KSETA Topical Courses, September 30 – October 4, 2019

Courses in the first week will take place in building 30.23, room 10/1

Introduction to quantum computing (broader) **all**	M. Marthaler (HQS GmbH)	30.09.2019	bldg. 30.23, room 10/1	13:30 - 16:45 h
	I. Pop (PHI)	04.10.2019	"	13:30 - 16:45 h

The idea of building a quantum computer has been around for quite some time now. Quantum computers would have a huge impact on the efficiency of computers, which in turn would result in never-before-seen changes in many fields like simulations or encryption. In this course, we will review the fundamentals of this field.

Understanding Machine Learning Methods (deeper) for **specialists**	Stefan Wunsch (ETP)	01.10.2019	bldg. 30.23, room 10/1	09:00 - 12:15 h 13:30 - 16:45 h

Nowadays, Machine Learning methods play a vital role in different fields of data analysis. It is therefore crucial to understand what an algorithm such as a Neural Network actually learns from the given training data. The focus of this course is to give more insights into this complex challenge.

Advanced topics in QCD: Soft-Collinear-Effective-Field-Theory, resummation (deeper) for **theoreticians**	Guido Bell (Uni Siegen)	02.10.2019	bldg. 30.23, room 10/1	09:00 - 12:15 h 13:30 - 16:45 h

KSETA Topical Courses, October 7 – October 11, 2019

Courses in the second week will take place in different rooms. Please see information below

Human made Climate Change: Facts, Mechanism, Causes. (broader) **all**	Thomas Leisner (IMK) et al.	07.10.2019	bldg. 30.41 HS1	09:00 - 12:15 h 13:30 - 16:45 h

This course will give an overview on the basics of climate parameters and aspects of climate change. The following topics will be discussed: energy budget of the earth, elements of the climate system (ocean, land, cryosphere), radiation transport and greenhouse effect, atmospherical dynamics and climate zones, aerosoles and clouds, carbon cycle, climate gas and photo chemistry, human intervention, feedbacks and tipping points, climate protection and climate engineering.

Graph Theory (with connection to Feynman diagrams) (broader) for **theoreticians**	S. Schlag, D. Hespe, S. Lamm (ITI)	08.10.2019	bldg. 30.34 LTI-Hörsaal	09:00 - 12:15 h 13:30 - 16:45 h

Graphs are a powerful mathematical concept to model complex relations between objects of the real world. Graph theory sits at the intersection of mathematics, computer science and manifold applications from diverse fields. This course introduces fundamental graph theoretical concepts and algorithms with a special focus on applications relevant to modern physics.

Symmetry principles of particle physics (broader) for **experimentalists**	U. Nierste (TTP)	09.10.2019 10.10.2019	bldg. 30.28 room 1 (R220)	09:00 - 12:15 h 13:30 - 16:45 h

Symmetries dictate the structure of the fundamental laws of nature. Symmetry transformations like e.g. rotations, Lorentz boosts, or gauge transformations are described by a mathematical concept called matrix groups. I give a basic introduction for experimentalists to group theory and discuss the symmetries of the Standard Model lagrangian. Then I discuss how symmetry considerations can guide us to theories of new physics which supersede the Standard Model.

Observational Astronomy (broader)	Victoria Grinberg (Uni Tübingen)	09.10.2019 10.10.2019	bldg. 30.28 room 1 (R220)	13:30 - 16:45 h 09:00 - 12:15 h

This course gives an overview of modern methods of astronomical observations in various energy ranges of the electromagnetic spectrum, with a special focus on space-based and X-ray astronomy. The course addresses detection methods and corresponding current and upcoming instruments and how these are being used to answer some of the key questions of today's astrophysics, especially where these questions overlap with fundamental physics and particle physics. An outlook on how to (try to) obtain astrophysical observations for an object of your own choice will also be given.

Basics of Machine Learning (broader) **all**	Simon Kast (Bosch)	11.10.2019	bldg. 30.22 "Kl. Hörsaal A"	09:00 - 12:15 h 13:30 - 16:45 h

In this course, we will introduce the basics of Machine Learning. Concepts like how to train a model or how to avoid overtraining will not only be discussed theoretically, but will also be shown in hand-on coding sessions using Decision Trees as a simple example. As a second type of Machine Learning models, neural networks and Deep Learning are presented, again with hands-on coding examples. This course will not be offered if the course "Methods of Machine Learning" is preferred more.

www.kseta.kit.edu