nEDM 2017

Report of Contributions

Contribution ID: **0** Type: **Oral**

Supersource of ultracold neutrons with superfluid helium at WWR-M reactor

Monday, 16 October 2017 14:35 (35 minutes)

Use of ultracold neutrons (UCN) gives unique opportunities of a research of fundamental interactions in physics of elementary particles. Search of the electric dipole moment of a neutron (EDM) aims to test models of CP violation. Precise measurement of neutron lifetime is extremely important for cosmology and astrophysics. Considerable progress in these questions can be reached due to supersource of ultracold neutrons based on superfluid helium, which is under construction now in PNPI. Our source aims at obtaining a density of UCN equals to 10⁴ n/cm³, two orders of magnitude exceeding that in existing sources presently available in the world. Now the project and basic elements of the source are prepared, full-scale model of the source is tested, the scientific program is developed. Increase in accuracy of neutron EDM measurements by order of magnitude is planned. The most intense source of UCN will allow PNPI become the centre of fundamental researches with UCN.

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Session Classification: MoAf1

Track Classification: Sources of ultra cold neutrons

Contribution ID: **1** Type: **Oral**

Status of the apparatus for the next phase of the neutron EDM search at PSI –n2EDM

Monday, 16 October 2017 09:45 (35 minutes)

“ on behalf of the nEDM collaboration at PSI

The next big step in sensitivity improvement of the search for a possible electric dipole moment of the neutron at the Paul Scherrer Institute, Switzerland requires a new apparatus with several improvements with respect to the present setup. In a first step of the new apparatus –dubbed n2EDM – a sensitivity improvement of a factor of 10 is envisaged. The new apparatus design, its status and preparation will be presented.

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Funding Agency

We acknowledge support by Swiss National Science Foundation, French Agence Nationale de la Recherche, Fund for Scientific Research, Flanders - Belgium , National Science Centre, Poland.

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Session Classification: MoMo1

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **2** Type: **Oral**

Effects of magnetic field non-uniformities

Tuesday, 17 October 2017 19:25 (25 minutes)

Magnetic field non-uniformities generate important systematic effects on the neutron EDM, especially for experiments using an atomic comagnetometer.
Field gradients generate frequency shifts of UCNs and atoms, possibly dependent on the electric field, they also induce transverse depolarization of UCNs.
All these effects will be reviewed.

I will first present a polynomial parametrization of the magnetic field adequate to describe such effects, generalizing the usual description in terms of linear gradients.
I will then report on a recent measurement of a false Hg EDM due to a cubic mode performed with the apparatus currently installed at PSI.
Finally the strategy to control the systematic effects due to field non-uniformities in the current PSI nEDM data will be presented.

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Funding Agency

ERC grant NEDM 2016-STG 716651

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Session Classification: TuEv

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

Contribution ID: **3** Type: **Poster**

Prospects for an improved precision of $_{Hg-199}$ with a ^{199}Hg-^{4}He co-magnetometer

Wednesday, 18 October 2017 15:00 (45 minutes)

In the scope of the n2EDM experiment, aiming for a sensitivity of $_{d_n} = 1\times10^{-27}$e.cm, the precise measurement of the magnetic field and its gradients is critical. Taking advantage of the gravitational shift between the neutrons and the mercury atoms of the co-magnetometer to correct for the false EDM induced by the relativistic motional field, this problem reduces to the knowledge of the $_{n}/_{Hg}$ at the 0.2ppm level. This ratio has already been measured at the 0.8ppm level [1] in the nEDM apparatus and will be improved by the n2EDM setup to the 0.1ppm level. As a sanity check, necessary in case of discovery of an EDM at the 10^{-27}e.cm level, this ratio can also be inferred by combining the independent measurements of $_{n}$ and $_{Hg}$ in different conditions. $_{n}$ itself is known with a precision of 0.24 ppm [2], and the mercury-199 magnetic moment has been measured by Cagnac in the 1960's [3] at the level of 1.7ppm which has to be improved. The hopeless goal of creating an homogeneous and stable magnetic field at the 0.1ppm level leaves us with the only option of measuring $_{Hg}$ using a co-magnetometer. 4He has been chosen has the second specie for this co-magnetometer since its magnetic moment is already known to better than 0.1ppm. For the mercury magnetometer, a frequency-quadrupled laser will provide the 254 nm light necessary to pump and probe the atoms. A Bell-Bloom scheme will be used for the pumping and the precession frequency will be measured by the modulated absorption of the probe beam. The helium part, designed by our collaborators at CEA-Leti, Grenoble (France), will use a well-established technique for helium magnetometry [4,5]. The preliminary tests and the expected sensitivity will be presented at the workshop.
[1] Afach, Phys. Lett. B 738 (2014)
[2] Greene, Phys. Rev. D 20 (1979)
[3] Cagnac, Ann. Phys. 6 (1961)
[4] Guttin, J. de Phys. IV, vol. 4, no. C4 (1994)
[5] Weis, Phys. Rev. A, vol. 74, no. 3 (2006)

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Session Classification: Posters

Contribution ID: **4** Type: **Oral**

Magnetic Field Apparatus for the Oak Ridge nEDM Experiment

Tuesday, 17 October 2017 19:50 (25 minutes)

A search for the neutron electric dipole moment (nEDM) will take place at the Spallation Neutron Source at Oak Ridge National Lab, aiming for a sensitivity of $<3 \times 10^{-28}$ e-cm. Polarized ultracold neutrons will precess in a 30 mG magnetic holding field inside a liquid helium cell, which will be doped with a minute amount of polarized He-3 to measure the precession frequency. Magnetic field gradients in the detector must be reduced below 3 ppm/cm relative to the holding field in order to mitigate the false nEDM signal due to the geometric phase effect and to increase the neutron and He-3 polarization lifetime. Material selection is restricted by the dual requirements of cryogenic and non-magnetic operation. I will discuss a 1/3-scale prototype magnet system that has demonstrated the required sensitivity using a nearly-hermetic, superconducting lead shield, as well as ongoing efforts to build and magnetically survey the full-scale cryostat and magnetic apparatus.

