

High and Ultra-High-Energy Neutrinos: Cosmic Accelerators, Black Holes, and Quantum Imprints

Prof. Dr. Elisa Resconi

TUM School of Natural Sciences, Technische Universität München

High and ultrahigh energy neutrinos provide a unique window into the most extreme environments in the Universe. Produced in powerful cosmic accelerators such as active galactic nuclei, these elusive particles traverse vast cosmic distances and reach Earth unharmed by magnetic fields or matter. In this talk, we explore how neutrinos act as messengers from supermassive black holes, revealing the physical conditions and processes in their vicinity. We also consider how their observation, in combination with other messengers, may provide subtle clues to the intimate nature of gravity at the quantum level. Highlighting recent results from IceCube and KM3NeT, I will present the scientific vision behind the Pacific Ocean Neutrino Experiment (P-ONE), which not only aims to deepen our understanding of the high-energy universe, but also promises to become a unique infrastructure for studying the rapidly changing ocean environment.