

# Neutrino-Nucleus Interactions for Current and Next Generation Neutrino Oscillation Experiments

December 3 – 13, 2013

Tuesday, December 3

*All talks in C520*

08:00	Registration in C411	
09:00	Welcome from the INT	David Kaplan, Director
09:10	Welcome and workshop overview	Organizers
09:30	QE Experimental Overview	Geralyn Zeller, Fermilab
09:50	QE at NOMAD	Roberto Petti, Univ of South Carolina
10:10	QE at MiniBooNE/SciBooNE	Kendall Mahn, TRIUMF
10:30	Coffee Break	
11:00	QE at MINOS and NOvA	Nathan Mayer, Tufts Univ
11:20	QE at ArgoNeuT	Ornella Palamara, Yale Univ
11:40	QE at MINERvA	Gabriel Perdue, Fermilab
12:00	Future Needs for QE measurements	Deborah Harris, Fermilab
12:30	Lunch	
14:00	Correlations in Nuclei and Spectral Functions	Ingo Sick, Univ Basel
15:00	Spectral functions in generators	Chun-Min Jen, Virginia Tech
15:30	The Transverse Enhancement Model	Arie Bodek, Univ Rochester
16:00	Coffee Break	
16:30	Discussion	

Wednesday, December 4

*Morning talks in C520*

08:30	Scaling of Inclusive Electroweak Interactions with Nuclei: Part I	Maria Barbaro, Univ di Torino
09:00	Scaling of Inclusive Electroweak Interactions with Nuclei: Part II	Juan Antonio Caballero, Univ Seville
09:30	Discussion	
9:55	Coffee Break	
10:15	RPA-based calculations of multi-nucleon effects in scattering	Marco Martini, Ghent Univ
11:00	SuSA-based calculations of multi-nucleon effects in scattering	Jose Enrique Amaro, Univ Granada
11:45	Lunch	

Wednesday, December 4 (Continued)

*Afternoon talks in C421*

- 13:15 Investigation of Nucleon Pair Correlations via  $(e, e'p)$ ,  $(e, e'pp)$  and  $(e, e'pn)$  Reactions  
Douglas Higinbotham, JLab
- 14:30 Coffee Break
- 15:30 Discussion

Thursday, December 5

*Talks in room C520*

- 09:00 Greens Function Monte Carlo  
Joseph Carlson, LANL
- 10:30 Coffee Break
- 11:00 Final State Interaction effects in nucleon emission  
Jan Sobczyk, Wroclaw Univ
- 12:30 Lunch
- 14:00 Multi-nucleon effects and their impact on MiniBooNE oscillation analyses  
Gerald Zeller, Fermilab
- 14:20 Multi-nucleon effects and their impact on T2K oscillation analyses  
Asmita Redij, AEC, Jaclyn Schwehr, Colorado State Univ,  
Yoshinari Hayato, ICRR/Univ of Tokyo, Mark Hartz, Univ of Tokyo
- 15:30 Coffee Break
- 16:00 Discussion

Friday, December 6

*Talks in room C520*

- 09:00 Is a Better Universal Model of CCQE in Sight?  
Gerry Garvey, LANL
- 10:30 Coffee Break
- 11:00 Discussion
- 12:00 Overview and Goals of Inelastic Scattering Discussions  
Christopher Mauger, LANL, Jorge Morfin, Fermilab
- 12:30 Lunch
- 14:00 Overview of inelastic scattering  
Arie Bodek, Univ of Rochester
- 15:30 Coffee Break
- 16:00 Theory of Resonance Production and Decay  
Luis Alvarez-Ruso, Univ Valencia

Saturday, December 7

*Discussions only - 4th floor*

Informal Discussions TBA

Sunday, December 8

*Talks in C520*

- 09:00 **Resonance production and Cascade approach to FSI** Steven Dytman, Univ of Pittsburgh
- 10:30 **Coffee Break**
- 11:00 **Reaction Mechanisms and their Influence on Physics Observables in Neutrino Nucleus Interactions** Ulrich Mosel, Univ Giessen
- 12:30 **Lunch**
- 14:00 **Pion Production in e-scattering with CLAS** Steven Manly, Univ Rochester
- 14:30 **Discussion of FSI** (Pion Absorption, Ronald Ransome + TBD)
- 15:30 **Coffee Break**
- 16:00 **Discussion**