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Funding Agency

US National Science Foundation, Grant 1506459

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Presenter: Dr SLUTSKY, Simon (Caltech)

Session Classification: TuEv

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

Contribution ID: **5** Type: **Oral**

nEDM as a dark matter detector: constraints on axion-like dark matter from limits on an oscillating EDM

Wednesday, 18 October 2017 15:45 (20 minutes)

nEDM as a dark matter detector: constraints on axion-like dark matter from limits on an oscillating EDM

N. J. Ayres for the nEDM collaboration at PSI

Axions and axion-like particles (ALPs) are popular dark matter candidates. Ultralight axion and ALP cold dark matter would manifest as a classical field, oscillating coherently on a galactic scale. Through their couplings to gluons, this field would induce an oscillation in the measured value of the EDMs of neutrons and other particles. We analyse datasets from the Sussex-RAL-ILL experiment (1998-2002) and the current PSI experiment (2015-2016) to obtain limits on a potential oscillation in the value of the EDM.

While many experiments probe the axion-photon coupling, we set the first laboratory limits on the axion-gluon coupling, improving upon the previous indirect cosmological limits by up to 3 orders of magnitude. Additionally, we improve upon laboratory constraints on the axion coupling to nucleons by up to a factor of 40.

Paper: arXiv 1708.06367 - Search for axion-like dark matter through nuclear spin precession in electric and magnetic fields

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Consider for Poster

Yes (if oral slot unavailable)

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Session Classification: WeAf2

Track Classification: Experimental techniques (cryogenic, room temperature, crystal)

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

Data blinding for the nEDM experiment

Thursday, 19 October 2017 11:05 (25 minutes)

Psychological bias towards (or away from) a prior measurement or a theory prediction is an intrinsic threat to any data analysis. While various methods can be used to avoid the bias (e.g. actively not looking at the result), only data blinding is a traceable and thus trustworthy method to circumvent the bias and to convince the external audience that there is not even an accidental psychological bias.

Data blinding is nowadays standard in particle physics, but it turns out that it is particularly difficult for a neutron electric dipole moment experiment as several cross measurements (various magnetometers) create a self-consistent network where it is hard to inject a fake signal.

In this presentation I will describe those difficulties and how they were defeated by our collaboration. This includes the mathematical models, as well as the cryptographic tools that ensure a trustworthy blinding. The practical implications on the day-to-day measurements will be explained, as well as strategies for unblinding the data. I will conclude with a compatibility check for future experiments.

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Session Classification: ThMo2

Track Classification: Experimental techniques (cryogenic, room temperature, crystal)

Contribution ID: **7** Type: **Oral**

Hunting the nedm by random walks

Wednesday, 18 October 2017 16:35 (25 minutes)

The behavior of a spin undergoing Larmor precession in the presence of
fluctuating fields is of interest to workers in many fields. Particles making random walks in inhomogeneous fields see time fluctuating fields which cause frequency shifts and relaxation which are related to their power spectrum, which can be determined by taking the Fourier transform of the auto-correlation functions of the field fluctuations. Recently we have shown how to calculate these correlation functions for
all values of mean free path (ballistic to diffusive motion) in finite bounded regions, using the model of persistent continuous time random walks (CTRW) for particles subject to scattering by fixed (frozen) scattering centers so that the speed of the moving particles is not changed by the collisions. Here we show how scattering with energy exchange from an ensemble of scatterers in thermal equilibrium can be
incorporated into the CTRW. . Our
results for the velocity autocorrelation function show a long time tail
which we also obtain from conventional di usion theory, with the same power, independent of dimensionality.
Our results are valid for any Markovian scattering kernel as well as any kernel based
on a scattering cross section ~1/v.

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Funding Agency

DOE

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Presenter: Prof. GOLUB, Robert (NCSU)

Session Classification: WeAf2

Track Classification: Systematic effects

Contribution ID: **8** Type: **Oral**

Commissioning of the ultracold neutron source at Los Alamos Neutron Science Center

Tuesday, 17 October 2017 09:55 (30 minutes)

The spallation-driven solid deutrium-based ultracold neutron (UCN) source at Los Alamos Neutron Science Center (LANSCE) has provided a facility for precision measurements of fundamental symmetries via the decay observables from neutron beta decay for over a decade. In preparation for a new room temperature neutron electric dipole moment (nEDM) search and to increase the statistical sensitivity of all experiments using the source an effort to increase the UCN output was initiated in 2014 and completed in Fall 2017. The upgrade had three main goals: optimized the geometry of the cryogenic source insert, improve the UCN guide system to the experiment hall, and add a second UCN beamline to support a future nEDM experiment. I will present the results of the commissioning of the new UCN source, possible future upgrades, and discuss the implications for the physics program at LANSCE.

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Session Classification: TuMo1

Track Classification: Sources of ultra cold neutrons

Contribution ID: **9** Type: **Oral**

Electric field development for cryogenic nEDM experiments

Tuesday, 17 October 2017 10:25 (25 minutes)

We present details of the design, construction and initial tests of an apparatus for high voltage testing of a full-size cryogenic nEDM cell in liquid helium at 4.2K. The test cell is cylindrical and of 24 cm internal diameter with stainless steel electrodes and an insulating spacer. The cylinder axis of the cell is vertical and the insulator is located in grooves in the electrodes. The electrode separation can be varied from 0.2 cm to 2.6 cm and a voltage of up to 260 kV can be applied across the cell.
It has long been expected that a nEDM cell immersed in superfluid LHe at 0.5 K should permit E-fields much greater then room temperature experiments. Long et al [1] showed that over 400 kV/cm was obtainable in a large cell without an insulating spacer at 4.2 K, but that this was reduced dramatically as the temperature, and hence pressure, was reduced to below 2 K in a pumped LHe bath. Subsequent work by Davidson [2] in this laboratory on small spacerless cells showed the dielectric strength in the superfluid at 1.9 K could be restored to its 400 kV/cm value by pressurising the LHe to 1 bar.
Further work in this laboratory by Davidson [2] and Hill [3], and that presented here, shows that the introduction of a dielectric spacer reduces the value of the breakdown field, Ebd, for any given geometry.
Initial Ebd data as a function of separation with the full-size cell in LN2 show a clear reduction compared to data from smaller scale cells. We shall shortly begin measurements in LHe at 4.2 K with this apparatus.
The primary aim of our experiments is to determine whether an E-field of 100 kV/cm can be maintained in this 1.2 litre cell at 4.2 K. If this can be demonstrated, then such a result, together with Davidson's pressure dependence data, should inform the design of a future cryogenic nEDM experiment.
[1] Long et al, arXiv:physics/0603231, 2006 [2] A. J. Davidson, PhD Thesis, University of Sussex, 2011 [3] D. Hill, Master's Thesis, Unversity of Sussex, 2010.

