KSETA Topical Courses, March 06 – 17, 2023

Registration open until 26 February

From the trees to the forest: neutrino masses and connections to new physics (deeper) **theoretician**	**Michael Schmidt (UNSW, Sydney)**	**06.03.2023 07.03.2023**	**13:30 – 16:45 13:30 – 16:45**	**Bldg. 30.23, room 6/1**

While neutrino masses have been experimentally established 25 years ago, the origin of neutrino masses is unknown. The seesaw mechanism provides a simple explanation but is only one possibility of many. After an introduction to the current state of neutrino physics, I will give an overview of the different possible origins of neutrino masses and discuss the phenomenology of a few selected models.

Superconducting Quantum Technology (broader) **all**	**Sebastian Kempf**	**07.03.2023 08.03.2023**	**09:00 – 12:15 09:00 – 12:15**	**Bldg. 30.23, room 6/1**

This lecture series introduces the broad subject area of superconducting quantum technology. I will particularly discuss Josephson tunnel junctions as basic building block for a variety of superconductor based micro- and nanocircuits used for quantum technology applications. I will then highlight some prominent applications such as superconducting quantum interference devices (SQUIDs) for quantum sensing as well as the Cooper pair box and transmon qubit for superconductor based quantum computing.

Multi-Messenger Data Analysis (deeper) **Astroparticle physicist**	**Markus Ahlers (NBI, Copenhagen)**	**08.03.2023 09.03.2023**	**13:30 – 16:45 09:00 – 12:15**	**Bldg. 30.23, room 6/1**

Among the most extraordinary phenomena in our Universe is the existence of very high-energy radiation in the form of cosmic rays, gamma-rays, and neutrinos. The strong connection between these cosmic probes is the foundation of "multi-messenger astronomy". In this course we will explore the fundamental relations between these messengers and discuss various methods of analyzing multi-messenger data. We will illustrate these methods with a few concrete examples using public neutrino and cosmic-ray data and python tools.

Modern Machine Learning for Particle Physics (broader) **all**	**Claudius Krause (Uni. Heidelberg)**	**09.03.2023 14.03.2023**	**13:30 – 16:45 13:30 – 16:45**	**Bldg. 30.23, room 6/1**

Modern machine learning is becoming a standard tool in our numerical tool box. Not only can neural networks boost the performance of existing algorithms, they can also enable new analysis or simulation strategies. I will introduce the basics of modern machine learning and then focus on specific applications such as (bayesian) regression and classification in lectures 1 and 2; and generative models (especially normalizing flows) in lectures 3 and 4. My examples will be chosen from particle physics publications of the last few years. Lectures 2 and 4 will be hands-on tutorials.

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Basics of Science Communication (better) all	Christian Scharun (NaWIK)	10.03.2023	09:00 – 17:00	Bldg. 30.23, room 3/1

Researchers play a central role in public communication about science, alongside professional communicators and journalists. They write articles and commentaries for newspapers and magazines, give interviews, appear at public events, are present on social media, and more. If you want to reach the general public, you have to get to the heart of the issues in a targeted and generally understandable way.

The introductory seminar serves to raise awareness in science communication. Participants learn about the interplay between research and the media. They learn about the essential aspects of good communication based on basic concepts and identify reasons why science communication is important.

Solving problems in High Energy Physics with the help of Mathematica (and other tools) (broader) all	Thomas Hahn (MPP, München)	13.03.2023 14.03.2023	13:30 – 16:45 09:00 – 12:15	Bldg. 30.23, room 6/1

After reviewing the main programming concepts in Mathematica and comparing them to those in FORM I will apply this knowledge to several physics problems and discuss the differences in the programming approach. We'll have a look at some numerical difficulties often encountered and then proceed to use two standard HEP packages, FeynArts and FormCalc, together with the insights gained on symbolic programming on some calculations with Feynman diagrams.

Chip design course (broader) all	Ivan Peric	16.03.2023 17.03.2023	09:00 – 16:45 13:30 – 16:45	Online via zoom

Microchip is one of the most important inventions in past 100 years. In this course, we learn the basics of chip design. After short introduction, we have the possibility to design an amplifier for a particle detector. We design and optimize the circuit, simulate time and energy resolution and make its layout using the latest software tools of Cadence.

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