Monday, December 9

*Talks in C520*

- 09:00 **Neutrino Interactions in the Transition Region** Satoshi Nakamura, Kyoto Univ
- 10:30 **Coffee Break**
- 11:00 **Overview of the Kulagin-Petti Model** Sergey Kulagin, Institute for Nuclear Research
- 11:45 **Theoretical Overview of Nuclear Parton Distribution Functions** Shunzo Kumano, KEK
- 12:30 **Lunch**
- 14:00 **Hadronization** Hugh Gallagher, Tufts Univ
- 15:30 **Coffee Break**
- 16:00 **Discussion**

Tuesday, December 10

*Talks in C520*

- 09:00 **Neutrino Generator Round Table 1**  
Hugh Gallagher, Tufts Univ, Ulrich Mosel, Univ Giessen, Jan Sobczyk, Wroclaw Univ,  
Yoshinari Hayato, ICRR/Univ Tokyo (TBC)
- 10:30 **Coffee Break**
- 11:00 **Neutrino Generator Round Table 2**  
Hugh Gallagher, Tufts Univ, Ulrich Mosel, Univ Giessen, Jan Sobczyk, Wroclaw Univ,  
Yoshinari Hayato, ICRR/Univ Tokyo (TBC)
- 12:30 **Lunch**
- 14:00 **A Quantitative Estimate of Nuclear Effects on the Measurement of Oscillation Parameters**  
Camillo Mariani, Virginia Tech & Davide Meloni, Univ Roma Tre
- 15:30 **Coffee Break**
- 16:00 **Discussion**
- 17:00 **NuSTEC meeting** Jorge Morfin, Fermilab

Wednesday, December 11

*Talks in C520*

- 09:00 **NC photon production: theory overview** Richard Hill, Univ of Chicago
- 10:30 **Coffee Break**
- 11:00 **NC photon production: experiments** Teppei Katori, Queen Mary, Univ of London
- 12:30 **Lunch**
- 14:00 **NC photon production: nuclear models and pion photoproduction**  
Xilin Zhang, Ohio Univ
- 15:30 **Coffee Break**
- 16:00 **NC photon Discussion**
- 17:00 **QE discussion**

Thursday, December 12

*Talks in C520*

- 09:00 **NC photon production: neutrino-nucleus coherent scattering**  
Luis Alvarez-Ruso, Univ Valencia
- 10:30 **Coffee Break**
- 11:00 **NC photon discussion and summary** Rex Tayloe, Indiana Univ
- 12:30 **Lunch**
- 14:00 **Theory, Generators, Experiments: What's next**  
Christopher Mauger, LANL & Jorge Morfin, Fermilab
- 15:30 **Coffee Break**
- 16:00 **QE Discussion**  
Gerry Garvey, LANL, Deborah Harris, Fermilab, Hirohisa Tanaka, UBC/IPP,  
Geraldyn Zeller, Fermilab

Friday, December 13

*Talks in C520*

- 09:00 **Open Microphone Session**
- 10:30 **Coffee Break**
- 11:00 **Outlook and To Do for the Future** Organizers, if needed

**Neutrino-Nucleus Interactions for Current and Next Generation Neutrino Oscillation Experiments  
Participants December 3 – 13, 2013**