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Funding Agency

U.K. Science and Technology Facilities Council

Consider for Poster

Yes

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Session Classification: TuMo1

Track Classification: High voltage and electric field control (generation, leakage currents,…)

Contribution ID: **10** Type: **Oral**

Improved Measurement of the EDM of Mercury-199

Monday, 16 October 2017 11:25 (35 minutes)

This talk will cover the latest results on the permanent electric dipole moment (EDM) of neutral ^{199}Hg atoms. The EDM is manifested as a small perturbation to the Larmor precession frequency due to the interaction energy of the electric dipole with a static electric field. The atoms are prepared in four separate glass vapor cells using optical pumping with resonant 254 nm laser light and allowed to precess in a common magnetic field and oppositely-directed electric fields. The precession frequency difference in a pair of cells is derived from the accumulated phase difference between two probe periods separated in time. Using this technique, we find the EDM projection onto the nuclear spin axis $d_{Hg} = (2.20 \pm 2.75_{stat} \pm 1.48_{syst}) \cdot 10^{-30} e \cdot$ cm. While consistent with zero, this result places a new upper limit on the EDM $|d_{Hg}| < 7.4 \cdot 10^{-30} e \cdot$ cm (95\% C.L.), improving the previous best limit by a factor of > 4. ^{199}Hg continues to have the most stringent limits for the EDM of any atomic or molecular system. The new limit constrains theories of physics beyond the Standard Model which incorporate new sources of time-reversal or CP symmetry violation.

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Funding Agency

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Presenter: Dr GRANER, Brent (University of Washington)

Session Classification: MoMo2

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **11** Type: **Oral**

Status of the data-analysis of the nEDM search at PSI

Tuesday, 17 October 2017 11:10 (30 minutes)

At the Paul Scherrer Institute (PSI) in Switzerland a collaboration of 15 institutions is measuring the nEDM using ultracold neutrons (UCN).
In recent years a total of nearly 55000 cycles each with an average of approximately 11500 UCN were recorded. The pre-analysis sensitivity of the dataset is about 0.95×10E-26 ecm.
This talk will present the summary of the ongoing statistical analysis by combining results from two analysis groups, both working on independently blinded data.

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Presenter: Dr SCHMIDT-WELLENBURG, Philipp (Paul Scherrer Institute)

Session Classification: TuMo2

Track Classification: Experimental techniques (cryogenic, room temperature, crystal)

Contribution ID: **12** Type: **Oral**

MC simulation efforts for nEDM experiment optimization and systematics calculations

Wednesday, 18 October 2017 09:35 (25 minutes)

In UCN physics experiments Monte Carlo simulation methods are very effective in the characterization and optimization of many-parameter systems, and when a detailed calculation of a geometry containing several sub-volumes is relevant. Exact analytic modeling is not feasible in many cases - for example because of gravity effects on UCN or because of UCN viewing several surface qualities at the same time.
MCUCN has been extensively used in the optimization of the PSI UCN source, beamlines and experiments in order to maximize UCN density or transmission. MCUCN has already been a useful tool in estimating systematic effects in the neutron electric dipole moment (nEDM) experiment, for checking data analysis software by toy data, or as part of the data analysis (providing e.g. collision rates).
In this presentation we briefly explain several recent applications of MCUCN, with emphasis on the future n2EDM apparatus at PSI and on spin tracking simulations for the R-curve analysis in the current experiment.

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Session Classification: WeMo1

Track Classification: Simulation tools (Monte Carlo, finite elements, ...)

Contribution ID: **13** Type: **Oral**

External magnetic fields - mapping, monitoring and shielding

Thursday, 19 October 2017 09:00 (25 minutes)

A measurement of the neutron electric dipole moment requires the magnetic field to be stable on a picotesla level. Yet in a typical experimental hall there are strong sources of magnetic field, nemeses of precise nEDM mesurements. A large-scale mapping, performed prior to the installation of the apparatus, can resolve the spatial distribution of the field. During the nEDM measurement the magnetic field in the hall can be monitored, providing on-line and historic information on its variation. Finally, an active magnetic field shielding system can efficiently shield against those, typically, strong and slow disturbance.

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Session Classification: ThMo1

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

Contribution ID: **14** Type: **Oral**

Neutron EDM Measurement with a Pulsed Beam

Monday, 16 October 2017 16:20 (35 minutes)

Currently, a new experiment aiming to measure the neutron EDM using a pulsed beam of cold neutrons is being commissioned at the University of Bern. The innovative measuring concept is ideally suited for high peak-flux and time-structure provided by next-generation pulsed spallation sources (e.g. the European Spallation Source ESS). The present design, technical challenges and solutions as well as preliminary results from our first beam time at the BOA beam line at SINQ/PSI will be presented.

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Presenter: Prof. RIES, Dieter (Johannes Gutenberg Universität Mainz)

Session Classification: MoAf2

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **15** Type: **Oral**

R&D on field stability and uniformity for the TRIUMF nEDM experiment

Thursday, 19 October 2017 09:25 (25 minutes)

The TRIUMF nEDM experiment employs a magnetically shielded Ramsey Resonance based EDM apparatus employing ultracold neutrons from a spallation based isopure Helium-II UCN source that is currently under construction at TRIUMF. Fluctuations and inhomogeneities of the roughly 1-uT measurement field are expected to be one of the leading sources of systematic errors in the experiment. This presentation will discuss recent R&D efforts toward the generation of a highly stable and uniform magnetic field inside a passively shielded volume. This work includes magnetic shield degaussing/idealization apparatus, self-shielded coil designs, and NMOR-based magnetometry.

