> 3Henpi^0 reaction at a beam momentum of 1.2 GeV/c will be presented. For the first time information on the total cross section and the differential distributions of this reaction were obtained. The total cross section was measured with an accuracy of about 11%. Various differential distributions exhibit a rich structures indicating important contributions of higher partial waves. The differential distributions are compared to theoretical expectations based on a phenomenological approach –the combination of a quasi-free model and a
partial wave expansion model for the three-body reaction.

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Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **58** Type: **Plenary Contribution**

KLOE measurement of the $\sigma(e^+e^- \to \pi^+\pi^-(\gamma))$ with Initial State Radiation and its contribution to the muon (g-2). Future prospects with KLOE-2

Thursday, 13 October 2011 11:30 (25 minutes)

The KLOE experiment at the ϕ factory DAΦNE in Frascati
(near Rome) is the first to have employed Initial State Radiation (ISR) to
precisely determine the $e^+e^- \to \pi^+\pi^-(\gamma)$ cross section below
1 GeV. Such a measurement is particularly important to test the Standard
Model calculation for the (g-2) of the muon, where a long standing
3σ discrepancy is observed.
In 2005 and 2008 KLOE has published a measurement of the
$\pi^+\pi^-$ cross section with the photon emitted at small angle, and a
new independent measurement with the photon emitted at large angle using
data taken in 2006 at a collision energy of 1 GeV ({\it i.e.} 20 MeV below
the ϕ-peak) has been published this year.
While these measurements were normalized to the DAΦNE luminosity
using large angle Bhabha scattering, a new analysis has been performed
which derives the pion form factor
directly from the $\pi^+\pi^-\gamma(\gamma)/\mu^+\mu^-\gamma(\gamma)$
ratio.
We present the KLOE results and discuss future prospects for these
measurements as well as their impact on the evaluation of the hadronic
contribution to the muon anomaly.

Primary author: Dr MANDAGLIO, Giuseppe (University of Messina)

Presenter: Dr MANDAGLIO, Giuseppe (University of Messina)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **59** Type: **Parallel Contribution**

Hard x-ray polarimetry applied to stored high-Z ions

Tuesday, 11 October 2011 09:50 (25 minutes)

Studies of the polarization of hard x-rays emitted in energetic heavy-ion atom collisions provide detailed information of the collision dynamics as well as of the atomic structure at high-Z [1]. Moreover, hard x-ray polarimetry also opens a route for polarization diagnosis of spin-polarized ion and electron beams as are discussed for future PNC experiments [2,3]. However, due to the lack of efficient polarimeters previous studies of the radiation stemming from highly-charged ions were mainly restricted to measurements of the spectral and angular distribution. Owing to recent progress in the development of highly segmented solid-state detectors, a novel type of Compton polarimeter for the hard x-ray regime has become available [4]. We present a position sensitive Si(Li) detector that was developed within the SPARC collaboration as a dedicated Compton polarimeter for the the energy region between 70 and a few 100 keV [5]. First measurements indicate that this instrument now allows precise and efficient measurements of photon linear polarization properties in various experimental environments [6,7,8]. Results from recent polarization studies performed at the ESR storage ring at GSI [7] and at the polarized electron source SPIN at the TU Darmstadt [8] will be presented.

[1] Th. Stöhlker et al., Eur. Phys. J.-Spec. Top. 169, 5 (2009)
[2] A. Surzhykov et al., Phys. Rev. Lett. 94, 203202 (2005)
[3] A. Bondarevskaya et al., J. Phys. B 43, 245001 (2010)
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[6] S. Hess et al., J. Phys. Conf. Proc. 195, 012025 (2009)
[7] G. Weber et al., Phys. Rev. Lett. 105, 243002 (2010)
[8] R. Märtin et al., AIP Conf. Proc. 1336, 94 (2011)

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Presenter: GÜNTER, Weber (Helmholtz-Institut Jena)

Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **60** Type: **Plenary Invited**

TSR@ISOLDE - The First Storage Ring Facility at an ISOL Facility

Tuesday, 11 October 2011 09:35 (35 minutes)

It has been proposed to use the Test Storage Ring (TSR) from MPI-K, Heidelberg, at the High Intensity Energy Isolde (HIE-ISOLDE) facility to perform experiments with stored exotic nuclides. With the integration of TSR at HIE-ISOLDE it would become the first storage ring at an isotope separator on-line (ISOL) facility. This, in combination with the capability of going to low beam energies (some MeV/u), opens up a broad area of research and offers unique opportunities for studies in nuclear structure and nuclear astrophysics. A substantial fraction of the vast number of radioactive beams produced at the ISOLDE facility, largely exceeding 800 isotopes from 70 elements, could be injected into the ring for storage, beam deceleration or acceleration. As injector, the superconducting HIE-ISOLDE Linac could be used. This Linac is an energy upgrade of the present REX-ISOLDE facility, designed to provide a final beam energy of at least 10 MeV/u for ion mass-to-charge ratios less than 4.5.