Luis Alvarez-Ruso	Univ Valencia	<a href="mailto:luis.alvarez@ific.uv.es">luis.alvarez@ific.uv.es</a>	12/4-12/13	C424	5-9828
Jose Enrique Amaro	Univ Granada	<a href="mailto:amaro@ugr.es">amaro@ugr.es</a>	12/2-12/11	C424	5-9827
Constantinos Andreopoulos	Univ Liverpool	<a href="mailto:costas.andreopoulos@stfc.ac.uk">costas.andreopoulos@stfc.ac.uk</a>	12/2-12/6	<i>no office</i>	
Artur Ankowski	Okayama Univ	<a href="mailto:artur.ankowski@roma1.infn.it">artur.ankowski@roma1.infn.it</a>	12/8-12/14	B447	6-5342
Maria Barbaro	Univ di Torino	<a href="mailto:barbaro@to.infn.it">barbaro@to.infn.it</a>	12/2-12/8	B447	6-5342
Omar Benhar	Univ La Sapienza	<a href="mailto:omar.benhar@roma1.infn.it">omar.benhar@roma1.infn.it</a>	12/9-12/13	C418	5-9782
Arie Bodek	Univ Rochester	<a href="mailto:ariebodek@gmail.com">ariebodek@gmail.com</a>	12/2-12/8	<i>no office</i>	
Juan Antonio Caballero	Univ Seville	<a href="mailto:jac@us.es">jac@us.es</a>	12/2-12/8	C422	5-9779
Joseph Carlson	LANL	<a href="mailto:carlson@lanl.gov">carlson@lanl.gov</a>	12/2-12/11	C438	5-9830
Kevin Connolly	Univ Washington	<a href="mailto:hbar@uw.edu">hbar@uw.edu</a>	12/3-12/13	<i>no office</i>	
Bill Donnelly	MIT	<a href="mailto:donnelly@mit.edu">donnelly@mit.edu</a>	11/30-12/7	C437	5-3620
Steven Dytman	Univ Pittsburgh	<a href="mailto:dytman@pitt.edu">dytman@pitt.edu</a>	12/4-12/14	<i>no office</i>	
Hugh Gallagher	Tufts Univ	<a href="mailto:hugh.gallagher@tufts.edu">hugh.gallagher@tufts.edu</a>	12/4-12/11	<i>no office</i>	
Gerry Garvey	LANL	<a href="mailto:garvey@lanl.gov">garvey@lanl.gov</a>	12/3-12/13	C420	5-9781
Carlotta Giusti	Univ Pavia	<a href="mailto:Carlotta.Giusti@pv.infn.it">Carlotta.Giusti@pv.infn.it</a>	12/2-12/8	C437	5-3620
Richard Gran	Univ Minnesota	<a href="mailto:rgran@d.umn.edu">rgran@d.umn.edu</a>	12/4-12/8	<i>no office</i>	
Deborah Harris	Fermilab	<a href="mailto:dharris@fnal.gov">dharris@fnal.gov</a>	12/2-12/9	<i>no office</i>	
Mark Hartz	Univ Tokyo	<a href="mailto:mark.hartz@ipmu.jp">mark.hartz@ipmu.jp</a>	12/3-12/13	<i>no office</i>	
Yoshinari Hayato	ICRR, Univ Tokyo	<a href="mailto:hayato@icrr.u-tokyo.ac.jp">hayato@icrr.u-tokyo.ac.jp</a>	12/2-12/14	<i>no office</i>	
Douglas Higinbotham	JLab	<a href="mailto:doug@jlab.org">doug@jlab.org</a>	12/2-12/7	<i>no office</i>	
Richard Hill	Univ Chicago	<a href="mailto:richardhill@uchicago.edu">richardhill@uchicago.edu</a>	12/8-12/13	C404	5-3971
Chun-Min Jen	Virginia Tech	<a href="mailto:cjen@vt.edu">cjen@vt.edu</a>	12/2-12/12	<i>no office</i>	
Teppei Katori	Queen Mary, U London	<a href="mailto:katori@fnal.gov">katori@fnal.gov</a>	12/6-12/14	<i>no office</i>	
Sergey Kulagin	Institute Nuclear Research	<a href="mailto:sergey.kulagin@gmail.com">sergey.kulagin@gmail.com</a>	12/1-12/13	B468	5-9721
Shunzo Kumano	KEK	<a href="mailto:shunzo.kumano@kek.jp">shunzo.kumano@kek.jp</a>	12/6-12/10	C431	5-3719
Kendall Mahn	TRIUMF	<a href="mailto:kendallm@triumf.ca">kendallm@triumf.ca</a>	12/2-12/12	B449	5-9773
Steven Manly	Univ Rochester	<a href="mailto:steven.manly@rochester.edu">steven.manly@rochester.edu</a>	12/4-12/9	<i>no office</i>	
Camillo Mariani	Virginia Tech	<a href="mailto:camillo@vt.edu">camillo@vt.edu</a>	12/9-12/12	<i>no office</i>	
Marco Martini	Ghent Univ	<a href="mailto:martini.marco@gmail.com">martini.marco@gmail.com</a>	12/2-12/13	B474	5-9774
Christopher Mauger	LANL	<a href="mailto:cmauger@lanl.gov">cmauger@lanl.gov</a>	12/5-12/14	C420	5-9780
Nathan Mayer	Tufts Univ	<a href="mailto:nathan.mayer@tufts.edu">nathan.mayer@tufts.edu</a>	12/2-12/14	<i>no office</i>	

