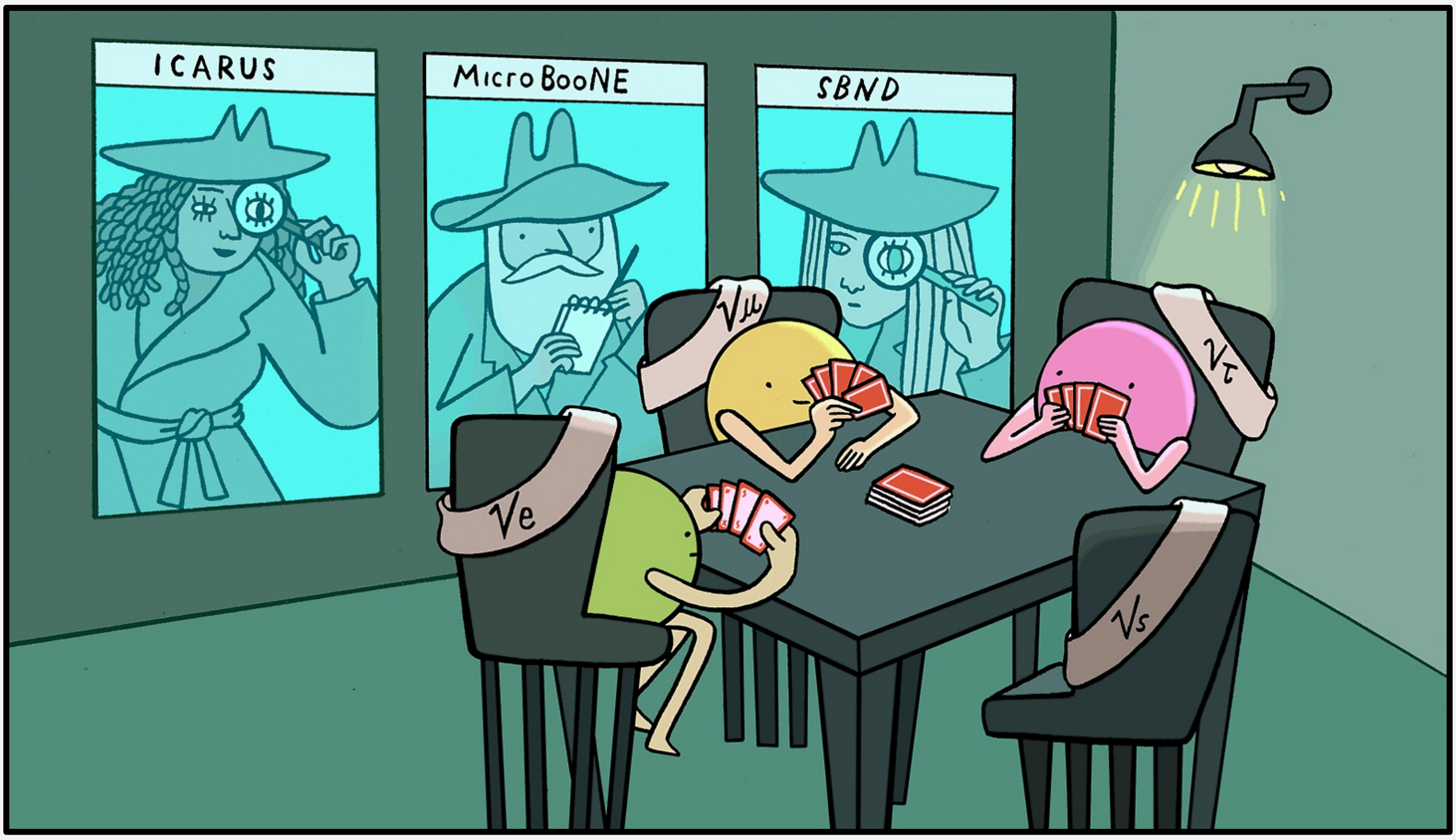
Neutrino Physics Today and Tomorrow:
Confronting Anomalies and Seeking BSM Signatures

Vedran Brdar
Oklahoma State University, USA



In this talk, I will first review the status of neutrino physics by focusing on the discovery of neutrino oscillations, a Nobel Prize-awarded phenomenon. This will be followed by a summary of open questions, one of which concerns experiments that have found anomalous results, challenging the standard three-neutrino framework. I will discuss the anomalous findings of the MiniBooNE experiment, which have been touted as either a possible hint of new physics or a reflection of our poor understanding of neutrino–nucleus cross sections. I will also discuss experiments studying neutrinos from intense radioactive sources, which have reported a deficit in the measured event rate for the process of neutrino capture on gallium-71, through which germanium-71 is produced.
Then, I will move to high-energy neutrinos observed by the IceCube and KM3NeT experiments. Specifically, the KM3NeT collaboration recently detected a neutrino event with an energy of 220 PeV, which is more than an order of magnitude higher than the highest-energy neutrino in IceCube's catalog. Despite its larger effective area and longer data-taking period, IceCube has not observed events of similar energies, which is unexpected. The 220 PeV neutrino detected at KM3NeT traversed approximately 150 km of rock and sea en route to the detector, whereas neutrinos arriving from the same location in the sky would have traveled through only about 15 km of ice before reaching IceCube. I will show how this difference in propagation distance can be utilized to address the tension between KM3NeT and IceCube. In the last part of the talk, I will discuss prospects for constraining light new physics particles at the forthcoming DUNE experiment, focusing on the liquid argon near detector.

Quarta-feira
16:00

4
junho
2025

Anfiteatro de Física
Escola de Ciências
Gualtar

CF-UM-UP
LIP
Universidade do Minho
Escola de Ciências
Departamento de Física