The project layout at its present stage will be presented, including the interfacing of the ring with the HIE-ISOLDE Linac beam lines. The different operational possibilities and constraints that arise when the ring is connected to an ISOL facility with a successive charge breeder will be addressed. The aspects of beam storage life-time, with and without an internal gas jet target, and attainable beam intensities at these energies will be discussed. The possibilities to perform beam cleaning inside the ring to suppress isobaric contaminants which can be present from the ISOL production stage will be evaluated. Finally, the ion charge-state requirements will be mentioned among other items.

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Presenter: Dr WENANDER, Fredrik (CERN)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **61** Type: **Plenary Contribution**

FLAIR, a next-generation facility for low-energy antiprotons

Friday, 14 October 2011 12:30 (25 minutes)

Eberhard Widmann

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The recently founded Facility for Antiproton and Ion Research FAIR at Darmstadt [1] will provide antiproton beams of intensities that are two orders of magnitude higher than currently available. Within the original plan of the full facility, antiprotons can be decelerated to 30 MeV using the NESR storage ring. This has triggered a proposal for a dedicated low-energy facility FLAIR (Facility for Low-energy Antiproton and Ion Research) [2,3], which was accepted in 2005.

FLAIR is designed to provide cooled antiproton beams using two storage rings of 300 keV and 20 keV minimum energy, enhancing greatly the number of antiprotons stopped in dilute gases or ion traps for precision spectroscopy compared to CERN-AD. Further advantages of FLAIR are the availability of slow-extracted (i.e. continuous) beams of antiprotons, thereby enabling nuclear and particle physics type experiments needing coincidence techniques, and the simul-taneous availability of unstable nuclei at low energies. This enables the use of antiprotons as hadronic probes for nuclear structure by determining neutron halos or skins.

An overview on the technical capabilities, planned experimental program and status of FLAIR will be given.

References

[1] http://fair-center.eu/

[2] FLAIR letter of intent (2004), available from http://gsi.de/forschung/fair_experiments/flair/index_e.html.

[3] FLAIR Technical Proposal (2005), available http://gsi.de/forschung/fair_experiments/flair/index_e.html.

Primary author: Prof. WIDMANN, Eberhard (Stefan Meyer Institute)

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

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **62** Type: **Invited Parallel**

Atomic Physics Research with Highly Charged Ions and Exotic Nuclei at the Future FAIR Facility

Tuesday, 11 October 2011 09:00 (35 minutes)

Thomas Stoehlker (1,2,3) and Reinhold Schuch (4)

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2 Physikalisches Institut, University of Heidelberg, 69120 Heidelberg, Germany
3 Helmholtz Institute Jena, 07743 Jena, Germany
3 Atomic Physics, Fysikum, AlbaNova University Centre, S-10691 Stockholm, Sweden

An overview about the envisioned program of the research collaboration (Stored Particle Atomic Research Collaboration, http://www.gsi.de/sparc) at the future GSI accelerator facility will be given. This program exploits the key features of the future international accelerator that offer a range of new and challenging opportunities for atomic physics and related fields [1]. Particular emphasis will be given to the current R&D activities of SPARC at the ESR storage ring.
In SPARC we plan experiments in two major research areas: collision dynamics in strong electromagnetic fields and fundamental interactions between electrons and heavy nuclei up to bare uranium. In the first area we will use heavy ions up to the relativistic energies for collision studies.
With the extremely short, relativistic enhanced field pulses, the critical field limit (Schwinger limit) for lepton pair production can be surpassed by orders of magnitudes. Com-plementary to the relativistic collision regime, at low ion energies the atomic interactions are dominated by strong perturbations and quasi-molecular effects. Here even investigations of the super-critical field regime will be possible.
The cooler ring NESR a "second-generation" ESR will have optimized features and novel in-stallations. This unique facility will allow for a broad range of experimental studies ranging from single ion decay spectroscopy to experiments exploiting highest beam intensities for accu-rate x-ray spectroscopy of atomic transitions in the heaviest one- and two-electron ions. These experiments will focus on structure studies of selected highly-charged ion species, a field that is still largely unexplored; with determinations of properties of stable and unstable nuclei by atomic physics techniques on the one hand, and precision tests of quantum electrodynam-ics (QED) and fundamental interactions in extremely strong electromagnetic fields on the other hand.
Different complementary approaches will be used such as relativistic Doppler boosts of optical or X-UV laser photons to the X-ray regime, or coherent radiation by channelling of relativistic ions, or electron-ion recombination, or electron and photon spectroscopy that will give hitherto unreachable accuracies. These transitions can also be used to laser-cool the relativistic heavy ions to extremely low temperature. Another important scenario for this class of experiments will be the slowing-down, trapping and cooling of particles in the ion trap facility HITRAP. There high-accuracy experiments in the realm of atomic and nuclear physics will be possible [3].

