Scientific Area	High Energy Physics		
Project Title	Algorithmic development of tensor networks for High Energy Physics		
Recruiting Institution	Padova University		
PhD awarding Institution	Padova University	**PhD Duration**	36 Months
Supervisor/Institution	S. Montangero (UNIPD)		
Co-Supervisor/Institution	D. Krücker (DESY)		
Secondment(s)	DESY		

Project Description

Develop and apply novel tensor network methods for High Energy Physics (HEP) and explore their interconnections with quantum algorithms to be run on current and future quantum computing hardware. Moreover, quantum-inspired machine learning tools based on tensor network methods will be applied to classification tasks of events occurring in LHC runs. The explored applications will be in particular tailored in view of the upcoming experiments of the High-luminosity (HL) LHC runs. In particular, we will explore applications to jet clustering algorithms, relevant for the project of ESR 4 and to tagging of Higgs to b-bbar processes, relevant for the project of ESR 5.

Project Objectives

- Acquire knowledge on modern quantum-based optimization and machine learning tools;
- Develop novel quantum-inspired and tensor network strategies and algorithms for HEP;
- Application of novel algorithms to relevant problems for HL-LHC.

Required Candidate Qualifications

- Master's degree in Physics or Computer Science;
- Knowledge of Quantum Mechanics and Quantum Information at advanced level;
- Programming skills (preferred in HPC environment);
- Communication skills;
- Preferred (not required) knowledge of Tensor Network Methods, HEP concepts and LHC experiments.