

T 41: Invited Overview Talks III

Time: Wednesday 11:00–12:30

Location: AudiMax

Invited Overview Talk T 41.1 Wed 11:00 AudiMax
One of a kind: the Higgs boson — ●MATTEO BONANOMI — Universität Hamburg

Discovered by the ATLAS and CMS experiments nearly 60 years after its prediction, the Higgs boson is a cornerstone of the Standard Model of particle physics.

What began as the challenge of discovering a rare particle has now become a vast program of precision measurements which have enabled a deep understanding of the origin of particle masses, the observation of rare Higgs couplings, and a highly granular characterization of the Higgs boson properties with unprecedented precision. This has only been possible thanks to sophisticated detector technologies and great advances in analyses techniques.

Today, experimental efforts are increasingly focused on the simultaneous production of multiple Higgs bosons. The observation of this process would provide direct insight into the Higgs self-interaction and could shed light on fundamental open questions about the origin and evolution of the Universe.

In this talk, I will provide an experimental overview of the field and highlight recent progress of the ATLAS and CMS Collaborations to understand and characterize this one-of-a-kind particle. In the final part of the talk, I will also discuss the experimental prospects for the ongoing Run III and the upcoming High-Luminosity phases of the LHC.

Invited Overview Talk T 41.2 Wed 11:30 AudiMax
Higgs Physics at the LHC and Beyond: Connecting Colliders and the Early Universe — ●THOMAS BIEKÖTTER — Instituto de Física Teórica UAM/CSIC, Madrid, Spain

The discovery of the Higgs boson was a landmark achievement, confirming the mechanism of electroweak symmetry breaking that gives

mass to elementary particles. At the same time, it marked the beginning of a deeper quest: to understand the underlying dynamics responsible for this mechanism, and to determine whether the Higgs sector is truly minimal, as predicted by the Standard Model (SM), or part of a richer structure predicting additional Higgs bosons.

I will present a theory overview of Higgs physics at the LHC and how precision measurements of the Higgs boson, together with searches for additional scalar particles, provide powerful probes of physics beyond the SM. Many well-motivated extensions of the Higgs sector link collider phenomenology directly to the early Universe. Extended Higgs sectors can accommodate viable Higgs-portal dark matter scenarios that can be probed at the LHC. Moreover, by altering the nature of the electroweak phase transition, a non-minimal Higgs sector can provide the conditions to dynamically generate the matter-antimatter asymmetry of the universe and leave observable imprints in the form of primordial gravitational waves. I will discuss how incorporating the full wealth of current and future LHC data is essential to obtain realistic, data-driven predictions for complementary observations at space-based gravitational-wave observatories like LISA.

Invited Overview Talk T 41.3 Wed 12:00 AudiMax
Gravitational waves from cosmological phase transitions. —

●THOMAS KONSTANDIN — Notkestraße 85, 22607 Hamburg, Germany
First-order cosmological phase transitions are an intriguing source of gravitational waves. Depending on the temperature of the phase transition, the gravitational wave spectrum can be observed by pulsar timing arrays, space-based interferometers or ground-based experiments. Quantifying the produced power spectrum is however quite challenging, and non-linear hydrodynamics and turbulence are essential for robust predictions. The aim of the presentation is to summarize the history of the field and also discuss some recent developments.