References

[1] SPARC Technical Proposal (2005) http://www.gsi.de/onTEAM/grafik/1068560945/ sparc-technical-proposal_print.pdf
[2] Th. St^hlker et al. NIM B: Beam Interactions with Materials and Atoms 261, 234 (2007)
[3] H.-J. Kluge et al., Advances in Quatum Chemistry, 53, 83 (2008)

Primary author: Prof. STOEHLKER, Thomas (GSI)

Presenter: Prof. STOEHLKER, Thomas (GSI)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **63** Type: **Parallel Contribution**

Polarized ion beams in atomic physics research

Tuesday, 11 October 2011 10:40 (25 minutes)

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(3) Department of Physics, FI-90014 University of Oulu, Finland
(4) Helmholtz-Institut Jena, 07743 Jena, Germany

In our presentation we will review the recent proposals for the production of the polarized ion beams and the methods for measuring of their polarization. Special emphasis will be placed on the application of atomic physics techniques. In particular, we will show how the charge transfer processes, occurring in storage rings, may serve as very sensitive probes of the heavy-ion spin polarization [1,2]. Besides the discussion of the operation and diagnostics of polarized beams, we shall stress their importance for the studies on fundamental symmetries in both atomic and nuclear physics. In this line, we recall the application of (polarized) highly-charged ions for for investigating parity nonconservation effects, the existence of a permanent electric dipole moment, or for testing the Standard Model [3].

References:

[1] A. Surzhykov, S. Fritzsche, Th. Stoehlker, and S. Tashenov, Phys. Rev. Lett. 94, 203202 (2005).
[2] A. Surzhykov, A. Artemyev, V. Yerokhin, Phys. Rev. A 83, 062710 (2011).
[3] L. Labzowsky and A. Prozorov, J. Phys.: Conf. Ser. 72, 012010 (2007).

Primary author: SURZHYKOV, Andrey (University of Heidelberg)

Presenter: SURZHYKOV, Andrey (University of Heidelberg)

Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **64** Type: **Parallel Contribution**

The ELISe electron rare isotope scattering experiment - status and perspectives

Tuesday, 11 October 2011 15:20 (25 minutes)

Haik Simon for the ELISe collaboration

At the New Experimental Storage Ring (NESR) at the FAIR facility an intersecting electron ion ring (eA collider, [1]) will allow scattering electrons with an energy of 125-500 MeV off exotic nuclei. The eA collider will enable for the first time to perform elastic, inelastic and quasielastic electron scattering off shortlived radioactive isotopes [2]. Charge distributions, transition form factors in giant resonance or electrofission experiments and spectral functions can be measured with a clean electromagnetic probe. The collider kinematics has the advantage that it will be possible to detect electrons and target like ejectile in coincidence. One of the most challenging aspects in this context is the design of a high-resolution electron spectrometer [3,4] with large acceptance adapted to the specific demands of an in-ring experiment. The impact of the worked out newest design options on the physics programme of the ELISe experiment will be discussed.

