Registration before March 6, 2015

KSETA Topical Courses, March 16 – 27, 2015

1 Practical detector physics in the lab for non-experimentalists (broader)	**Ulrich Husemann, Günter Quast, Alexander Dierlamm, Ralf Ulrich**	**17.03.2015 18.03.2015 CN, bldg. 402**	**13:30 – 16:45 h 13:30 – 16:45 h**

This course is offered specifically for doctoral researcher who have no real-life experience in working in a particle physics laboratory environment. Basic knowledge about experiments, as e.g. obtained from the "Physikalisches Fortgeschrittenen Praktikum" are required. Doctoral researchers will have the opportunity to work in small groups of 2 people in well-equipped laboratories at Campus North on the setup of small particle physics/detector experiments using normal experimental equipment. The following experiments are offered:
1) Muon lifetime measurement with scintillator panels based on coincidence measurements
2) Commission of a Gamma-ray spectrometer with a crystal calorimeter, photon sensor and a signal digitizer
4) a transient current technique measurement of silicon sensors (TCT) with short laser pulses
3) probe-station to measure capacitance, reverse current, and resistances of silicon strip sensors
Two experiments from this list can be selected by any participant.
The distribution into groups and assignment to experiments will be performed on the first day, before the start of the practical work. Experienced tutors will be there to help and to discuss. Some basic data analysis with software tools, which are provided, is partly foreseen. The underlying physics will be discussed along the measurement and the data analysis, but is not in the focus of this course.

2 What do I need, if I will leave science towards industry? (better)	**Udo Erdmann**	**19.03.15 CS, bldg. 30.10. r. 339**	**9:00 – 16:45 h**

As a graduated scientist or engineer a next career step within industry will definitely include management responsibilities. Therefore skills in management and leadership will be expected. Planning to open an own business or start up requires knowledge in managing a company as well. In both cases the needed skills can be divided in three classes: corporate management, project management, technology and innovation management.
This course is focussed on project management and business model evaluation which are part of the first two aforementioned classes. Three examples of possible technological product development projects will be worked on, spanning from the design of the project all the way up to the resource planning. Classical myths and mistakes of product development will be discussed in order to avoid them in real life later on. Before the planning of the project the three project ideas will be checked whether they are fit enough to create revenue. Shortly speaking, the business model of the idea will be tested. Ways to make an idea a business model are worked out throughout the course. For every example one hour is used to check the business model behind an idea, and one more hour to design and plan the product development project based on that business model.

3 Scientific writing – A quick-start guide (better)	**Sebastian Fischer**	**20.03.15 CS, bldg. 30.10. r. 339**	**9:00 – 16:45 h**

The doctoral thesis is the most important thesis a physicist has to prepare. It contains the results of his/her research and is the proof of his/her qualification as a scientist. The thesis should be prepared in form and content in a way that it fulfils the common scientific requirements. The seminar will deal, among others, with the following topics: "Why is the message so important and how do we find it?", "How does a meaningful table of contents looks like?", "What do we have to take into account while writing the introduction?"

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4 Memorizing, reading and working strategies (better)	**Erika Magyarosi**	**23.03.2015** **24.03.2015** **CS, bldg. 30.23, r. 10/1**	**9:00 – 16:45 h** **9:00 – 16:45 h**

In the first part of the seminar, you get to know different memorizing strategies that help you to remember numerous kinds of information quickly and reliably – names and dates, the content of a speech or presentation, as well as complex contents, whose acquirement extend over several months. Besides getting to know the methods, we will especially focus upon the adjustment of your own thinking model and structures. In this way, you will have the possibility to develop your own memorizing strategies during numerous practical exercises, which allow you to apply the mnemonic-techniques in your professional and private everyday life.
The second part of the seminar deals with reading and working strategies, which enable a quicker and more efficient reading and working speed. We will do some exercises for rapid and disciplined eye movements. You will get to know verified learning and reading strategies and we will deal with themes such as reading motivation and reading assistance. Furthermore, we will learn how to improve concentration, to expand your vocabulary and to read more efficiently at your computer.
Goals:
– Memorizing information quickly and long lasting
– Store (expert) knowledge in a structured way
– Crosslink different fields of knowledge effectively
– Access knowledge selectively and reliably
– Develop efficient reading and working habits

