Imperial College London

Science & Technology Facilities Council

# Welcome and introduction


K. Long, 16 February, 2017

# First discussion of nuSTORM in the context of the Physics Beyond Colliders workshop

Thursday 16 Feb 2017, 13:00 → 16:00 Europe/London

Seminar Room 119 (Sir Alexander Fleming Building, Imperial College London)

Kenneth Richard Long (Imperial College (GB))

https://ind[illegible]h/event/606246/

**Description** The physics potential of nuSTORM was presented in the September 2016 "Physics Bey[illegible]iders" [illegible]orkshop kick-off meeting. A work-package has been created in the PBC workshop to consider the fea[illegible]ble[illegible]nuST[illegible]in the North Area at CERN and to evaluate its performance.

The meeting will review briefly the neutrino physics of nuSTORM and t[illegible]that h[illegible]en done[illegible]te on its design. Time has been set aside in the agenda of the meeting for the discussion of the stu[illegible]o be pu[illegible]in the context of the PBC workshop.

Please make your way to the Exhibition Road entrance[illegible]mperia[illegible]ge L[illegible]. The Sir Alexander Fleming (SAF) building (building 33 on the Campus map) is located on the ro[illegible]hat leads [illegible]entra[illegible]o the College on the left-hand side. It is a large, modern glass structure.[illegible]se see the [illegible]e C[illegible] below.

To reach Seminar Room 11[illegible]er the [illegible]building and g[illegible]hort flight of stairs directly opposite the entrance. Walk to the end of the mezzanine. Semi[illegible]oom [illegible]located[illegible]n the right hand side towards the end of the passage.

T[illegible]mes in th[illegible]low a[illegible]al tim[illegible]times are in GMT.

Ph[illegible]confe[illegible]e d[illegible]s for remot[illegible]icipants are listed in the second attachment below.

[illegible]of-So[illegible]ain[illegible] Phone-details.pdf

**Regis[illegible]ion** [illegible]event is open to new participants. Register

**P[illegible]** Alan David Bross, Ao Liu, David Kelliher, David Neuffer, Jingyu Tang, Jorge G. Morfin, Matheus Hostert, Mike Lamont, Patrick Huber, Paul Kyberd, Peter Sievers, Shinji Machida, Steven Boyd, Yoshiharu Mori

Welcome!

# nuSTORM

- A neutrino "light source":
  - High-quality neutrino beam for many applications
  - Proposed (Bross et al) for sterile-neutrino search
  - Much work done:
    - Performance evaluation: physics, ring, diagnostics …
    - Implementation at FNAL considered in some detail

- Opportunity:
  - Exploit exquisite neutrino-beam properties to:
    - Execute high-impact neutrino-nucleus scattering programme
      - Neutrino oscillations (long and short baseline)
      - Nuclear physics
      - Sterile-neutrino search, non-standard interactions …
  - Develop as option for CERN—Physics Beyond Colliders w/s

# IPPP/NuSTEC topical meeting on neutrino-nucleus scattering

http://conference.ippp.dur.ac.uk/event/583/

18-20 April 2017
Europe/London timezone

**IPPP Durham**

Search

- Overview
- Timetable
- Contribution List
- Accommodation
- Travel Information

**Support**

l.a.wilkinson@durham...

Neutrino-nucleus scattering is a critical input to present and future neutrino experiments. Uncertainties related to νA cross sections make a substantial contribution to the systematic-error budgets of, for example, T2K and NOvA, while hadronisation uncertainties need to be addressed in sterile-neutrino-search experiments such as MicroBooNE.

The future sensitivity of DUNE and Hyper-K will be no less sensitive to our understanding of νA scattering. The statistical weight of the data sets collected by each of these experiments will be such that uncertainties on the cross-section themselves and the uncertainty on the $\nu_e$ A to $\nu_\mu$ A cross-section ratio must be reduced to the percent level. Such precise knowledge is required not only to manage the overall systematic uncertainty but also to avoid biases in the oscillation parameters extracted from the data. Evidence for CP-invariance violation (CPiV) will be sought by measuring the rate of $\nu_e$ appearance in a $\nu_\mu$ beam. Therefore, a lack of understanding of $\nu_e$ A scattering will be a pernicious source of bias or uncertainty in the interpretation of any evidence for CPiV.

The measurement, theoretical understanding and phenomenological description of νA scattering are each challenging. To understand νA scattering in sufficient detail for the future neutrino-physics programme to reach its full potential will require the effective collaboration of experimenters, theorists and phenomenologists. Indeed, in the energy range of interest, the combined expertise of nuclear and particle theorists and phenomenologists will be required. Such a collaboration is also likely to generate new insights into long-range QCD and nuclear phenomena.

The goals of the workshop will be to:

- Take stock of the current status of , νA scattering data, the nuclear and particle theory through which it is understood and the phenomenological description of the cross sections and hadronic final states;
- Discuss the programme of measurement, theory and phenomenology required to develop an understanding commensurate with the future neutrino-physics programme; and to
- Evaluate the path towards "global fits" that can be used to make reliable predictions of neutrino-nucleus scattering.

The workshop will be organised jointly by the IPPP and NuSTEC and will include discussion, and appropriate development, of the NuSTEC white paper on neutrino scattering. The desired output of the workshop is a short document in which the status of the field is briefly reviewed and the way forward — experimental, theoretical and phenomenological — is outlined.

# Today

- Take stock:
  - Unique physics potential
  - Accelerator-design work on which PBC study will build
  - Implementation at FNAL on which PBC study can draw
- Identify/advise on:
  - Areas in which PBC study should focus
  - First steps in PBC-study programme
- Agree:
  - Immiedate next steps; and
  - Follow-up meeting

**13:00** → 13:10 **Welcome and introduction**
**Speaker:** Kenneth Richard Long (Imperial College (GB))

**13:10** → 13:30 **Motivation for neutrino cross-section measurements at nuSTORM**
**Speaker:** Patrick Huber (Virginia Tech)
02-nuSTORM-01Hub...

**13:30** → 13:50 **The challenges in neutrino-nucleus scattering physics to be addressed by nuSTORM**
**Speaker:** Jorge G. Morfin (Fermilab)
Morfin-Challenges fo...

**13:50** → 14:10 **nuSTORM and the Physics Beyond Colliders workshop**
**Speaker:** Mike Lamont (CERN)

**14:10** → 14:30 **nuSTORM at FNAL - performance of target, horn, injection and FODO ring**
**Speaker:** Dr. Ao Liu (Fermilab)

**14:30** → 14:50 **nuSTORM at FNAL: consideration of implementation**
**Speaker:** Alan Bross (Fermilab)

**14:50** → 15:10 **nuSTORM: design of an FFAG-based storage ring**
**Speaker:** Jaroslaw Pasternak (Imperial College, London)

**15:10** → 15:30 **nuSTORM: performance of an FFAG focussing ring**
**Speaker:** Sam Tygier

**15:30** → 15:50 **Discussion with a view to agreeing the next steps**

**15:50** → 16:00 **Conclusions and next meeting**
**Speaker:** Kenneth Richard Long (Imperial College (GB))