[1] NUSTAR/ELISe - Baseline Technical Report (2006)
[2] The electron-ion scattering experiment ELISe at the International Facility for Antiproton and Ion Research (FAIR)-A conceptual design study
Nucl. Inst. Meth. A637 (2011) 60-76
[doi:10.1016/j.nima.2010.12.246]
[3] A novel spectrometer for studying excotic nuclei with the electron/ion collider ELISe
Nucl. Inst. Meth. A640 (2011) 123-132
[doi:10.1016/j.nima.2011.02.025]
[4] Constant gap spectrometer design for the Electron/Ion Collider ELISe
To be published, Nucl. Inst. Meth. A

Primary author: Dr SIMON, Haik (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Presenter: Dr SIMON, Haik (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **65** Type: **Plenary Invited**

Nuclear Physics at the Lanzhou storage ring

Monday, 10 October 2011 09:35 (35 minutes)

The nuclear physics program of the Lanzhou storage ring will be illustrated

Primary author: Prof. XU, H. S. (Institute of Modern Physics)

Presenter: Dr WANG, Meng

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **66** Type: **Plenary Contribution**

Progress on direct mass measurements with the FRS-ESR facility at GSI

Monday, 10 October 2011 10:10 (25 minutes)

Baohua Sun for the FRS-ESR mass collaboration

Heavy ion storage rings operated in an isochronous mode and/or equipped with the phase-shape cooling devices can be used for high-precision, high-sensitivity and high-efficiency mass measurements of stored nuclei. This has been achieved at GSI Darmstadt, where two complementary methods, Schottky Mass Spectrometry (SMS) and Isochronous Mass Spectrometry (IMS) were developed based on the combination of the fragment separator (FRS) and the storage ring (ESR). So far the storage ring spectrometry has been successfully used in covering more than 1/3 of known nuclei in mass measurements [1]. In this contribution, we will discuss the progress on mass experiments, with emphasis on the new isotopes (236Ac, 224At, 221Po, 222Po, and 213Tl) discovered [2] and the first extension of IMS in isomeric investigation [3]. Recent developments in the instrumentation like the application of resonant Schottky pick up will also be briefly reported.
References:
[1] B. Franzke, H. Geissel, and G. Muenzenberg, Mass Spectrom. Rev. 27 (2008) 428.
[2] L. Chen, et al., Phys. Lett. B 691 (2010) 234–237; L. Chen, PhD thesis, JLU Giessen, 2008.
[3] B. Sun, et al., Phys. Lett. B 688 (2010) 294–297

Primary author: Dr SUN, Baohua (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Presenter: Dr SUN, Baohua (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **67** Type: **Parallel Contribution**

A new data analysis technique for isochronous mass measurement at CSRe

Tuesday, 11 October 2011 10:15 (25 minutes)

X. L. Tu, Y. H. Zhang, H. S. Xu, Yu. A. Litvinov
and Cooperation Group of Mass Measurement at CSRe

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GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Storage ring plays an important role in atomic mass measurement. One of operation modes, the isochronous mass spectrometry, has been successfully operated at the experimental ring CSRe in IMP. This mode is based on the accurate determination of revolution time for the stored ions. However, due to instability of the magnetic fields of CSRe, the revolution time may drift, thus deteriorate the mass resolving power of the spectrometry. In this talk, a new data-analysis technique has been developed to correct the drift in the revolution time, thus yielding a mass resolving power of (m/Δm) ~1.7×105(sigma).

Primary author: TU, Xiaolin (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: TU, Xiaolin (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: Nuclear Physics II

Track Classification: Nuclear Physics

Contribution ID: **68** Type: **Plenary Invited**

The Evolution of Lepton Collider Detectors

Wednesday, 12 October 2011 10:10 (35 minutes)

The character and capabilities of lepton storage ring detectors has naturally evolved. I will discuss the configurations of recent and current detectors at VEPP, the b-factories, LEP, and potential detectors at a Muon Collider or a linear electron collider, CLIC/ILC.

Primary author: Dr HAUPTMAN, John (Iowa State University)

Presenter: Dr HAUPTMAN, John (Iowa State University)

Session Classification: Accelerator physics and detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **69** Type: **Plenary Contribution**

The Nuclear Physics Program at the NESR Storage Ring at FAIR

Monday, 10 October 2011 12:20 (35 minutes)

Nasser Kalantar-Nayestanaki, for the EXL collaboration
KVI, University of Groningen, Groningen, The Netherlands

