Research Area: Subhaditya Bhattacharya

I work in particle physics, theory and phenomenology. The field is in a crucial juncture, it aims to find answers to many unsolved problems which will decide the fate of understanding our universe and the laws of nature that governs it. The major concerns at this moment are the presence of an unknown dark matter (DM) component, the source of tiny neutrino mass, the physics behind matter-antimatter asymmetry and the nature of Higgs physics as well as the symmetry breaking mechanism. My research interest lies in physics beyond the Standard Model and the search for it in upcoming direct, indirect and collider search experiments. The frameworks that we focus for study includes Standard Model Effective Theory (SMEFT) connecting Higgs and Dark Matter, electroweak extensions of the Standard Model, explaining DM, matter-anti matter asymmetry, and connecting them to neutrino mass generation. Our interest lies not only in model building but also to pinpoint search strategies, and to provide a comparison/distinction with the existing results.

Amongst several research contributions, we have found a new kind of DM candidate, called pseudo FIMP, which can interact with visible sector via loop mediated interaction. We are exploring its possibility of detection via direct and collider searches. We also have found a typical two bump signal which indicates the existence multipartite DM at the collider. The statistical significance, relation of relic density to the relative heights of the two peaks are under study. In an effort to correlate the dark sector with matter anti matter asymmetry and neutrino masses, we see that there exists a possibility to probe it via gravitational wave signal. However, how this signal can be distinguished from other similar signals is a point of our future study. We are working extensively in optimal precision in estimating New Physics couplings in collider experiments by minimising the covariance matrix. This has already been applied to several cases of top quark physics, DM physics etc. We also wish to study the impact of machine learning and boosted decision tree in optimal New Physics estimation. We are planning to extend the idea to other search strategies in context of direct search experiments. We are also working on the low mass dark matter search possibilities and complementarity in direct, astrophysical and collider search prospects. See for details of our recent publications in HEP INSPIRE website: https://inspirehep.net/literature?sort=mostrecent&size=25&page=1&q=Subhaditya%20Bhattacharya&ui-citation-summary=true

We are looking for motivated and hard working students who wish to contribute to this challenging field. Those who are good at both analytical and numerical calculations, has studied mathematical physics, quantum physics seriously, has interest both in theory and experimental search strategies are encouraged to contact.