Registration until September 4, 2017

KSETA Topical Courses, September 18 – 29, 2017

All courses take place in building 30.23, room 10/1

Software Design for Scientists (better) **For all**	**Benedikt Hegner**	**18.09.17** **19.09.17**	**9:00 - 16:45 h** **9:00 - 12:15 h**

Basics
Track 1: Tools and Techniques
- Code versioning, software life-cycle and testing
- Debugging and profiling

Track 2: Software design in the many-cores era
- Modern processor designs and challenges to the development of software
- Design patterns in C++ and concepts of Physics software design
- HEP software design: future

Introduction to Multivariate Classification: Traditional Techniques and Deep Learning (better) **For all**	**Thomas Keck**	**20.09.17**	**9:00 - 16:45 h**

This lectures introduces algorithms and concepts used in multivariate analysis and machine learning, with focus on multivariate classification. In the first part, traditional techniques like boosted decision trees and support vector machines are discussed. In the second part, artificial neural networks and recent developments in the field of deep learning are explained. The acquired knowledge will be applied in a series of hands-on exercises, using the widely employed frameworks sklearn and tensorflow.

Quantum Field Theory for Experimentalists (broader)	**Michael Rauch**	**19.09.17** **21.09.17**	**13:30 - 16:45 h** **9:00 - 12:15 h**

In this course, we will cover the basic concepts of quantum field theory. Starting from the relativistic Dirac and Klein-Gordon equations, we will discuss the quantization of fields and explore the connection between symmetries and conservation laws. Then, we will introduce the Dyson-Wick technique and develop Feynman rules, leading to the calculation of physical observables like cross sections or decay probabilities. In the final part, we will then discuss higher-order effects of the perturbative series. We will outline how to calculate the appearing loop integrals and show how to deal with the arising divergences by means of regularization and renormalization.

Neutrino Physics and neutrino Oscillations (deeper) For **experimentalists**	**Christian Weinheimer**	**21.09.17** **22.09.17**	**13:30 - 16:45 h** **9:00 - 12:15 h**

The discovery of neutrino oscillations by atmospheric, solar, accelerator and reactor neutrinos (Nobel prize in physics 2015) proofed neutrinos to have non-zero masses. These neutrino masses - still unknown - are much smaller than the masses of the other fundamental fermions, pointing to a new mass mechanism beyond the normal Yukawa coupling to the Higgs particles. The main open questions of today's neutrino physics are: neutrino mass scale, neutrino mass hierarchy, CP phase in the neutrino sector, the particle character of the neutrinos: Majorana or Dirac, connected to these questions: the origin of the neutrino mass. The answers to these questions are very relevant for particle physics as well as for cosmology. For astrophysics there is another very important question: the origin of the ultra-high energetic extra-terrestic neutrinos. After a short introduction into the history of neutrino physics this lecture series covers the mentioned topics as well as the corresponding experiments.

Self-assessment and Application (better) for all	**Doris Brenner**	**25.09.17** **26.09.17**	**9:00 - 16:45 h** **9:00 - 16:45 h**

Der Bewerbungsprozess beginnt weit früher als beim Schreiben von Bewerbungs-unterlagen. Mit diesem Workshop machen Sie sich fit für den erfolgreichen Berufseinstieg nach der Promotion. Sie erhalten zielgerichtete Informationen rund um den gesamten Berufsorientierungs- und Bewerbungsprozess. Dabei handelt es sich nicht um „Patentrezepte“, die pauschal übernommen werden sollen, sondern um individuelle Ansätze, die auf Ihr Persönlichkeits- und Qualifikationsprofil ausgerichtet werden.
Der Bewerbungs- und Auswahlprozess wird dabei auch aus Unternehmenssicht betrachtet. Dieser Blick „hinter die Kulissen“ ist wichtig, um zu verstehen, worauf es bei der Bewerbung tatsächlich ankommt. Praktische Übungen helfen Ihnen dabei, das Gelernte auch in der Praxis umsetzen zu können.

General theoretical concepts on particle physics (broader)	**N.N.**	**postponed spring 2018**	

description of physical concepts

Introduction to Graph Theory (broader) for **specialists**	**Daniel Funke (ITI)**	**28.09.17**	**9:00 - 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 with a special focus on applications relevant to modern physics.

Modern Silicon Detectors (deeper) for **exp., engineers**	**Ivan Peric**	**29.09.17**	**9:00 - 16:45 h**

Modern silicon sensors require highly integrated electronics which is usually implemented in form of ICs. The course will include following topics: design of CMOS front-end electronics for the readout of silicon sensors, radiation tolerance of CMOS transistors, noise in amplifiers, time resolution. Levels of hybridization, such as strip-, hybrid- pixel-, and monolithic detectors will be introduced. The second part of the lecture will be about the active pixel detectors, such as slow CMOS APS, DEPFET detectors and

their issues such as reset noise. The last topic will be the advanced HVCMOS sensors and their applications.