The upcoming FAIR facility in Darmstadt, Germany, will produce intense high energy beams of exotic nuclei, electrons and anti-protons, which will be used to explore the properties of new regions of the chart of nuclides of key importance for both nuclear structure and nuclear astrophysics. Since the nucleus under study is the one which is produced in the process of in-flight fragmentation, one has to deal with unusual kinematics in which the probe, generally a light nucleus, anti-protons and electrons, is the target being bombarded by the heavy nucleus. Anti-protons and electrons are accelerated as well and collide with the nucleus under study. At FAIR, there are plans to have several rings for all these activities. The radioactive ions are guided to the New Experimental Storage Ring (NESR) and bombard extremely thin stationary targets in the so-called inverse kinematics within the EXL program. The large revolution frequency of the beam in the ring compensates for the small target thickness and creates reasonable luminosities and unique possibilities for nuclear reaction studies. The same ring will be used for precision mass and decay measurements of radioactive ions by the ILIMA collaboration. Electrons will be accelerated in a different ring and collide with the radioactive nuclei in the ELISe experiment emphasizing the electromagnetic interaction with nuclei. Finally, the anti-protons will be brought to the same ring and collide with radioactive nuclei highlighting yet other aspects of nuclear structure.
The physics case and challenges for all these experiments will be discussed in this talk.

Primary author: Prof. KALANTAR-NAYESTANAKI, Nasser (KVI, University of Groningen)

Presenter: Prof. KALANTAR-NAYESTANAKI, Nasser (KVI, University of Groningen)

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **70** Type: **Plenary Contribution**

Neutral kaon interferometry at KLOE and KLOE-2

Thursday, 13 October 2011 10:10 (25 minutes)

Neutral kaons produced in correlated pairs at a phi-factory offer unique possibilities to perform fundamental tests of CPT invariance, as well as of the basic principles of quantum mechanics. The analysis of the
data collected by the KLOE experiment at DAFNE is still ongoing with the aim of improving previous results and limits on several parameters describing CPT violation and/or decoherence.
Ancillary measurements like the regeneration cross section on the beam pipe
materials are also in progress and will be very useful to reduce the systematic uncertainties.
Prospects on improvements at the KLOE-2 experiment, aiming at an increase of the
integrated luminosity of about a factor ten with an upgraded detector, will be also discussed.

Primary author: BALWIERZ, Izabela

Presenter: Mrs BALWIERZ, Izabela (Jagiellonian University)

Session Classification: Hadron Physics III

Track Classification: Hadron Physics

Contribution ID: **71** Type: **Plenary Invited**

Comparison of detector systems for general purpose experiments at the LHC and the Tevatron

Wednesday, 12 October 2011 09:35 (35 minutes)

In my presentation, will summarize performance of two general purpose collider physics detectors: CDF at Fermilab and CMS at LHC.
In particular, i will concentrate on the calorimeter issues encountered during operation of CDF and CMS and discuss planned upgrades for CMS.

Primary author: Prof. DE BARBARO, Pawel (University of Rochester)

Presenter: Prof. DE BARBARO, Pawel (University of Rochester)

Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **72** Type: **Plenary Invited**

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Primary author: Dr GIANOTTI, paola (lnf)

Track Classification: Nuclear Physics

Contribution ID: **73** Type: **Plenary Contribution**

Design and Construction of a Cylindrical GEM Detector as Inner Tracker Device at KLOE-2

Wednesday, 12 October 2011 12:15 (25 minutes)

We report on the design and construction of a triple-GEM detector as a new Inner Tracker (IT) for the KLOE-2 experiment at the Frascati Phi-factory. The IT is composed of four tracking layers, each providing an independent 2-dimensional space point.
Each layer is a fully cylindrical triple-GEM detector.
The front-end electronics is based on the GASTONE ASIC, specifically developed for this detector, a charge amplifier with digital output integrating 64 channels in one single chip.
After three years of R&D the construction of the first layer has started, with the aim of completing the detector by middle of 2012.
We report on the R&D achievements, including the construction process, the results of two beam-tests with prototype detectors, and the present realization status of the final detector and electronics.

Primary author: Dr BENCIVENNI, Gianni (INFN lnf)

Presenter: MORELLO, Gianfranco (LNF)

Session Classification: Accelerator physics and detectors II

Track Classification: Accelerator Physics

Contribution ID: **75** Type: **Plenary Invited**

Hypernuclear Physics at Storage Rings

Thursday, 13 October 2011 14:30 (35 minutes)

Traditionally hypernuclear physics experiments are fixed target ones and they are carried out at secondary beam of hadron accelerators.
However storage rings represent an interesting alternative approach.
In my contribution I will historically review few selected examples of hypernuclear studies performed at storage rings and I will illustrate the perspectives of some hypernuclear measurements planned at future facilities.

