

November 30th - December 4rd 2020

Community-wide [Nov. 30 - Dec. 1] <https://indico.fnal.gov/e/leplar2020>
DUNE-focused [Dec. 3-4] <https://indico.fnal.gov/e/leplardune2020>

LEPLAr

workshop on Low Energy Physics in Liquid Argon

Photo credit: Steve Krave

Organizers:

D. Caratelli
A. Friedland
S. Gardiner
I. Gil Botella
A. Himmel
B. Littlejohn
G. Karagiorgi
M. Kirby
G. Lehmann
M. Mooney
J. Riechenbacher
K. Scholberg
M. Sorel
A. Sousa
T. Yang
J. Yu

Poster credit: David Caratelli

“Low-Energy Events”

... define as the $< \sim 100$ MeV regime

“Stubs and Sparkles”

... ~ 10 cm scale electron tracks
+Comptons from nuclear
deexcitation γ 's, etc..

(“events you could hold in your arms”)



...but that also make up components of GeV-scale events



LEPLAr Goals

- Identify **physics opportunities** in the <100 MeV regime that can be addressed by DUNE (and similar large LArTPCs) and related **technical challenges** for the different technical working groups. Included are low-energy signatures within GeV-scale events.
 - Develop a **standard set of signal and background assumptions**, identify **knowledge gaps and possible experimental/theoretical remedies**
 - **Enhance communication** between DUNE technical working groups for addressing LE-physics-related challenges
 - **Share experience** with other LArTPC experiments
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- Short term output: **white paper for Snowmass**
 - Longer term output: better design and implementation for LE physics
 - Mostly technical focus, but some higher-level physics
 - DUNE-focused, but inviting some broader participation
 - Quite possibly there will be follow-on workshops

Public Workshop

Day 1: (Mon Nov 30) Physics

- Supernova burst, other transient
- Solar, DSNB
- Low-energy BSM
- MeV-scale signatures as part of GeV-scale events

Many theorists, non-collaborators invited

open to community

Day 2: (Tue Dec 1) Simulations

- Interaction generators
- Particle transport
- Photon transport
- Ancillary measurements

Many theorists, non-collaborators invited

Internal DUNE Workshop

Day 3: (Thu Nov 3) Hardware

- Photon and TPC optimization
- Calibration
- Backgrounds
- Low-level reco

Mostly DUNE internal discussion

DUNE collaborators

Day 4 (Fri Nov 4) Software

- High-level reco
- Trigger
- DAQ
- Computing

Mostly DUNE internal discussion

Note: lots of overlap between topics!

Daily Workshop Format

- Two talk sessions
 - Two panels with questions
for panelists + audience
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- Identify opportunities
 - Identify challenges
 - What are the knowledge gaps?
 - Identify deliverables for the next months/years
(for DUNE and community)

Day 1: Physics Motivations

Organizers: Alex Friedland, Bryce Littlejohn, Alex Sousa, Jae Yu

- Core-collapse supernova bursts, other transients (thermonuclear SNe, mergers, ...)
- Solar, DSNB
- Low-energy BSM
- MeV-scale signatures as part of GeV-scale events
- include also “aspirational” topics, i.e., that might be enabled by very low background, very low energy threshold (perhaps for “Module of Opportunity”)

Day 2: Simulations

Organizers: David Caratelli, Steven Gardiner, Bryce Littlejohn

- Interaction cross sections and generators
 - high energy
 - low energy
- Particle propagation:
 - photons
 - hadrons
- Detector response
- Ancillary measurements
 - Cross sections
 - Particle transport

Day 3: Detector optimization for low energy

Organizers: Inés Gil-Botella, Mike Mooney, Juergen Reichenbacher,
Michel Sorel, Tingjun Yang

- Photons
- TPC optimization
- Calibrations
- Backgrounds
- Low-level reco (noise, ROI finding, hit reco)
- Experience from other experiments (ArgoNeut, MicroBooNE)

Day 4: Software/DAQ/Computing

Organizers: Alex Himmel, Georgia Karagiorgi, Mike Kirby,
Giovanna Lehmann, Heidi Schellman

- High-level reco (pattern recognition, track finding, ML)
- Trigger/data selection
- DAQ
- Computing
- Experience from other experiments (MicroBooNE, SBN)

Workshop Deliverable

- White paper for Snowmass (two?)
 - Contact organizers for Overleaf edit access
- Follow-on workshops? (TBD)
- DUNE Slack #leplar-workshop (for DUNE collaborators)