Neutron Electric Dipole Moment: from theory to experiment

Report of Contributions

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

Estimating CP-violating nucleon matrix elements from CP-conserving ones

Thursday, 4 August 2022 10:30 (1 hour)

Presenter: WALKER-LOUD, Andre (Lawrence Berkeley National Laboratory)

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

Topology in SU(N) gauge theories

Tuesday, 2 August 2022 10:30 (1 hour)

Presenter: Dr TEPER, Michael (University of Oxford)

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

Neutron electric dipole moment using lattice QCD

Monday, 1 August 2022 12:00 (1 hour)

We present results on the neutron electric dipole moment $|\vec{d}_n|$ using an ensemble of N_f=2+1+1 twisted mass clover-improved fermions with lattice spacing of $a\simeq$0.08 fm and physical pion mass ($m_\pi\simeq$139 MeV). We compute the CP-odd electromagnetic form factor $F_3(Q^2\rightarrow0)$ by expanding the action to leading order in θ. This gives rise to correlation functions that involve the topological charge, for which we employ a fermionic definition by means of spectral projectors. We find a value of
$|\vec{d}_n|$=0.0009(24) θ e·fm.

Presenter: Prof. ALEXANDROU, Constantia (University of Cyprus)

Contribution ID: **4**   Type: **not specified**

Fermion correlations and absence of CP violation in the strong interactions

Wednesday, 3 August 2022 12:00 (1 hour)

Presenter: Prof. GARBRECHT , Bjorn (Technical University Munich)

Contribution ID: **5**   Type: **not specified**

Calculation of neutron EDMs on the lattice

Wednesday, 3 August 2022 15:00 (1 hour)

Presenter: Dr YOON, Boram (Los Alamos National Laboratory)

Contribution ID: **6**   Type: **not specified**

Disentangling physics beyond the Standard Model with EDMs

Thursday, 4 August 2022 16:00 (1 hour)

Presenter: Dr MEREGHETTI, Emanuele (Los Alamos National Laboratory)

Contribution ID: **7**   Type: **not specified**

Neutron Electric Dipole Moment from the Theta Term with Overlap Fermions

Thursday, 4 August 2022 12:00 (1 hour)

We report our calculation of the neutron electric dipole moment (EDM) induced by the theta term. We use overlap fermions on three 2+1-flavor RBC/UKQCD domain wall lattices with pion mass ranging from ~300 to ~500 MeV. The use of lattice chiral fermions guarantees a correct chiral limit even at finite lattice spacings and enables us to reliably extrapolate our result from heavy pion masses to the physical point. Furthermore, by utilizing the partially-quenched chiral extrapolation formula, several valence pion points are added to better constrain the chiral extrapolation. With the help of the cluster decomposition error reduction (CDER) technique and a large amount of statistics accumulated, the statistical uncertainty is effectively controlled. We also carefully check the systematic uncertainties from the two-state fits, the momentum extrapolation, the chiral extrapolation and the CDER technique.

Presenter: Dr LIU, Keh-Fei (University of Kentucky)

Contribution ID: **8**   Type: **not specified**

Cosmological implications of the Neutron Electric Dipole Moment

Tuesday, 2 August 2022 09:30 (1 hour)

Presenter: Prof. COVI, Laura (Georg-August-Universität Göttingen)

Contribution ID: **9** Type: **not specified**

Theta Dependence of QCD and QCD-like Theories

Monday, 1 August 2022 10:30 (1 hour)

Presenter: Prof. D' ELIA, Massimo (University of Pisa)

Contribution ID: **11** Type: **not specified**

Cluster decomposition, the index theorem, and the strong CP problem

Tuesday, 2 August 2022 12:00 (1 hour)

Presenter: Dr TAMARIT, Carlos (Technische Universität München)

Contribution ID: **12** Type: **not specified**

Aspects of strong CP violation

Thursday, 4 August 2022 09:30 (1 hour)

In this talk, I will explore consequences of the QCD θ-term in our Universe as well as in the Multiverse. First, I discuss the bounds set by element generation in the Big Bang on the value of θ. Then, I present precision results on various couplings of the axion to matter and also discuss a recent proposal of enhanced axiproduction via the $\Delta(1232)$ resonance.

