

Revisiting Instanton Physics

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Instantons play a central role in the semiclassical description of non-perturbative phenomena in gauge theories. Their interpretation, however, can be subtle in the presence of spontaneous symmetry breaking or when topological information is treated in a nontrivial way.

In this talk, we revisit conceptual issues surrounding instantons, focusing on how semiclassical configurations and their contributions should be defined and interpreted beyond naive instanton counting. In particular, we discuss the roles of constraints and controlled limiting procedures, and clarify what must be specified to make well-defined semiclassical analyses. This includes both the construction of the relevant minimum configurations and the prescription for evaluating and combining their contributions. Where useful, we draw on simpler settings and lower-dimensional analog models to illuminate the underlying mechanisms.

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