5 Astroparticle physics: 13 billion years of evolution reviewed in a one-day-course (broader)	**Klaus Eitel, Markus Roth, Kathrin Valerius**	**25.03.15** **CS, bldg. 30.10. r. 339**	**9:00 – 16:45 h**

Astroparticle physics is the field at the intersection of particle physics, astronomy and cosmology. It combines our knowledge about the largest structures in the Universe with our understanding of the smallest particles and the forces between them. The research programme at KIT addresses fundamental questions in this context: Where is the origin of cosmic rays, and how do these charged particles propagate in the Milky Way? What are the highest-energy particles and how do they obtain their incredibly high energies? Why do we need Dark Matter? Can we detect Dark Matter particles directly or indirectly via their annihilation products? What is the mass of neutrinos and how did they shape the structure of the early Universe? In this introductory course we will explain how to tackle these questions, how they are linked and how they are addressed by experiments.

6 Experimental top quark physics (deeper)	**Maria Aldaya (DESY, EKP)**	**26.03.2015** **27.03.2015** **CS, bldg. 30.10. r. 339**	**9:00 – 12:15 h** **9:00 – 12:15 h**

The objective of the course is to prepare its participants for possible upcoming discoveries by discussing the physics, analysis methods, and results on the top quark physics areas covered by the LHC experiments. The lectures will address the identification of the objects involved, the signal and background properties, the background estimation, and the extraction and interpretation of the final results. Specifically, the following topics will be covered:
- Brief introduction to the top quark, including its discovery
- Brief reminder of the basics of hadron collider physics
- Detection of top quark signatures in the experiments
- Top quark pair production cross section
- Single top production cross section
- Top quark mass
- Overview of other top quark properties: charge asymmetry, spin correlations, etc
- Boosted topology
- Associated production of top quarks and Higgs boson
- Overview of searches for new physics in the top quark sector

The course aims at advanced master students and PhD students from LHC experiments and from related fields. No prior knowledge of top quark physics is required.

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7 Introduction to flavour physics (deeper)	**Jennifer Girrbach-Noe (TUM)**	**26.03.2015** **27.03.2015** **CS, bldg. 30.10. r. 339**	**13:30 – 16:45 h** **13:30 – 16:45 h**

In this lecture I will give an introduction to flavour physics. First, the Standard Model of particle physics (SM) is reviewed especially its gauge structure and particle content with focus on the electroweak interactions. I will present the flavour structure of the SM in detail and derive quark- and lepton-mixing which is encoded in the CKM- and PMNS-matrix. Furthermore the Unitarity Triangle, the origin of CP violation and the three different types of CP violation are discussed. With this basic knowledge about flavour physics concrete flavour observables, like meson mixing and various flavour violating decay modes are presented and compared with the current experimental status.
Despite the great success of the SM there are substantive hints (both theoretical and experimental) for physics beyond the SM. Since flavour physics is not only a very powerful tool to test the SM but also to search for new physics (NP), open questions of the SM and possible extensions are sketched. I will then illustrate with some concrete examples the potential to find NP with the help of flavour physics. It can probe very short distance scales that are beyond the direct reach of the LHC without directly producing new heavy particles. With its rich phenomenology the flavour sector can help us to disentangle different models beyond the SM.

8 Applying Python in Scientific Computing (broader)	**Manuel Giffels**	**26.03.2015** **27.03.2015** **CS, bldg. 30.23, r. 12/1**	**9:00 – 16:45 h** **9:00 – 16:45 h**

The Course aims towards Python beginners, which have either already done baisc scripting in Python or a good understanding of basic C++. Without going into too much details of the Python syntax itself, the course focuses more on introducing special language features and good coding practices (e.g. the usefulness of coding conventions). An overview over scientific libraries for data analysis will be given as well as a thorough introduction into object oriented programming with special emphasis on structuring analysis code. Finally, if time permits, modern techniques of software engineering such as unit-testing will be briefly touched.