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Tackling Sterile Neutrino Global Fits with Simulation-Based Inference

Thursday 15 May 2025 09:00 (23 minutes)

Neutrino experiments across diverse production and detection methods, baselines, and energy ranges have observed anomalies hinting at beyond-Standard Model physics. These unexplained appearances and disappearances could stem from oscillations into sterile neutrino states. Global fits—combined statistical analyses of multiple experiments—are essential for probing such models. However, even in the simplest 3+1 sterile neutrino scenario, these fits become computationally intractable due to violations of Wilks' theorem. In this talk, I will outline these statistical challenges, introduce simulation-based inference (SBI)—a cutting-edge machine learning (ML) approach to efficient analyses of data—and demonstrate how SBI can overcome computational barriers in global fits. Once fully developed, SBI has the potential to unlock previously inaccessible analyses in particle physics, and may be a vital tool for hunting down the sterile neutrino.

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