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Looking for the Unexpected at the LHC with Semi-Supervised Anomaly Detection

Friday 25 July 2025 15:00 (20 minutes)

Over the past decades, many Beyond the Standard Model (BSM) alternatives have been proposed to address the shortcomings of the otherwise (impressively) successful Standard Model. However, increasingly stringent experimental constraints, particularly from collider searches, place severe pressure on BSM scenarios. On the other hand, the rapid advancement of Artificial Intelligence and Machine Learning (AI/ML) in High Energy Physics has opened exciting avenues in the search for and study of BSM Physics. In this talk, I will showcase developments in AI/ML applications and techniques that will help us look, and eventually find, BSM Physics. I will highlight model-independent searches for new physics, emphasising anomaly detection methods that leverage semi-supervised learning to identify deviations from Standard Model predictions without relying on specific BSM assumptions, including the introduction of a purely semi-supervised statistical test on the Standard Model-only null hypothesis. This will illustrate the immense potential of AI/ML to enhance the scope of experimental searches for BSM Physics, and to help use getting closer to find new physics regardless of how unexpected it might be.

Presenter: ROMAO, Miguel Crispim

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