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Natural Sciences and Engineering Research Council (NSERC) of Canada

Consider for Poster

No

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Presenter: Prof. BIDINOSTI, Christopher (University of Winnipeg)

Session Classification: ThMo1

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

Contribution ID: **16** Type: **Oral**

High Electric field development for the SNS nEDM Experiment

Wednesday, 18 October 2017 13:45 (25 minutes)

The SNS nEDM collaboration is developing an experiment to search for the neutron's electric dipole moment (EDM), using ultracold neutrons (UCNs) stored in superfluid liquid helium, to be run at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory. In this experiment, being able to achieve a strong and stable electric field in superfluid liquid helium in the region where UCNs are stored is of critical importance, because in EDM searches in general the sensitivity depends linearly on the strength of the applied electric field. However, the phenomenon of electric breakdown in liquid helium is poorly understood, and as such a major R&D effort is under way. The SNS nEDM collaboration developed an apparatus to study electrical breakdown in liquid helium at temperatures as low as 0.4 K at pressures between the saturated vapor pressure and 1 atm for electrodes 12 cm in diameter with a gap size of a few cm. A series of measurements were performed using this apparatus. The collaboration is currently constructing a larger cryostat that can accommodate a half scale electrode-measurement cell system. In this talk, the current status of the high electric field R&D and the implications of the findings on the SNS EDM experiment will be discussed.

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Funding Agency

US Department of Energy, US National Science Foundation

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Session Classification: WeAf1

Track Classification: High voltage and electric field control (generation, leakage currents,...)

Contribution ID: **17** Type: **Oral**

New effort to develop a new nEDM experiment at LANL

Tuesday, 17 October 2017 09:35 (20 minutes)

Research and development work at LANL towards a new neutron EDM experiment using the LANL UCN source with a sensitivity goal of several x 10-27 e-cm is currently ongoing. The initial focus of this effort was an upgrade of the UCN source and a demonstration that a sufficient number of UCN can indeed be stored in a nEDM measurement cell and was successfully completed. In this talk, the concept of the experiment and current status of this R&D will be presented.

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Funding Agency

Los Alamos National Laboratory LDRD program office, US National Science Foundation

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Presenter: CLAYTON, Steven (Los Alamos National Laboratory)

Session Classification: TuMo1

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **18** Type: **Poster**

High Resolution Two Photon Spectroscopy of the 6p←5p transition of Xenon at 252 nm

Wednesday, 18 October 2017 15:00 (45 minutes)

The nEDM (neutron electric dipole moment) project at TRIUMF's recently established ultra cold neutron (UCN) facility in Canada will introduce a dual co-magnetometer with cohabiting 129Xe and 199Hg for measuring precise magnetic fields within a neutron storage cell. By simultaneously incorporating two atomic species we can deduce both the magnitude and gradient of the magnetic fields, thereby lowering the systematic uncertainties in the nEDM measurement.

Toward this end, the spin precession of polarized 129Xe will be detected by measuring fluorescence intensities following the spin-selective two-photon excitation from the ground 5p6(1S0) state to the excited 5p5(2P3/2)6p state at 252 nm. In order to detect the fluorescence efficiently, the 6p state will be excited by intense 252 nm UV (ultraviolet) radiation created in an enhancement optical cavity. As the first step, we recently observed the fluorescence of the 6p state of Xe atoms excited by 252 nm in an optical cavity. We have used a home-built CW (continuous wave) single-frequency UV laser light source based on an optically pumped semiconductor laser with two resonant frequency doubling cavities. We detected the fluorescence spectrum of the six most abundant isotopes of Xe successfully, with hyperfine resolved peaks for 129Xe and 131Xe isotopes. By calibrating frequencies using a frequency comb, we have determined the hyperfine constants of 129Xe and 131Xe in the 6p(2P3/2) state precisely. In addition, we have analyzed the isotope shift of Xe in the 6p state. We will discuss the analysis of the two-photon excitation spectrum, and our current progress on the measurements of precession of polarized Xe atoms.

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Presenters: ALTIERE, Emily (University of British Columbia); MILLER, Eric (University of British Columbia)

Session Classification: Posters

Contribution ID: **19** Type: **Poster**

Compensation of Magnetic Fields at the the TRIUMF nEDM Experiment

Wednesday, 18 October 2017 15:00 (45 minutes)

The existence of a non-zero neutron electric dipole moment (nEDM) would violate parity and time-reversal symmetry. Extensions to the Standard Model predict the nEDM to be 10^{-26} – 10^{-28} e-cm. The current best upper limit set by Sussex/RAL/ILL nEDM experiment is 3.0×10^{-26} e-cm. The nEDM experiment at TRIUMF is aiming at the 10^{-27} e-cm sensitivity level . We are developing the world's highest density source of UCN. The experiment requires a very stable (<~pT) and homogeneous (<~nT/m) magnetic field (B0) within the measurement cell. My involvement in the nEDM experiment is the development of active magnetic shielding to stabilize the external magnetic field by compensation coils. A prototype active magnetic shield has been tested at The University of Winnipeg. I will report on latest experimental results from this prototype and simulations conducted to understand the results. The magnetic environment at TRIUMF is more challenging than in our laboratory in Winnipeg, because of the closeness of the experiment to the TRIUMF cyclotron magnetic field (B $\sim 350 - 400$ μT 'which is almost one order of magnitude larger than usual background fields') and the changing environment with iron. Studies of the implementation at TRIUMF will also be reported.

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Funding Agency

1. Natural Sciences and Engineering Research Council of Canada (NSERC).
2. Canada Foundation for Innovation (CFI).

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Session Classification: Posters

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

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

Xe/Hg dual-comagnetometer for the TRIUMF neutron EDM experiment

Wednesday, 18 October 2017 11:15 (25 minutes)

In support of the neutron electric dipole moment (EDM) experiment at TRIUMF, we are developing a ^{129}Xe/^{199}Hg dual-comagnetometer that can monitor the magnetic field drift and reduce the uncertainties arising from geometric phase effects caused by inhomogeneous fields.
Using UV light sources, we will excite transitions in ^{129}Xe and ^{199}Hg suitable for detection of their spin precession.
Initial spin polarization of these species will be achieved via optical pumping.
This talk will report our current status and future plans.

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Presenter: Dr HAYAMIZU (FOR THE TRIUMF JAPANESE-CANADIAN UCN COLLABORATION), Tomohiro (The University of British Columbia)

Session Classification: WeMo2

Track Classification: Magnetic field sensors (atomic co-magnetometry, AQUIDS, fluxgate)

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

Systematic and Operational study apparatus for nEDM@SNS

Wednesday, 18 October 2017 12:05 (25 minutes)

nEDM @SNS experiment is designed to be able to measure neutron EDM down to 10^{-28} range due to special technique for suppressing systematic effect arising from magnetic field gradients in presence of electric field. This technique requires cryogenic environment at about 0.5K and use of polarized ^3He in the same cell as trapped neutrons. We also plan to utilize simultaneous spin dressing technique for both, neutron and ^3He, to increase statistical sensitivity. To accelerate commissioning of the main nEDM experiment with turn around on the scale of month, we have designed a smaller apparatus, without electric field and with turn around about a week, which can be used to develop operational technique for spin manipulations at cryogenic environments as well as characterization of the systematic effect. At present we have completed commissioning of the new non-magnetic dewar and are assembling and testing cryogenic essentials of the apparatus.

