# Advanced Lectures in Physics in Switzerland II


**Sunday 25 May 2025 - Friday 30 May 2025**

**SRS**

# Scientific Programme

**Quantum chaos and Sachdev-Ye-Kitaev model** by Alexey Milekhin (Caltech)
Quantum chaos is a complex phenomena which can manifest itself differently on different time-scales. I will talk about two most common probes into chaos: eigenenergy repulsion and out-of-time ordered correlation functions. I will illustrate them using the Sachdev--Ye--Kitaev (SYK) model: a very simple-looking model of interacting fermions which exhibit very rich physics, with applications in both condensed matter and high-energy physics. At the end of my lectures I will cover the double-scaling limit of the SYK which has recently received a lot of attention in the literature.

**Hydrodynamics in quantum field theory** by Akash Jain (University of Amsterdam)
In these lectures, we will examine the framework of hydrodynamics through the lens of quantum field theory. We will explore how the equations of hydrodynamics emerge as a universal, long-wavelength description of many-body systems near thermal equilibrium. Building on this foundation, we will construct a Wilsonian effective action for hydrodynamics, known as the Schwinger-Keldysh effective field theory. If time permits, we will also explore the connection between hydrodynamics and holography, delving into how near-equilibrium fluctuations of black holes give rise to hydrodynamic behaviour.

**Weak integrability breaking and thermalization** by Federica M. Surace (Caltech)
In these lectures, I will explore the concept of thermalization and its breakdown in integrable systems, where conventional thermalization paradigms fail. I will then examine how small integrability-breaking perturbations give rise to distinct thermalization timescales, highlighting the role of "weak" integrability-breaking perturbations. Finally, I will discuss their implications for thermalization dynamics and transport properties.