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SONDERKOLLOQUIUM

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BIBLIOTHEK, WESTBAU PHYSIK

Beyond the Standard Model through the Precision Frontier

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The Standard Model (SM) of particle physics is an impressively successful description of all known elementary particles and their interactions. However, it fails to account for a number of observations, such as dark matter and neutrino masses, and leaves several theoretical issues unresolved, such as the hierarchy problem and the flavour puzzle. While these shortcomings imply the existence of physics beyond the SM (BSM), direct searches at the Large Hadron Collider (LHC) have reached their energy limit without finding any new particles. Nevertheless, even if new particles are too heavy to be directly discovered, they still leave their imprints by modifying the interactions of the known particles. Precision measurements can explore these modifications, providing an indirect way to probe energies far beyond the reach of direct searches. With the forthcoming high-luminosity LHC and numerous dedicated flavour physics and low-energy precision experiments, we are in fact entering an epoch of indirect BSM searches that will persist for decades through the era of next-generation colliders such as the FCC-ee, which will not directly reach higher energies but will further enhance precision to unprecedented levels.

In this talk, I will outline strategies and methods to harness the extensive amount of precision data that will become available, aiming to identify modifications in the interactions of known particles and uncover physics beyond the Standard Model. This involves developing systematic techniques and innovative computational tools based on Effective Field Theory methods as well as model building to chart the vast landscape of possible new physics scenarios, while integrating large amounts of data from numerous precision experiments.