Primary author: Dr FELICIELLO, Alessandro (INFN Torino)

Presenter: Dr FELICIELLO, Alessandro (INFN Torino)

Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics

Contribution ID: **76** Type: **Parallel Contribution**

Upgrade of the ALICE Inner Tracking System

Friday, 14 October 2011 10:35 (25 minutes)

In order to fully exploit the physics potential of future high energy collider, a Vertex Detector providing high resolution track reconstruction is required. The Vertex Detector should be based on a technology capable of withstanding high track density and in case a large radiation exposure. In particular, near the interaction point the current silicon strip detector are not suitable for the expected environment and the silicon pixel detector both hybrid and monolithic are the most attractive option. These devices allow to build very light detectors for accurate tracking and vertexing also in a low momenta environment. In this contribution some ongoing developments on hybrid and monolithic pixel detectors for vertex detectors of future high-energy physics experiment will be reviewed.

Primary author: Dr MANZARI, Vito (INFN Bari)

Presenter: Dr MANZARI, Vito (INFN Bari)

Session Classification: Future Facilities and Detectors II

Track Classification: Future facilities and Detectors

Contribution ID: **77** Type: **Plenary Contribution**

Gaseous Time of Flight detectors

Tuesday, 11 October 2011 16:40 (25 minutes)

The introduction of timing Resistive Plate Chambers opened the way for very large area gaseous time-of-flight detectors. Such detectors have immediately found application in several Heavy Ion experiments and applications are being pursued in other fields, such as medical instrumentation. In this communication we will review the physical operating principles and the status of the technology.

Primary author: FONTE, Paolo (LIP, Coimbra)

Presenter: FONTE, Paolo (LIP, Coimbra)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors

Contribution ID: **78** Type: **not specified**

Closing remarks

Friday, 14 October 2011 13:20 (15 minutes)

Presenter: Prof. EGELHOF, Peter (GSI Darmstadt, Germany)

Session Classification: Future Facilities and Detectors II

Contribution ID: **79** Type: **Parallel Contribution**

Towards the Diagnostic of Spin-Polarized Particle Beams: Application of Compton Polarimeters

Tuesday, 11 October 2011 11:55 (25 minutes)

Renate Märtina,b, Roman Bardayc, Joachim Endersc, Yuliya Poltoratskac, Uwe Spillmannb, Andrey Surzhykova,b, Günter Weberd , Vladimir A. Yerokhina,b,e and Thomas Stöhlkera,b,d

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X-ray radiation arising in energetic collisions of charged particles is generally known to exhibit distinct polarization features reflecting both the dynamics as well as the atomic structure of the collision system. Moreover, in case of spin-polarized particles the polarization properties of the emitted radiation are significantly altered compared to the case of unpolarized collision partners. For the case of bremsstrahlung this so-called polarization transfer was systematically studied theoretical by Tseng and Pratt [1] already in the 1970s and has recently been revisited by several theoretical and experimental works [2, 3]. These recent studies were mainly initiated by the development of novel Compton polarimeters that allow precise measurements of linear polarization in the hard x-ray regime [4] and by the fact that the polarization transfer opens a route for the diagnosis of spin-polarized particle beams. The latter is of particular importance for experiments at the future FAIR facility, where the use of spin-polarized ion beams is planned [5]. Here, besides the bremsstrahlung process also the radiative recombination [6] and characteristic transitions [7] are discussed as probes for the degree of spin-polarization of the ion beam.
We will present measurements addressing the linear polarization properties of bremsstrahlung emitted in polarized electron-atom collisions. These experiments were performed at the polarized electron source SPIN of the TU Darmstadt [8] and proof the feasibility of this polarimetry technique.

[1] H. K. Tseng and R. H. Pratt, Phys. Rev. A 7, 1502 (1973)
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[3] S. Tashenov, to be published
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[5] T. Aumann et al., EPJ Web of Conferences 3, 01006 (2010)
[6] A. Surzhykov et al., Phys. Rev. Lett. 94. 203202 (2005)
[7] A. Bondarevskaya et al., Phys. Rep., in Press (2011)
[8] Y. Poltoratska et al., J. Phys.: Conf. Ser. 298, 012002 (2011)

Primary author: Dr MAERTIN, Renate (University of Heidelberg)

Presenter: Dr MAERTIN, Renate (University of Heidelberg)

