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Decoding the nature of Dark Matter at current and future experiments

Decoding the nature of Dark Matter (DM) is one of the most important problems of particle physics. DM can potentially provide unique signatures at collider and non-collider experiments. Details of these signatures which we expect to observe in the near future would allow us to delineate the properties of DM and the respective underlying theory Beyond the Standard Model (BSM). While there are many comprehensive phenomenology studies of various appealing BSM models, using “top-bottom” approach, there is no clear strategy for the reverse task of identifying underlying theory from the new signatures.

To solve this problems one should consider the comprehensive set of signatures, database of models and use modern methods, including machine learning and artificial intelligence, which would allow us to decode the underlying theory form new signals. One of the important tools which could be helpful to solve the problem is Recently, High Energy Physics Model Database (HEPMDB) was created to make a step forward towards solving this problem. It is aimed to facilitate connection between HEP theory and experiment, to store, validate and explore BSM models and connect them to characteristic signatures. DM decoding is based on a very important complementarity of Large Hadron Collider (LHC) an DM direct and indirect detection experiments. This complementarity, modern analysis methods, comprehensive database of BSM models and their signatures are the key points for decoding of not only DM properties but the the whole underlying theory of Nature. The current status, the future prospects, strategies and tools for DM identification will be discussed.

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