Workshops & Schools Working Group

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Thank you: Jon Paley, Natalie Jachowicz, Raquel Castillo, Jorge Morfin

NuSTEC Board Meeting
12/15/22

Working Group Objectives

- Foster the understanding of neutrino interactions
- Attract new people
- Ensure continuity of the expertise
- Connect theorists and experimentalists
- Provide early career researchers with opportunities to present their findings
- Encourage open discussion and collaboration

Workshops

We would like to:

1. Identify specific needs and target audience who could benefit from a workshop
2. Find potential fundings
3. Avoid conflicts with other workshops

Previous Workshops

Previous NuSTEC workshop have been very successful:

2017 IPPP

2018 SIS/DIS

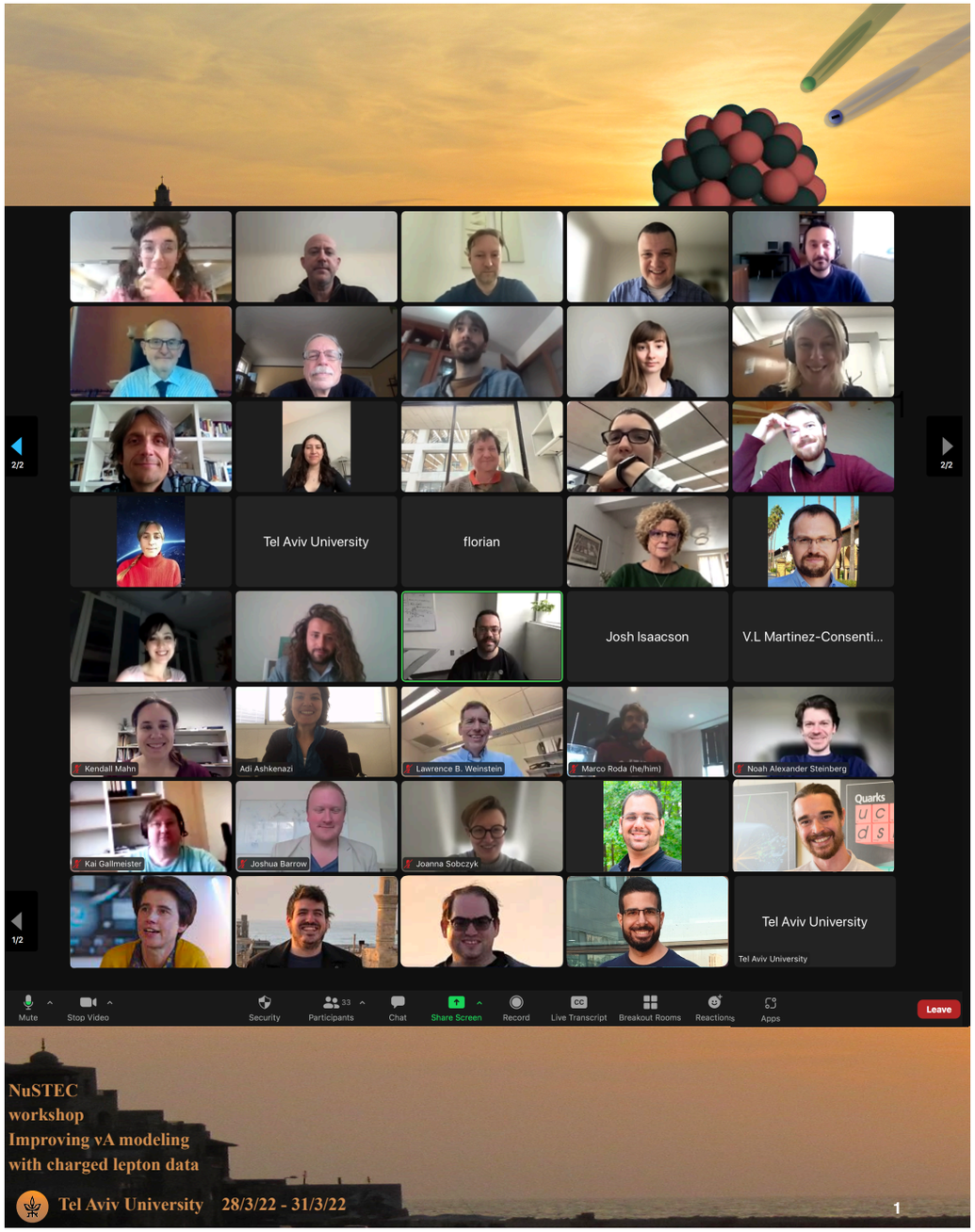
2019 Single pion production

2021 New Directions (online)

2022 Improving the art of neutrino nuclei modelling with charged lepton scattering data (online)

Even online workshops were very well attended

Average of once a year



Focusing on Neutrino scattering at low and intermediate energies

Cover the physics of neutrino nucleus interactions, from Cl
supernova and oscillation experiments from both theoretica
experimental perspective.

Due to MITP constraints limited to 30 participants

Next Workshops

1. **Experimental methods for cross-section extraction.**

   Which variables should be used (True Ev?)

   Agreed upon systematics

   Statistical issues in cross-section extraction (e.g. unfolding, template fitting).

