Contribution ID: **108** Type: **Talk**

The simplicity of confinement

Monday 3 November 2025 15:30 (20 minutes)

I revisit the proposal that colour confinement in non-Abelian gauge theories is related to the dynamics of Abelian magnetic monopoles using methods derived from Topological Data Analysis, which provide a mathematically rigorous characterisation of topological properties of fields defined on a lattice. After introducing homology, I shall discuss how this concept can be used to quantitatively analyse the behaviour of Abelian monopoles identified through the Maximal Abelian Projection across the deconfinement phase transition of SU(3) Yang-Mills. Specifically, I define an observable called "simplicity", which measures the number of topologically non-trivial loops per connected component in a current network. A finite-size scaling of the ensemble-averaged simplicity of Abelian magnetic monopole currents provides the expected value of the critical coupling with an accuracy that is generally higher than that obtained with conventional thermodynamic approaches at comparable statistics. Initial results for QCD will also be discussed.

Parallel Session (for talks only)

Vacuum structure and confinement

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Session Classification: Vacuum structure and confinement