Presenter: Prof. MEISSNER, Ulf (University of Bonn)

Contribution ID: **13** Type: **not specified**

The nEDM @ Spallation Neutron Source experiment: our novel approach and other physics reach

Monday, 1 August 2022 09:30 (1 hour)

Presenter: Prof. LEUNG, Kent (Montclair State University)

Contribution ID: **14** Type: **not specified**

The LANL nEDM Experiment

Monday, 1 August 2022 15:00 (1 hour)

Presenter: Prof. ITO, Takeyasu (Los Alamos National Laboratory)

Contribution ID: **15** Type: **not specified**

BeamEDM –A beam experiment to search for the neutron electric dipole moment

Wednesday, 3 August 2022 10:30 (1 hour)

Presenter: Prof. PIEGSA, Florian (University of Bern)

Contribution ID: **16** Type: **not specified**

EDMs and Baryogenesis

Tuesday, 2 August 2022 15:00 (1 hour)

Presenter: Prof. RAMSEY-MUSOLF, Michael (University of Massachusetts)

Contribution ID: **17**   Type: **not specified**

The Peccei-Quinn axion and QCD topology

Friday, 5 August 2022 11:30 (1 hour)

The Peccei-Quinn axion provides a simple solution to the strong-CP problem and is also a possible source of Dark Matter, being thus one of the most well-motivated extension of the Standard Model.

The simple relation between the axion mass and the QCD topological susceptibility allows, once the behavior of the latter quantity as a function of the temperature is known, to put useful bounds on the axion scale through the misalignment mechanism, which in principle could also be probed by forthcoming experiments such as IAXO.

The numerical non-perturbative computation of the temperature-behavior of the QCD topological susceptibility from lattice simulations is however an highly non-trivial task, being it plagued by serious computational problems, and many different strategies to overcome them have been proposed in the recent literature to this end.

In this talk, after reviewing the main physical aspects of axion physics and of QCD topology, I will give an overview about the current status of lattice determinations of the QCD topological susceptibility at high temperatures and I will discuss possible future research directions.

Presenter: Dr BONANNO, Claudio (INFN Sezione di Firenze)

Contribution ID: **18** Type: **not specified**

The most stringent limit on the nEDM and future improvements at PSI

Wednesday, 3 August 2022 09:30 (1 hour)

As widely known, the discovery of an electric dipole moment (EDM) of the neutron would manifest the invariance time reversal and violate the combined symmetry of charge and parity (CP). At current experimental sensitivities an univocal signature of new physics, either induced by the QCD Theta-term or some beyond Standard Model mechanism.
I will present the most stringent limit on the neutron EDM,
$|d_n| < 1.8 \times 10^{-26}$ ecm [4], from an experiment performed at the Paul Scherrer Institute by an international collaboration deploying Ramsey's method of separated oscillating magnetic fields on stored ultra cold neutrons. I will motivate and discuss the most salient feature of the experiment, a 199Hg co-magnetometer and an array of optically pumped cesium vapor magnetometers to cancel and correct for magnetic field changes.
In a second part, I will present the design of the new instrument, n2EDM, currently mounted at PSI, which will further increase the sensitivity to about 1×10^{-27} ecm [5].

References

[1] A.D. Sakharov. JETP Lett. 5, 24(1967)
[2] C.L. Bennett, D. Larson, J. L. Weiland, et al., ApJS 208, 20 (2013)
[3] D.E. Morrissey and M.J. Ramsey-Musolf, New J. Phys. 14, 125003 (2012)
[4] C. Abel et al., PRL124, 081803 (2020)
[5] N.J. Ayres et al., EPJC81, 512 (2021)

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

Contribution ID: **19**   Type: **not specified**

QCD Theta term contribution to nEDM with Stabilized Wilson Fermion on the lattice

Friday, 5 August 2022 09:00 (1 hour)

Presenter: Dr KIM, Jangho (Forschungszentrum Juelich)

Contribution ID: **20** Type: **not specified**

Neutron electric dipole moment from QCD?

Thursday, 4 August 2022 14:30 (1 hour)

In this talk I will present a dynamical solution of the strong CP problem and discuss its consequences for the existence of a non-vanishing electric dipole moment of the neutron.

Presenter: SCHIERHOLZ, Gerrit (DESY)

Contribution ID: **21** Type: **not specified**

Updates on the PanEDM experiment and future outlook

Friday, 5 August 2022 10:00 (1 hour)

Presenter: DEGENKOLB, Skyler (Universität Heidelberg)

Contribution ID: **22**   Type: **not specified**

Andreas Athenodorou - Welcome

Monday, 1 August 2022 09:15 (15 minutes)