



Registration open until February 11

KSETA Topical Courses, February 19 – March 1, 2024

The Standard Model Effective Field Theory: theory and phenomenological applications (broader) All	Ilaria Brivio (University of Bologna)	19.02.2024 20.02.2024	13:30 – 16:45 09:00 – 12:15	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
---	---	--	--	--

The course will provide an introduction to the basic principles underlying the formulation of Effective Field Theories (EFTs) and a more in-depth presentation of the Standard Model EFT (SMEFT), that is extensively used in searches for new physics signals in high energy experiments.

It will cover both theoretical and phenomenological aspects of SMEFT, with the aim of equipping students with the knowledge required to interpret SMEFT results and perform simple studies of specific processes.

The program includes, among other topics, a close look at the SMEFT structure in the electroweak and flavor sectors, a primer on SMEFT predictions at tree level (and 1-loop) and the presentation of a few case studies from Higgs and flavor physics and from global fits. Time permitting, it will also include a short tutorial on Monte Carlo simulations for SMEFT using the SMEFTsim package.

Dynamics of spacetime: gravitational waves and cosmology (broader) All	Bjoern Malte Schaefer (Uni. of Heidelberg)	20.02.2024 21.02.2024	13:30 – 16:45 09:00 – 12:15	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
--	--	--	--	--

General relativity considers spacetime to be a dynamic object. The notion of time-evolving gravitational fields is most prevalent in gravitational waves and cosmological solutions. Observations of spacetime dynamics in these systems is not only possible but gives a glimpse into the fundamental laws of Nature. The course gives an intuitive introduction into the concepts of relativity and discusses observations in cosmology and gravitational waves, giving an outlook on how these experiments impact gravitational physics.

Scientific Writing (better) All	CJ Fitzsimons (Leadership Sculptor)	22.02.2024 23.02.2024	09:00 – 17:30 09:00 – 17:30	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
---	---	--	--	--

Max. 12 people

Young scientists can benefit from the workshop because they receive information about what makes a clear, concise, and compelling manuscript. They also have the chance to receive individual feedback on their own manuscripts, so they can make changes in their texts in parallel to learning the theory. In addition, the workshop addresses typical challenges with scientific writing and offers guidance about overcoming those obstacles.

Ethics in the lab (better) All	Alexander Bagattini (KIT)	26.02.2024	09:00 – 13:00	(online course including ~4h preparation)
--	----------------------------------	-------------------	----------------------	--

Max. 25 people

What is the relation between good and successful research, on the one hand, and ethical and responsible research, on the other hand? This workshop focuses on typical conflicts that particularly early career researchers may face in the context of a publish-or-perish culture: Is it okay for me to ignore and leave out statistical “outliers” when presenting my research data in case they impact the overall results more than I would like? Is such data “massaging” already scientific misconduct? How transparent must research practice be, when at the same time one has to succeed in the competitive world of scientific research? How to respond when you notice academic misconduct by a colleague? How should you handle problematic expectations of your supervisor?

In this workshop, however, we not only want to explain that these areas of conflict exist, but above all provide tools that can help you make your own decisions. We will do this by discussing realistic cases and using these cases to illustrate how easy it is to overlook important things and thus unintentionally overstep boundaries. In this way, participants can acquire the skills they need to recognize and avoid scientific misconduct. The workshop provides general skills and knowledge of research ethics needed for scientists to address the questions raised above. Participants attain the skills to rationally reflect on their role as a scientist from an ethical standpoint, including the specific expectations that role involves in a broader social context.

The workshop will show that successful research goes hand in hand with ethical and responsible research.



Brane Dynamics (deeper/broader) Theoretical Particle Physicists	Marco Bonetti (KIT)	26.02.2024	13:30 – 16:45	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
		28.02.2024	13:30 – 16:45	
		29.02.2024	13:30 – 16:45	

We will characterize the motion of p-branes (p-dimensional manifolds embedded in an ambient space). We will make use of differential geometry and theory of elasticity to construct a Lagrangian formalism that will allow us to study the dynamics of the system. We will review equilibrium configurations and introduce the concept of D-branes to study the propagation of waves on the brane. We will then consider the interaction between a charged p-brane and an external gauge field, closing our discussion with the quantization of brane dynamics.

Introduction and practical exercises: Detection of ionizing radiation (broader) For students without practical knowledge of ionizing radiation	Joachim Wolf (KIT)	27.02.2024	09:00 – 11:30	F2-20 (B1)
			13:00 – 17:00	F2-21 (B2), F2-22 (B3) Bldg. 30.22 (CS)

(The content of this course is part of the advanced physics laboratory course)

The aim of this one-day course is an introduction to radiation measurement technology with various detectors, the handling of radioactive sources, the experimental detection of ionizing radiation in the laboratory, as well as the analysis and interpretation of the measurements. The measurements take place in the nuclear physics laboratory of the exercises for master's students in physics with the equipment used there.

The participants will perform one or more experiments in groups of two.

Electroweak symmetry breaking and physics of extended Higgs sectors (broader) Particle and Astroparticle Physicists	Georg Weiglein (DESY)	27.02.2024	09:00 – 12:15	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
		28.02.2024	09:00 – 12:15	

In these lectures the current understanding of the underlying nature of electroweak symmetry breaking will be summarized and the most pressing open questions will be discussed. In this context in particular the exploration of the Higgs potential and possible implications of extended Higgs sectors will be addressed. The interplay between Higgs physics and measurements and searches at particle colliders, the thermal evolution of the early universe giving rise to the electroweak phase transition, and possible signals at future gravitational wave observatories will be explained.

Acceleration and transport of galactic cosmic rays (broader) Astroparticle Physicists	Philipp Mertsch (RWTH Aachen)	29.02.2024	09:00 – 12:15	Physik-Hörsaal Nr. 4 (Kl. HS B) Bldg. 30.22 (CS)
		01.03.2024	09:00 – 12:15	

The Universe is pervaded by a non-thermal population of high-energy, charged particles. At energies below a few PeV, where the sources are certainly galactic, these are called galactic cosmic rays. Despite decades of observational and theoretical advances, the sources of cosmic rays have still not been unambiguously identified. While solving the question of cosmic-ray origin is of great interest in itself, cosmic rays also play a central role in the evolution of galaxies and can be used as probes of fundamental physics, e.g. dark matter. In this series of lectures, we provide a street-level introduction to galactic cosmic rays, their sources and their transport. In a short tutorial session, we will explore how the theoretical models derived can be fitted to data from the AMS-02 experiment, so please, bring your laptop.