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This work was supported in part by the US National Science Foundation under Grant No.\ PHY-0314114 and the US Department of Energy under Grant No.\ DE-FG02-97ER41042.

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Session Classification: WeMo2

Track Classification: Systematic effects

Contribution ID: **22** Type: **Oral**

SuperSUN and PanEDM: a new superthermal UCN source for a new nEDM measurement

Tuesday, 17 October 2017 09:00 (35 minutes)

The most severe difficulty in measuring the neutron EDM is low achievable density of ultracold neutrons; this is addressed by the new source SuperSUN, currently under construction at the Institut Laue-Langevin. The intense primary cold beam H523 will be shaped by a unique tapered guide geometry, and guided for a further three meters inside an 11-liter converter volume with circular cross-section. UCNs produced by downscattering in the converter medium of ultrapure superfluid ^{4}He will be trapped by a combination of magnetic and neutron-optical potentials; they can be released by a cold mechanical valve for extraction into room-temperature experimental environments. The source will be commissioned in two phases: Phase I with only material trapping of UCNs, and Phase II introducing a superconducting octupole magnet to achieve long storage times and automatic polarization.

PanEDM, the first experiment planned for the SuperSUN source, directly addresses the second key experimental limitation: systematic errors arising from magnetic field inhomogeneity. A five-layer magnetic shield in two dismountable parts reduces the magnitude and drift of magnetic field gradients over the cubic volume of ~125 liters that contains the storage cells for Ramsey spectroscopy. Residual field homogeneity and temporal stability for weak external perturbations have been respectively demonstrated at the levels of 100 pT/m absolute, and 1 pT/m over hours. Systems of atomic magnetometers and fluxgates monitor the magnetic environment, providing crucial systematic checks and diagnostic information.

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Programme ANR : Défi de tous les savoirs (DS10) 2014

DFG SPP 1491, Cluster of Excellence ‘Universe’

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Session Classification: TuMo1

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **23** Type: **Poster**

Vertical UCN Source Status at TRIUMF

Wednesday, 18 October 2017 15:00 (45 minutes)

The neutron EDM experiment at TRIUMF aims to measure the nEDM to the precision of ~10^{-27} e·cm by using a new superfluid He ultracold neutron (UCN) source. The Japan-Canada UCN source is unique in combining a neutron spallation source with superfluid helium. The new UCN source is expected to yield the highest density of UCNs worldwide. The ongoing research on the present vertical UCN source at TRIUMF is crucial for designing the future UCN source. The status of the present UCN source and the result of the cooldown test will be presented.

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Session Classification: Posters

Contribution ID: **24** Type: **Oral**

Status of the Vertical UCN Source for the TRIUMF neutron EDM Experiment

Tuesday, 17 October 2017 19:00 (25 minutes)

We developed an intense ultracold neutron (UCN) source using superfluid helium (He-II) at the Research Center for Nuclear Physics (RCNP), in Japan. This UCN source uses He-II as a UCN converter to produce a high density of UCN. At the exit of the UCN source, a UCN density of 26 UCN/cm^3 at 90 neV critical energy was achieved with the 400 W proton beam of the ring cyclotron of RCNP in 2011.
In 2016, this UCN source was transported from RCNP to TRIUMF to perform an experiment to finally search for the neutron electric dipole moment (nEDM). The UCN source was installed on the dedicated BL1U proton beamline of TRIUMF in 2017. We performed a cooling test using liquid helium and succeeded in condensing He-II into the UCN production volume and cooling it down to 0.92K.
In this talk, the current status of this UCN source and preparation for the first UCN production at TRIUMF will be discussed.

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Session Classification: TuEv

Track Classification: Sources of ultra cold neutrons

Contribution ID: **25** Type: **Oral**

Status of the UCN guides development for the TRIUMF UCN source and TRIUMF neutron EDM experiment.

Tuesday, 17 October 2017 20:15 (20 minutes)

We are currently developing a super-thermal Ultracold Neutron (UCN) source using phonon exchange in super-fluid helium. To take full advantage of the high density of UCNs from our source, high transmission guides for polarized UCNs are being developed. Statistical sensitivity is the main limiting factor for a neutron EDM measurement. Furthermore, this sensitivity also depends on the initial polarization of the stored UCNs. Polarization must be maintained from the UCN source to the EDM cell. Preliminary material characterizations and plans to determine the transmission and the depolarization per bounce of these new guides with UCNs will be presented in this talk.

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Session Classification: TuEv

Track Classification: Transport and manipulation of ultra cold neutrons (materials, valves, polarization, spin transport, neutron detection)

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

UCN detection and spin measurement for the TRIUMF neutron EDM experiment

Thursday, 19 October 2017 11:30 (25 minutes)

The Ultracold Neutron (UCN) source at TRIUMF is expected to produce a high density of UCN, and TRIUMF's first experiment using this source will be a search for a neutron Electric Dipole Moment (nEDM). Tests of a lithium glass scintillator detector capable of meeting the expected high rate of UCN was tested at PSI in 2015, and the design of an apparatus to use four of these detectors is underway to measure both spin states of the neutron for both electric field configurations from two simultaneously running experimental cells. This talk will present the result of the detector measurements at PSI, and studies completed in the design of the simultaneous spin measurement apparatus.

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Session Classification: ThMo2

Track Classification: Transport and manipulation of ultra cold neutrons (materials, valves, polarization, spin transport, neutron detection)

Contribution ID: **27** Type: **Oral**

High Voltage Generation and SQUID Applications in the SNS nEDM Experiment

Wednesday, 18 October 2017 11:40 (25 minutes)

In the SNS nEDM experiment, liquid helium at around 0.4 Kelvin will fill and surround the measurement cells. In addition to its roles in superthermal production of ultracold neutrons and scintillator, the liquid helium has excellent dielectric strength, and the planned electric field in the cells is ~75 kV/cm. This field requires a voltage applied to the central electrode of ~650 kV. Instead of feeding such a high voltage from an external source into the cryogenic central vessel, a major technical challenge, a much smaller voltage will be fed into the central volume and amplified. In this talk, I will describe current plans for 1) high voltage generation and 2) a device to perform non-contact measurement of the amplified voltage. Also, as a somewhat separate topic, I will describe progress in implementing SQUIDs into the experiment since the last nEDM workshop.

