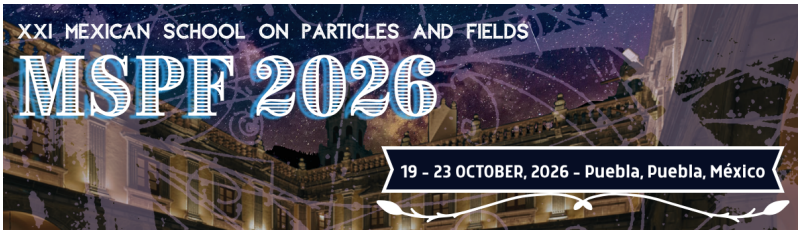
XXI Mexican School on Particles and Fields 2026



Monday 19 October 2026 - Friday 23 October 2026

Puebla

Conference Scientific Programme

Programme Tentative Academic Program The program combines theoretical foundations, computational tools, data analysis, and hands-on instrumentation to provide participants with an integrated introduction to contemporary high-energy physics. 1. Foundations of the Standard Model of Particle Physics, by Prof. Myriam Mondragón Ceballos [UNAM] Fundamental particles and interactions Gauge symmetries and conservation laws Electroweak and strong interactions Experimental tests of the Standard Model Open questions and physics beyond the Standard Model 2. The Higgs Sector: Unraveling the Fundamental Interactions of the Standard Model, by Prof. Luis Flores Castillo [The Chinese University of Hong Kong] The Higgs mechanism and electroweak symmetry breaking Higgs boson production and decay channels Experimental discovery and measurements at the LHC Higgs couplings to fermions and gauge bosons Current results and prospects for future studies 3. Introduction to Gravitation and Modern Physics, by Prof. Iraís Rubalcava [BUAP] Foundations of special and general relativity Gravity as the geometry of spacetime Black holes and gravitational waves Connections between gravitation, cosmology, and particle physics Open questions concerning gravity and quantum mechanics 4. Hands-on Instrumentation for High-Energy Physics, by Prof. Epifanio Ponce, Prof. Guillermo Tejeda, M.I. Emigdio Jiménez [BUAP] and Prof. Mateo Ramírez [IBERO] Principles of particle detection Introduction to detector components and readout systems Assembly and testing of particle detectors Construction and characterization of scintillator detectors Signal acquisition using a coincidence module Detector calibration and performance evaluation Analysis of signals and data from currently operating experiments 5. ROOT for High-Energy Physics Data Analysis: From Fundamentals to Advanced Tools, Dr. Stephan Hageböck [CERN] Introduction to ROOT Histograms, graphs, and data visualization Data input and output using TFile and TTree Introduction to RDataFrame Collections and advanced RDataFrame features Interoperability between C++ and Python Using ROOT in Jupyter notebooks Emerging ROOT tools: RFile, RNTuple, new histogram interfaces, and memory management Development of reproducible analysis workflows 6. Practical Machine Learning for High-Energy Physics Data Analysis, Prof. Alfredo Castañeda [Universidad de Sonora] Introduction to machine learning in high-energy physics Preparation and exploration of LHC Open Data Feature selection and data preprocessing Supervised learning for classification and regression Model training, validation, and performance evaluation Interpretation of machine-learning results Practical analysis of data from LHC experiments Implementation of reproducible workflows in Python and Jupyter Integrative Activities Throughout the program, participants will work on practical exercises connecting theory, instrumentation, and data analysis. The course will culminate in a small project in which participants will acquire or examine experimental data, process it using ROOT and Python, and apply statistical or machine-learning techniques to interpret the results.