   Cross experiments agreement is needed

2. **Generator tuning**

   Different generators apprroaches

   Experiment specific tunes from (NOvA, uBooNE, MINERvA, T2K)

3. **Going beyond QE - Single pion production, 2p2h, RES and SIS and DIS**

4. **External constraints to Flux**

5. **External constraints to cross section**

Workshop Input from Experiments

uBooNE (Afro):
1. External constraints (electron scattering [e4v, LDMX], flux constraints with hadron production data [NA61, etc])
2. Neutral-current measurements for disappearance oscillation studies
3. Measurements with antineutrinos for DUNE
4. Low energy measurements and theory (inclusive and exclusive channels) for solar/supernova neutrino analyses
5. Coherent elastic neutrino-nucleus scattering (what is the needed precision to test for various BSM scenarios?)
6. Tuning efforts. Some questions in particular: which data sets are used, and which are excluded? What are the criteria, how is this determined, what choices are made when there is tension between data sets? How are the tuning parameters chosen, and how are a priori uncertainties on them estimated?
7. Data longevity / preservation: How can we best store and preserve the utility of the data measurements that we are making now? Is there information that every measurement should try to present as part of its data release? What is the format in which this data is best released for use (nuisance, hepdata, something else)?
8. Energy range of cross section measurements. In addition to the transition region, already addressed in your email, are additional low energy measurements needed for supernova physics, how are these measurements best made, and what measurements are most needed?
9. Heads up wrt the CC0pi measurements, we are gonna be having multiple new measurements coming out in the near future, so stay tuned!

SBND (Vishvas and Andy):
1. SBND has very high stats so even though the SIS region is in the tails of our interaction rates we can make useful measurements. But right now we don't really have much of an idea of what would be useful measurements. Theoretical guidance on what measurements can make a big impact would be useful, and this is likely to come from workshops and coffee break discussions, etc.
2. For a CC0pi workshop, I think this is useful and obviously relevant to us as it's the primary interaction mode and will be critical for most SBN oscillation searches. One thing for us to consider is that we'll have the statistics (and hopefully resolution) to really zoom in on narrow parts of phase space where certain effects might be dominant and therefore easier to pin down.
(Especially) For a CC0pi workshop, SBND-PRISM will be able to test/demonstrate with less than a year or so of data (which will be true for other channels too, but we will have humongous stats for CC0pi).
3. I strongly think that a workshop on tuning methods and their impacts will be very important and timely.

ICARUS (Minerba):
1. I think the tuning, systematics, unfolding and the incomplete descriptions for 2p2h, RES and DIS are some of the urgent to do the community have
2. I think a dedicated workshop about 2p2h and/or RES/DIS will be useful, QE is not the full story for current and future experiments
3. The systematics, we are using some house made from the experiment and the theory community is starting to work on this. I think it will be useful to collaborate more and establish some parameters/systematics we all could use
4. Every experiment has different tunes, I am afraid we could be hiding some phyisics with the tunes. Maybe some guidance from theory community could help to have more meaningful parameters to tune

T2K (Margherita):
The fact is that we find all your proposal veeeery interesting and there is not much to add.
All topics you mentioned are absolutely relevant and those are the questions we regularly rise up.

Thank you Clarence

Next Workshops

Do you have any other idea?

Would you like to join the organization of one of those ideas?

The NuSTEC School

From last meeting:

Aiming for a 9-10 days school to newcomers
for postdocs graduate students working on neutrino interaction

educate experimentalists and theorists to have a much better understanding of both the nuclear and particle physics of neutrino-nucleon/nucleus scattering. The lectures will be delivered by internationally recognized experts in the field and will cover such topics as strong and electroweak interactions in nuclei, methods for calculating scattering in nuclei, final state interactions, connections with electron scattering, approaches to estimating scattering systematic uncertainties in oscillation experiments, and monte carlo simulation methods and tools.

In person school better than remote

Should be affordable

Many experts (either in main lab or next to a big conference)

The NuSTEC School - Schedule

Aiming for 2024

6 Months before location organisers funding secured
Registration starts

4 months before program closed
Registration closes

Thank you Raquel

The NuSTEC School - Venues

CERN (Albert De Roeck)

nuINT Sao Paulo (Helio da Motta)

Fermilab

Los Alamos (Sowjanya Gollapinni, Joe Carellson, Emanuelle Mereghetti)

ECT*

JLab

The NuSTEC School - Venues

CERN (Albert De Roeck)
- Lots of support, potentially also financial support and local organization
- Available at 2024

nuINT Sao Paulo (Helio da Motta)
- Positive response
- Same venue as “Instituto Princípia”

Fermilab
- Already hosting International Neutrino School this summer
- Known problem with entrance approvals

Los Alamos (Sowjanya Gollapinni, Joe Carellson, Emanuelle Mereghetti)
- Very positive response
- Venue in Santa Fe, available this summer

ECT*
- Opens a call for DTP proposals in Spring. Potentially interested

JLab
- Positive first reaction

The NuSTEC School - Funding

Estimated budget $90K, out of which $40K from fees. Need to raise minimum of $50K

Potential funders 5K-20K:

- DOE write a proposal using FWP
- JLab
- NSF
- ANL
- Fermilab FRA
- Fermilab ND
- CERN
- URA
- Private funders: Corporate Partner Rocco and Robert Lourie

Thank you Jorge

The NuSTEC School

If you're interested in joining the effort we're looking for help in:

General organisation -

Funding -

Contact venues -

Looking forward to a great new year filled with NuSTEC activity

Thank you