NuSTEC Update

NuInt 2017 – Toronto, Canada

Jorge G. Morfin
Fermilab
25 June 2017

NuSTEC: Membership

- THEORISTS
- Luis Alvarez Ruso (co-spokesperson)
- Sajjad Athar
- Maria Barbaro
- Omar Benhar
- Richard Hill
- Patrick Huber
- Natalie Jachowicz
- Andreas Kronfeld
- Marco Martini
- Toru Sato
- Rocco Schiavilla
- Jan Sobczyk (nuWRO)

- EXPERIMENTALISTS
- Sara Bolognesi
- (Steve Brice)
- Raquel Castillo
- Dan Cherdack
- Steve Dytman (GENIE)
- Andy Furmanski
- Yoshinari Hayato (NEUT)
- Teppei Katori
- Kendall Mahn
- Camillo Mariani
- Jorge G. Morfín (co-spokesperson)
- (Ornella Palamara)
- Jon Paley
- Roberto Petti
- Gabe Perdue (GENIE)
- Federico Sanchez
- (Sam Zeller)

( ) indicates advisor

NuSTEC Web Page

http://nustec.fnal.gov

NuSTEC: Neutrino Scattering Theory Experiment Collaboration

NuSTEC School 2017

NuSTEC school is a training program in the **physics of neutrino-nucleus scattering**, to be held at **Fermilab, Batavia IL, USA in 7-15 November 2017**. Registration will be open soon.

News

June 12 – Program is fully fixed.

NuSTEC School 2017 7-15 November

Applications open in a week or two

http://nustec.fnal.gov/school2017/

NuSTEC School 2017

NuSTEC Training in Neutrino-Nucleus Scattering Physics 2017

The NuSTEC school is a training program in the **physics of neutrino-nucleus scattering**, to be held at **Fermilab, Batavia IL, USA in 7-15 November 2017**. Registration will be open soon.

The program will include **33 hours of lectures** and **12 hours of recitation** encouraging questions and discussion on all of the day's lectures. The aim of the program is to provide the necessary theoretical background on the physics of electroweak interactions with nucleons and nuclei. It should allow the participants to understand recent developments and to contribute to this field, which has become very important for the future of neutrino physics. Although this training is ideally suited for experimental and theoretical advanced graduate students and young postdocs, senior researchers may find these lectures informative and are welcome to participate.

NuSTEC School 2017 7-15 November

Program with Lecturers fixed

NuSTEC Training in

Neutrino Nucleus Scattering Physics

Fermilab, November 7-15, 2017

	Topic	Hours	Lecturer
0	General introduction	1	P. Huber
1	Introduction to electroweak interactions on the nucleon	3	R. Hill
2	Introduction to neutrino-nucleus scattering	3	J. W. Van Orden
3	Strong and electroweak interactions in nuclei	3	S. Pastore
4.1	Approximate methods for nuclei (I)	2	A. Ankowski
4.2	Approximate methods for nuclei (II)	2	N. Jachowicz
4.3	Ab initio methods for nuclei	2	A. Lovato
5	Pion production and other inelastic channels	3	T. Sato
6	Description of exclusive channels and final state interactions	3	K. Gallmeister
7	Inclusive electron and neutrino scattering in the shallow and deep inelastic regimes	3	J. Owens
8	Systematics in neutrino oscillation experiments	3	S. Bolognesi
9.1	Monte Carlo Methods and Event Generators	3	T. Golan
9.2	Nuisance	2	P. Stowell

- For details of the content of each lecture series please go to:

http://nustec.fnal.gov/school2017/

NuSTEC White Paper

Kendall Mahn and Gabe Perdue

(arXiv:1706.03621)

NuSTEC White Paper: Status and Challenges of Neutrino-Nucleus Scattering

L. Alvarez-Ruso,[1] M. Sajjad Athar,[2] M.B. Barbaro,[3] D. Cherdack,[4] M.E.Christy,[5] P. Coloma,[6] T.W. Donnelly,[7] S. Dytman,[8] R. J. Hill,[9,10,6] P. Huber,[11] N. Jachowicz,[12] T. Katori,[13] A. S. Kronfeld,[6] K. Mahn,[14] M. Martini,[15] J. G. Morfín,[6] J. Nieves,[16] G. Perdue,[6] R. Petti,[17] D. G. Richards,[18] F. Sánchez,[19] T. Sato,[20] J. T. Sobczyk,[21] and G. P. Zeller[6]

NuSTEC White Paper

Ongoing discussion on publishing the white paper in a journal

NuSTEC White Paper

NuSTEC White Paper

A living document? – periodically updated?

Where do we go from here?
How do we address these challenges?

- First of all – what additions and/or changes would you like to see to this review of the status and collection of challenges. We are establishing a convenient way to collect feedback (Wiki?).
- Do we actually need a strategy?
  - From the recent INT workshop as well as contact with Fermilab Directorate and informal chats with funding agency types – a strategy of how we as a community want to address these challenges is important.
  - Can we as a community decide on the most important challenges for each topic?
- NuSTEC will initiate or continue collaborations of theorists and/or experimentalists to address certain challenges.
- NuInt is an excellent example of how we do, and can continue to, address these challenges through workshops.

Addressing the Challenges with Workshops

- Shall we have shorter more focused workshops to address important specific challenges?

- For example, possible Near Future NuSTEC Workshops:
  - **Fermilab Theory-Group "Winter Workshop"** A workshop on neutrino-nucleus scattering physics aimed at HEP theorists is being organized in association with our November school.

  - **Workshop on ν – nucleon physics** – A common challenge across topics! Considerable community interest in a new high-statistics **ν – N** experiment. What experimental techniques? What can (lattice-gauge) theory bring us?

  - **Higher-W** – Last INT workshop spent 90% of the time on QE and fundamental nuclear structure (**important across W!**) 10% on Delta production. The community needs an equally probing look at SIS (Delta to DIS) and the DIS regions. Very important for DUNE.

Addressing the Challenges

- The proposal is to consider these challenges and how to address them as they arise in discussions throughout NuInt.
- Summarize where we are at the conclusion of NuInt.
- Gather interested parties post-NuInt for a planning exercise on addressing these challenges..

Backup

Example Challenges: Theorists

- Significant improvements of nuclear models by theorists are essential and should include:

  1. The development of a unified model of nuclear structure giving the initial kinematics and dynamics of nucleons bound in the nucleus.
  2. Modeling neutrino–bound-nucleon cross sections not only at the lepton semi-inclusive cross section level, but also in the full phase space for all the exclusive channels that are kinematically allowed.
  3. Improving our understanding of the role played by nucleon-nucleon correlations in interactions and implementing this understanding in MC generators, in order to avoid double counting.
  4. Improving models of final state interactions, which may call for further experimental input from other communities such as pion-nucleus scattering.
  5. Expressing these improvements of the nuclear model in terms that can be successfully incorporated in the simulation of neutrino events by neutrino event generators.

These steps can most efficiently be accomplished with additional support of theorists working in this area in a well-coordinated international program. It is then vital to have an established procedure that promotes nuclear and high energy theorists joining neutrino interaction generator experts and neutrino experimentalists in working toward this goal. The aim of this program should be to provide more robust models to meet the requirements of the oscillation experiments, and to deepen the engagement between theorists and generator builders so as to speed the implementation of improved models in generators.