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US DOE Office of Science, Nuclear Physics

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Session Classification: WeMo2

Track Classification: Magnetic field sensors (atomic co-magnetometry, AQUIDS, fluxgate)

Contribution ID: **28** Type: **Oral**

Commissioning status of the UCN facility at TRIUMF

Monday, 16 October 2017 12:00 (30 minutes)

The Japanese-Canadian Ultracold Neutron (UCN) Source is a new facility under construction at TRIUMF. The distinct feature of TRIUMFs UCN facility is the combination of a neutron spallation source with a superfluid helium UCN converter - unique among all existing and planned UCN sources worldwide. The goal of the UCN project at TRIUMF is to provide a density of several hundreds of UCN per cubic cm to experiments at up to two ports: one of them will be dedicated to determine the neutron electric dipole moment (nEDM) to the 10^(−27) e·cm level of precision.
The presentation shall give an introduction to the infrastructre of the facility. Over the last couple years, the proton beamline and spallation target dedicated to UCN production have been finalized and commissioned successfully. The kicker magnet which allows to share the proton beam between the UCN facility and other accelerator users operates successfully as well. The audience will be briefly updated about the current status of the project: The vertical UCN source cryostat (previously used at RCNP) has been installed and tested at TRIUMF, and is currently being prepared for first UCN production in Canada. In parallel, the collaboration is working on the design of an advanced UCN source cryostat as well as a next generation nEDM spectrometer.

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Session Classification: MoMo2

Track Classification: Sources of ultra cold neutrons

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

Monte Carlo optimization of a next-generation ultracold-neutron source

Wednesday, 18 October 2017 10:00 (25 minutes)

The TRIUMF Japanese-Canadian UCN Collaboration is planning a next-generation ultracold-neutron source. To maximize the number of ultracold neutrons available to experiments, Monte Carlo simulations of neutrons over a wide energy range are needed. Additionally, heat deposit due to neutron scattering, neutron capture, and gamma radiation is an important design parameter.

This presentation will show how we use simulation tools like Fluka, MCNP, and PENTrack to optimize the combination of neutron moderators and the geometry of the source.

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Session Classification: WeMo1

Track Classification: Simulation tools (Monte Carlo, finite elements, …)

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

Progress on the high-voltage and EDM cell studies for the TRIUMF neutron EDM experiment

Wednesday, 18 October 2017 14:10 (25 minutes)

The currently established best limit on the neutron EDM was obtained by eliminating and investigating main systematic effects using an atomic co-magnetometer inside the neutron storage volume.
The next generation neutron EDM search at TRIUMF aims to introduce 129-Xe as co-magnetometer due to its low neutron absorption cross section. An optical detection scheme of 129-Xe spin precession is available using a transition involving two photons at 256 nm. Ultimately, the goal is an optically probed dual co-magnetometer using both 129-Xe and 199-Hg inside the neutron storage cell to further improve understanding and cancellation of systematic effects. While 199-Hg is an established co-magnetometer in high electric fields xenon has to be studied for its dielectric properties in the pressure range of interest.
The high-voltage test setup at TRIUMF is built to measure the high-voltage breakdown properties of various gas mixtures of 199-Hg/129-Xe at total pressures of 10^{-2} to 10^{-5} mbar. In this talk the current status of the high voltage test setup and EDM cell design will be discussed.

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Session Classification: WeAf1

Track Classification: High voltage and electric field control (generation, leakage currents,...)

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

Developments for the next generation neutron EDM search at TRIUMF

Tuesday, 17 October 2017 11:40 (30 minutes)

We aim to search for the neutron EDM down to 1e-27e*cm by using ultracold neutrons at TRIUMF.
In order to achieve this goal, systematic errors of the neutron EDM measurement must be drastically reduced as well as the statistical error.
With this objective, we are developing a next generation EDM measurement system.
This talk will describe the current status and the future plans for the neutron EDM search at TRIUMF.

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Session Classification: TuMo2

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **32** Type: **Oral**

Magnetometry for next generation neutron EDM experiments

Wednesday, 18 October 2017 10:50 (25 minutes)

Experiments searching for the electric dipole moment (EDM) of the neutron require a stable and homogeneous magnetic field. Statistical and systematic uncertainties in such experiments depend on magnetic field gradients and fluctuations of those gradients and the field itself. In order to monitor the different aspects of the magnetic field we developed a variety of special magnetometer systems based on optically-pumped Cs, 199Hg, or 3He. The used magnetometer techniques included variometers, multibeam vector readout [1], accurate all-optical field readings [2], and the readout of precessing 3He spins with Cs OPM [3]. We will present an overview of magnetometer systems in our current neutron EDM experiment as well as plans for a next-generation upgrade (n2EDM). The n2EDM experiment at PSI requires a large number of Cs sensors similar to arrays previously designed for bio- magnetometry [4].

References

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(2015).

[2] Z. D. Grujic, P. A. Koss, G. Bison, and A. Weis. A sensitive and accurate atomic magnetometer based on free spin precession. Eur. Phys. J. D
69(5) 2015.

[3] H.-C. Koch, G. Bison, Z.D. Grujic, W. Heil, M. Kasprzak, P. Knowles, A. Kraft, A. Pazgalev, A. Schnabel, J Voigt, and A. Weis.
Investigation of the intrinsic sensitivity of a 3He/Cs magnetometer. Eur. Phys. J. D 69(11), 262 (2015).

[4] G. Lembke, S. N. Erne, H. Nowak, B. Menhorn, A. Pasquarelli, and G. Bison. Optical multichannel room temperature magnetic field imaging system for clinical application. Biomed. Opt. Exp. 5(3), 62–65 (2014).

