Lectures will take place in Aula D, 2nd floor - Department of Physics and Geology - Via A. Pascoli.

Seminar will take place in Aula A, 1st floor - Department of Physics and Geology - Via A. Pascoli.

Quanta-chat will take place in the meeting room, 1st floor - Department of Physics and Geology - Via A. Pascoli.

Lectures will also be broadcast on ZOOM: https://cern.zoom.us/j/7459026581

The seminar will be streamed via TEAMS: https://tinyurl.com/QCNNJETS

Lecture 1 - Tuesday, January 21: 11:00–13:00

Title - Quantum Computing Today – An Introduction

Dr. Alice di Tucci - DESY (DE) - Center for Quantum Technology and Applications (CQTA)

Abstract:
In this lecture, we will discuss the fundamental principles and key characteristics of quantum computing, along with an overview of the current state of the art. We will introduce quantum bits and the operations that can be performed on them. Unique features of quantum computing, such as superposition and entanglement, will be explored, leading to the construction of quantum circuits.

Lecture 2- Wednesday, January 22: 11:00–13:00

Title - Grover's Algorithm and the NISQ Era

Dr. Alice di Tucci - DESY (DE) - Center for Quantum Technology and Applications (CQTA)

Abstract:
Building on the fundamentals of quantum computing and quantum circuits introduced in the previous lecture, we will delve into Grover's algorithm, designed to tackle the unstructured search problem. We will then explore algorithms optimized for the Noisy Intermediate-Scale Quantum (NISQ) era, with a particular focus on the Variational Quantum Eigensolver (VQE), its applications, and potential limitations.

Seminar - Wednesday, November 22: 15:00–15:40

Title: Quantum Convolutional Neural Networks for jet images classification

Dr. Hala Siddig Mahamed Elhag - DESY (DE) - Center for Quantum Technology and Applications (CQTA)

Abstract:
Quantum computing's potential to outperform classical methods has triggered growing interest, particularly in quantum machine learning (QML). In this talk, we explore the application of QML in high-energy physics (HEP), focusing on top-quark tagging—a task where classical convolutional neural networks (CNNs) excel but struggle with highly energetic jet images. Given this task, we use quantum convolutional neural networks (QCNNs) with a noiseless simulator and compare their performance to classical CNNs. Through varying encoding types—used to translate the classical data into quantum states—, loss functions, and convolutional quantum circuits, we demonstrate how QCNNs, especially those optimized via dimensional expressivity analysis (DEA), can outperform classical models with fewer parameters. These findings highlight the potential of QML in advancing HEP analysis.

Quanta-chat - Thursday, January 23: 10:00–12:00

Follow-up discussion from the December miniworkshop - Quant@PG:
https://indico.cern.ch/event/1479692/