Kevin McFarland	Univ Rochester	<a href="mailto:kevin@rochester.edu">kevin@rochester.edu</a>	12/4-12/9	<i>no office</i>	
Guillermo Megias Vazquez	Univ Seville	<a href="mailto:megias@us.es">megias@us.es</a>	12/2-12/8	<i>no office</i>	
Davide Meloni	Univ RomaTre	<a href="mailto:meloni@fis.uniroma3.it">meloni@fis.uniroma3.it</a>	12/7-12/13	B474	5-9775
Oscar Moreno	MIT	<a href="mailto:osmoreno@mit.edu">osmoreno@mit.edu</a>	12/2-12/7	B474	5-9775
Jorge Morfin	Fermilab	<a href="mailto:morfin@fnal.gov">morfin@fnal.gov</a>	12/5-12/13	C411A	5-3606
Ulrich Mosel	Univ Giessen	<a href="mailto:mosel@physik.uni-giessen.de">mosel@physik.uni-giessen.de</a>	11/30-12/13	B468	5-9723
Satoshi Nakamura	Kyoto Univ	<a href="mailto:nakamura@yukawa.kyoto-u.ac.jp">nakamura@yukawa.kyoto-u.ac.jp</a>	12/2-12/14	C437	5-3620
Juan Nieves	IFIC (CSIC & UV)	<a href="mailto:jmnieves@ific.uv.es">jmnieves@ific.uv.es</a>	12/9-12/15	C437	5-3620
Scott Oser	UBC	<a href="mailto:oser@phas.ubc.ca">oser@phas.ubc.ca</a>	12/2-12/13	<i>no office</i>	
Ornella Palamara	Yale Univ	<a href="mailto:ornella.palamara@yale.edu">ornella.palamara@yale.edu</a>	12/2-12/5	<i>no office</i>	
Gabriel Perdue	FNAL	<a href="mailto:perdue@fnal.gov">perdue@fnal.gov</a>	12/3-12/7	<i>no office</i>	
Roberto Petti	Univ South Carolina	<a href="mailto:petti@sc.edu">petti@sc.edu</a>	12/2-12/7	C418	5-9782
Xin Qian	BNL	<a href="mailto:xqian@bnl.gov">xqian@bnl.gov</a>	12/2-12/13	<i>no office</i>	
Ronald Ransome	Rutgers Univ	<a href="mailto:ransome@physics.rutgers.edu">ransome@physics.rutgers.edu</a>	12/7-12/10	C437	5-3620
Asmita Redij	AEC	<a href="mailto:asmita.redij@lhep.unibe.ch">asmita.redij@lhep.unibe.ch</a>	12/3-12/10	<i>no office</i>	
Federico Sanchez	IFAE	<a href="mailto:fsanchez@ifae.es">fsanchez@ifae.es</a>	12/2-12/13	<i>no office</i>	
Rocco Schiavilla	JLab	<a href="mailto:schiavil@jlab.org">schiavil@jlab.org</a>	12/8-12/13	C422	5-9779
David Schmitz	Univ Chicago	<a href="mailto:dwschmitz@uchicago.edu">dwschmitz@uchicago.edu</a>	12/5-12/10	<i>no office</i>	
Anne Schukraft	Fermilab	<a href="mailto:aschu@fnal.gov">aschu@fnal.gov</a>	12/2-12/9	<i>no office</i>	
Jaclyn Schwehr	Colorado State Univ	<a href="mailto:jackie.schwehr@colostate.edu">jackie.schwehr@colostate.edu</a>	12/1-12/15	<i>no office</i>	
Armen Sedrakian	Uni Frankfurt	<a href="mailto:sedrakian@th.physik.uni-frankfurt.de">sedrakian@th.physik.uni-frankfurt.de</a>	12/3-12/7	<i>no office</i>	
Ingo Sick	Univ Basel	<a href="mailto:ingo.sick@unibas.ch">ingo.sick@unibas.ch</a>	12/2-12/8	C404	5-3971
Jan Sobczyk	Wroclaw Univ	<a href="mailto:jsobczyk@ift.uni.wroc.pl">jsobczyk@ift.uni.wroc.pl</a>	12/2-12/13	B447	6-5006
Hirohisa Tanaka	UBC/IPP	<a href="mailto:tanaka@phas.ubc.ca">tanaka@phas.ubc.ca</a>	11/30-12/14	C411A	5-3633
Rex Tayloe	Indiana Univ	<a href="mailto:rtayloe@indiana.edu">rtayloe@indiana.edu</a>	12/8-12/14	C422	5-9778
Wally Van Orden	Old Dominion Univ/JLab	<a href="mailto:vanorden@jlab.org">vanorden@jlab.org</a>	12/2-12/7	C422	5-9778
Stanley Yen	TRIUMF	<a href="mailto:stan@triumf.ca">stan@triumf.ca</a>	12/2-12/13	B449	5-9726
Geralyn Zeller	Fermilab	<a href="mailto:gzeller@fnal.gov">gzeller@fnal.gov</a>	12/2-12/13	C411A	5-3606
Xilin Zhang	Ohio Univ	<a href="mailto:zhangx4@ohio.edu">zhangx4@ohio.edu</a>	12/3-12/14	B470	N/A