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Session Classification: WeMo2

Track Classification: Magnetic field sensors (atomic co-magnetometry, AQUIDS, fluxgate)

Contribution ID: **33** Type: **Oral**

Development of a High Intensity Ultra-Cold Neutron Source using Superfluid Helium at TRIUMF

Wednesday, 18 October 2017 09:00 (35 minutes)

Ultracold Neutrons (UCN) are extremely slow neutrons with a kinetic energy in the order of 100 neV. As a consequence, UCNs are totally reflected at the surface of certain materials and can be confined in a material bottle. Using this unique property, UCNs are used for various experiments such as neutron electric dipole moment searches, neutron lifetime measurements, gravity experiments, and other.
An advanced high intensity UCN source is being developped at TRIUMF. The UCN source is composed of a combination of a spallation neutron source and a superfluid helium UCN converter. Spallation neutrons are thermalized first by LD_2 or D_2O moderators. After that they give their kinetic energy to a phonon (single- phonon excitation) or phonons (multi-phonon excitation) in superfluid helium to result in UCNs. A dedicated proton beam line of which beam power is 20 kW was built at Meson halll, TRIUMF. In order to avoid up-scattering of UCN, superfluid helium UCN converter kept cold around 1 K. Cryogenics is a key of our source. Design of the UCN source will be discussed.

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Session Classification: WeMo1

Track Classification: EDM experiment overviews

Contribution ID: **34** Type: **Oral**

The SNS nEDM experiment

Monday, 16 October 2017 14:00 (35 minutes)

The SNS nEDM experiment plans to use a cryogenic central detector and magnet system along with a polarized 3He co-magnetometer to achieve neutron EDM
sensitivities < 3x10-28 e-cm. An overview of the experiment will be discussed including its present status, schedule and a summary of the technical progress on many of the key components.

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Session Classification: MoAf1

Track Classification: Other EDM searches (only overview talks)

Contribution ID: **35** Type: **Oral**

Statistical distribution of electrical breakdown in liquid helium

Wednesday, 18 October 2017 14:35 (25 minutes)

Realization of large electric fields is an important goal for neutron electric dipole moment (nEDM) experiments. For a nEDM experiment performed in superfluid helium such as the SNS nEDM experiment, it is vital to understand the behavior of high electric fields in this medium. The electrical breakdown, which limits the applicable electric potential and field, in liquid helium is poorly understood, but the breakdown is thought to be initiated at electrode surfaces. In order to obtain insight into this phenomenon, we collected data on the distribution of the breakdown voltage and the time before breakdown for small electrodes (effective area ~ 1 cm in diameter) immersed in liquid helium, at various temperature and pressures. In order to study the effect of the surface properties, both electro-polished and mechanically polished stainless steel electrodes were studied. In this talk, we will describe the measurement, present the results, and our interpretation of the results.

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Presenter: Dr PHAN, Nguyen (Los Alamos National Laboratory)

Session Classification: WeAf1

Track Classification: High voltage and electric field control (generation, leakage currents,…)

Contribution ID: **36** Type: **Oral**

Critical Spin Dressing

Thursday, 19 October 2017 10:40 (25 minutes)

It has long been proposed [1] that spin dressing [2] could be employed to realize a highly effective helium-3 nuclear precession co-magnetometer for a neutron electric dipole moment search. The proposal requires application of an intense, continuous, and far off-resonant oscillating magnetic field in such a way that the apparent Larmor precession frequency of both species is modified. Under appropriate conditions a desirable situation known as critical dressing is anticipated: the neutron and the helium-3 nucleus (or more generally, any two spin species) are expected to behave as if they had the same gyromagnetic ratio and hence should precess at the same rate in a static magnetic field.

Spin dressing has been studied in the context of the neutron [3], helium-3 [4], and a variety of other systems [5]. Critical dressing, however, has not previously been demonstrated. We will present results from recent NMR experiments in which simultaneous dressing of ^{1}H and ^{19}F nuclei is studied, and in which critical dressing is observed. Insight gleaned from these experiments is expected to inform strategies for integrating critical dressing into a neutron electric dipole moment search.

[1] Phys Rep **237**, 1 (1994)
[2] J Phys (France) **30**, 153 (1969)
[3] Phys Rev Lett **58**, 2047 (1987)
[4] e.g. Phys Rev A **85**, 3 (2012); Phys Rev C, **76**, 5: 051302, (2007); and Phys Rev C, **84**, 2: 022501, (2011)
[5] e.g. Nature **471**, 83 (2011) or Nature **476**, 185 (2011)

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Session Classification: ThMo2

Track Classification: Experimental techniques (cryogenic, room temperature, crystal)

Contribution ID: **37** Type: **Oral**

Production of highly uniform magnetic field for the n2EDM experiment at the Paul Sherrer Institute.

Thursday, 19 October 2017 09:50 (25 minutes)

This work presents a preliminary design of the coils system developped for the neutron electric dipole moment experiment (n2EDM) at the Paul Sherrer Institute (PSI). The goal of this experiment is to find new sources of CP violation through the measurement of the neutron electric dipole. The current best limit of the nEDM measurement, 2.9×10^{-26} e.cm (90% C.L.) was reached by the RAL-Sussex-ILL collaboration in 2006. The n2EDM experiment aims at improving by one order of magnitude the statistical sensitivity while keeping under control the systematics effects. The gain in sensitivity, as well as the control of the systematics, require to produce a very uniform field.

First, the requirements on the field uniformity will be reminded. Then, the design of the main coil B_0 will be presented. The performances of this coil, simulated by the COMSOL software, will be shown, as well as the robustness of the COMSOL predictions. A field uniformity below 10^{-4} is achieved inside the precession chamber. Requirements on the field gradients are fulfilled. A possible technical design is presented. The influence of the mechanical imperfections are studied.

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Session Classification: ThMo1

Track Classification: Magnetic field control (passive and active shielding, coil design, current sources)

Contribution ID: **38** Type: **Oral**

Introduction and logistics

Monday, 16 October 2017 09:00 (15 minutes)

Presenter: Dr PICKER, Ruediger (TRIUMF)

Session Classification: MoMo1

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

EDM Theory Overview

Presenter: Dr MORRISSEY, David (TRIUMF)

Contribution ID: **40** Type: **Oral**

The TRIUMF science program

Monday, 16 October 2017 15:55 (25 minutes)

Presenter: Prof. DILLING, Jens (TRIUMF)

Session Classification: MoAf2

Contribution ID: **41** Type: **Oral**

PF2 at the ILL and nEDM research

Monday, 16 October 2017 09:15 (30 minutes)

The Institut Laue Langevin (ILL) is an international research centre at the leading edge of neutron science and technology. As the world's flagship centre for neutron science, the ILL provides scientists with a very high flux of neutrons feeding some 40 state-of-the-art instruments, which are constantly being developed and upgraded.
The ultracold (UCN) and very cold neutron (VCN) installation PF2 ("Physique Fondamentale 2") is described and reactor stress test related and requested upgrades are presented.
A brief retrospection on neutron electric dipole moment (nEDM) research using UCNs is given and the status quo for PF2 is described.