Session Classification: Accelerator physics and detectors I

Track Classification: Accelerator Physics

Contribution ID: **80** Type: **not specified**

Nuclear Physics at the ESR Storage Ring

Presenter: Prof. BOSCH, Fritz (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany)

Contribution ID: **81** Type: **not specified**

Nuclear physics program at the ESR storage ring

Monday, 10 October 2011 09:00 (35 minutes)

Fritz Bosch, GSI Helmholtzzentrum , D-64291 Darmstadt, Germany

Abstract

This talk presents a survey of experiments conducted in the last years at the ion-storage ring ESR of GSI, addressing nuclear physics, nuclear astrophysics and closely related fields. The ESR is a powerful and in many respects unique tool. Connected with a synchrotron and a fragment separator, it provides stable as well as exotic highly-charged ions in an energy range from a few MeV/u up to 400 MeV/u. Those beams exhibit a tiny relative momentum spread $\Delta p/p < 10\text{-}6$ after the application of stochastic and electron cooling, and can be stored for extended periods of time (~ hours). Moreover, this ring offers for heavy, highly-charged ions the capability of single-ion detection within a very short time. These properties, together with sophisticated in-ring devices, such as a windowless gas target, collinear laser beams and Schottky-noise detectors, open up the very first access to several precision experiments in the fields of nuclear physics and neighbouring research fields on the one hand, and to the investigation of very rare processes on the other hand. The focus of this talk will be on the following topics:
· Precision measurements of masses and lifetimes of nuclei far off stability, e.g. in the rp- and r-process regions of stellar nucleosynthesis, by exploiting two complementary detection methods, namely "Schottky"(SMS)- and "Isochronous"(IMS)- Mass Spectrometry.
· Studies of beta decay and, in particular, of two-body beta decay (orbital electron capture and bound-state beta decay) of few-electron ions by means of "single-ion decay spectroscopy", where the "fate"of single beta- unstable ions, being prepared in well-defined quantum states, is monitored continuously.
· Collinear laser spectroscopy addressing e.g. the ground-state hyperfine splitting of heavy few-electron ions, which gives precise information on nuclear magnetization and quantum-electrodynamic (QED) corrections.
· Di-electronic recombination providing access to nuclear charge radii (see also special talk).
· Proof of principle of in-ring nuclear reactions of exotic nuclei (see also special talk).
A broad research program concerning in-ring nuclear reactions of exotic nuclei is not yet possible due to the present limitation of the intensity of stored exotic ions. However, when the approved FAIR facility at GSI will come into operation, exotic beams with many orders of magnitude higher intensity can be safely expected.

Presenter: Prof. BOSCH, Fritz (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany)

Session Classification: Nuclear Physics I

Track Classification: Nuclear Physics

Contribution ID: **83** Type: **Parallel Contribution**

Results on the $K^-_{stop}A \to \Sigma^\pm\pi^\mp A'$ reaction on light nuclei.

Tuesday, 11 October 2011 17:55 (25 minutes)

The $K^-_{stop}A \to \Sigma^\pm\pi^\mp A'$ reaction is studied on light nuclei, $A =$ $^{6,7}Li$, ^{9}Be, ^{13}C and ^{16}O.
The outgoing Σ's and π's are detected 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 FINUDA tracker, which consists of 5 position sensitive layers. Final $\Sigma^\pm\pi^\mp$ pairs are selected requiring topological cuts 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 compared to previous experimental measurements. 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 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.
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.

Primary author: Prof. CAMERINI, Paolo (Univ. Trieste & INFN Trieste)

Presenter: Prof. CAMERINI, Paolo (Univ. Trieste & INFN Trieste)

Session Classification: Hadron Physics II

Track Classification: Hadron Physics

Contribution ID: **84** Type: **Parallel Contribution**

The SuperB project

Tuesday, 11 October 2011 17:30 (25 minutes)

The SuperB experiment is a next generation Super Flavour Factory expected to accumulate 75ab^-1 of data at the Y(4S) in five years of nominal running. In addition to running data at the Y(4S), SuperB will be able to accumulate data from the psi(3770) up to the Y(6S). A polarized electron beam enables unique physics opportunities at SuperB. We also discuss the detector design for this new facility.

Primary author: Dr WILSON, Fergus (RAL)

Presenter: Dr WILSON, Fergus (RAL)

Session Classification: Future Facilities and detectors I

Track Classification: Future facilities and Detectors