Università degli Studi di Padova

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AULA VOCI

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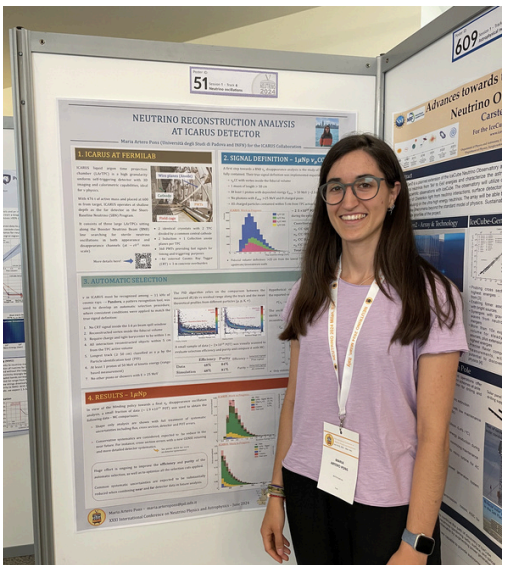
First Search for Sterile Neutrino Oscillation Leading to νμ Disappearance in the Booster Neutrino Beam at ICARUS

Abstract: The ICARUS Collaboration successfully operated the 760-ton T600 detector at the LNGS underground laboratory before its refurbishment at CERN and relocation to Fermilab. Since 2021, ICARUS has been recording neutrino events from both the Booster Neutrino Beam (BNB) and the off-axis Neutrinos at the Main Injector (NuMI) beam. Now in its fifth year of continuous operation, ICARUS demonstrates the maturity of large-scale Liquid Argon Time Projection Chamber (LAr-TPC) technology, providing a critical foundation for future experiments like DUNE.

In this seminar, the first search for muon-neutrino disappearance in the BNB using the ICARUS detector is presented. Neutrino events, identified as charged-current muon-neutrino interactions with a final state consisting of a muon and at least one proton (1μNp), are selected from data collected during 2022–2023 (ICARUS Run 2) and compared with simulation-based expectations. The results are interpreted within a two-neutrino approximation of the 3+1 sterile-neutrino framework, accounting for systematic uncertainties associated with the neutrino flux, interaction modeling, and detector response. Fits of the data with the oscillation model are compatible with the no-oscillation hypothesis, indicating a null muon neutrino disappearance within the experimental sensitivity and hence exclusion contours are reported.

Even if the current sensitivity is limited by systematic effects primarily due to unconstrained flux and cross-section uncertainties, this initial oscillation analysis probes the parameter space favoured by existing νμ disappearance measurements and establishes important foundations for future Short-Baseline Neutrino (SBN) Program analyses where the combined data from SBND and ICARUS will substantially reduce these uncertainties and enable a definitive test of the long-standing sterile-neutrino anomalies.

Maria Artero Pons received her PhD in Particle Physics from the University of Padova in 2024, where she currently holds a postdoctoral fellowship within the ICARUS and DUNE collaborations. She first specialized in neutrino physics during her Master's thesis at Universidad Complutense de Madrid, where she began her work with Liquid Argon Time Projection Chamber (LArTPC) technology. Her current research focuses on enhancing the precision of neutrino interaction analysis and event reconstruction algorithms. She also served as ICARUS Run Coordinator, overseeing detector operations and contributing to the experiment's milestone of five years of successful continuous operation.



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