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Session Classification: MoMo1

Track Classification: EDM experiment overviews

Contribution ID: **42** Type: **Oral**

Atomic EDM measurement with 129Xe: The HeXe experiment and its motivation

Tuesday, 17 October 2017 12:10 (35 minutes)

EDM measurements in a number of systems are needed to sort out the theoretical meaning of the current experimental landscape (represented by a set of upper limits) and to interpret a potential future discovery. A global analysis of EDM results in the context of a restricted set of low-energy parameters that follow from an effective-field theory approach shows that there is currently no model-independent constraint on the EDM of any experimentally accessible system. Thus even though 199Hg is intrinsically more sensitive to most sources of CP violation and the experiment is more sensitive to the atomic EDM than 129Xe, the discovery potential in 129Xe is just beyond the current limit. Moreover the constraining the hadronic parameters including CP-violating pion-nucleon couplings, a short-range contribution to the neutron EDM and a CP-violating atomic electron-nucleus coupling is most limited by the current experimental sensitivity for129Xe. Improving the 129Xe EDM sensitivity is thus strongly motivated. An approach that could in principle provide one or more orders of magnitude sensitivity is the measurement of free precession using SQUID magnetometers in an exquisitely controlled magnetic environment with 3He comagnetometry - the HeXe experiment. Developments of SQUID magnetometery and magnetically-shielded rooms at TUM-Garching, PTB in Berlin, EDM cells with collaboration from Juelich Neutron Scattering Center, and noble gas polarization also at Michigan, have culminated in a recent EDM measurement that is being evaluated. The global analysis of EDM results related to our motivation and progress towards a measurement that realizes the potential of these techniques will be described.

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Session Classification: TuMo2

Track Classification: EDM experiment overviews

Contribution ID: **43** Type: **Oral**

The Helium-3 system for the SNS neutron EDM experiment

Monday, 16 October 2017 16:55 (25 minutes)

In the SNS experiment, polarized 3He is used to measure the neutron precession frequency as well as to serve as a co-magnetometer. The polarized 3He, from an atomic beam source, is injected into the system and then removed therefrom in each measurement cycle (using a 'heat flush'technique). I will discuss the current status of the system.

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Session Classification: MoAf2

Contribution ID: **44** Type: **Poster**

The UCN facility at TRIUMF

Wednesday, 18 October 2017 15:00 (45 minutes)

The newly installed vertical source at TRIUMF will enable the production of neutrons with energies below 300~neV, referred to as ultracold neutrons (UCN). A superfluid helium cryostat uses three cooling stages and a heat exchanger to produce isopure He-II at <1K. Fast neutrons are produced through spallation of a tungsten target by a proton beam from the TRIUMF 520~MeV cyclotron. These neutrons are cooled down through a series of moderators: first to 300~K in liquid D2O, then to < 80~K in ice D2O, and finally to the ultracold regime in the He-II bulk within the cryostat. Neutrons in this temperature range can be confined by strong interactions with high Fermi potential materials, allowing them to be directed and stored. The ability to confine UCN makes them useful for exploring fundamental neutron physics. In particular, the UCN produced at TRIUMF will be used to probe the upper limit of the neutron electric dipole moment (nEDM), currently bound as $|d_n| < 3{\times}10^{-26} e$cm. The existence of the nEDM is a violation of CP-symmetry, and the magnitude of the nEDM provides insight into CP violating processes.

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Session Classification: Posters

Contribution ID: **45** Type: **Oral**

nEDM research led by PNPI

Wednesday, 18 October 2017 16:05 (30 minutes)

Neutron electric dipole moment (nEDM) research at the Petersburg Nuclear Physics Institute (PNPI) in Gatchina, Russia, is briefly reviewed and the present and near future programme led by PNPI at the Institut Laue Langevin (ILL) in Grenoble, France, outlined.

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Session Classification: WeAf2

Track Classification: EDM experiment overviews

Contribution ID: **46** Type: **not specified**

Conclusion and Closeout

Thursday, 19 October 2017 11:55 (20 minutes)

Presenter: Dr PICKER, Ruediger (TRIUMF)

Session Classification: ThMo2

Contribution ID: **48** Type: **Oral**

CP Violation and the Search for Electric Dipole Moments

Monday, 16 October 2017 10:45 (40 minutes)

CP violation presents two major puzzles for our understanding of fundamental physics. On one hand, we do not know the origin of the CP violation observed in quark mixing. On the other, the amount of CP violation that is seen is not enough to account for the excess of matter over antimatter and appears to be anomalously small compared to what is expected from the structure of the strong force. Upcoming searches for permanent electric dipole moments (EDMs) will play a central role in addressing these questions. In this talk I will explain how tests of EDMs will teach us about the mechanism underlying the matter asymmetry, the flavour and CP structure of new physics beyond the Standard Model, and the resolution to the strong CP problem.

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Session Classification: MoMo2

Track Classification: Theory background

Contribution ID: **49** Type: **Poster**

Status and results for the nEDM experiment at PSI

Wednesday, 18 October 2017 15:00 (45 minutes)

The nEDM experiment at the Paul Scherrer Institute (PSI) has finished data taking and preparations for the installation of the new n2EDM apparatus are in progress. This poster presents the best performances of the nEDM experiment in terms of the transverse spin relaxation time T_2, the visibility α and the best statistical sensitivity per day. We also show the best performances of the Cesium and Mercury magnetometers and results of a recent measurement of a full Ramsey curve. First physics results of the 2015/16 about the limit on an oscillating EDM and the connected search for axions will be presented.

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Cryogenic commissioning of UCN source at PULSTAR

Monday, 16 October 2017 15:10 (20 minutes)

Recently we completed cryogenic commissioning of the UCN source at PULSTAR reactor, located at NC State University campus. As part of the commissioning , we have studied growth of a solid deuterium crystal in situ using external camera and temperature probes. In addition, we did simulation of the pulsed heat input into walls of the cryostat, to simulate condition typical for the pulsed UCN sources.

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