

Abelian Instantons and Monopole Scattering

Friday 28 June 2024 11:30 (45 minutes)

It is usually assumed that 4D instantons can only arise in non-Abelian theories. In our recent work arXiv:2406.13738, we re-examine this conventional wisdom by explicitly constructing instantons in an Abelian gauge theory: QED_4 with N_f flavors of Dirac fermions, in the background of a Dirac monopole. This is the low-energy effective field theory for fermions interacting with a 't Hooft-Polyakov monopole, in the limit where the monopole is infinitely heavy (hence pointlike) and static. This theory, whose non-topological sectors were studied by Rubakov and Callan, has a far richer structure than previously explored. We show how to calculate the topological instanton number, demonstrate the existence of 't Hooft zero modes localized around such instantons, and show how instantons in the path integral provide the underlying mechanism for the Callan-Rubakov process: monopole-catalyzed baryon decay with a cross-section that saturates the unitarity bound. Our computation relies on correctly identifying the relevant EFT for monopole catalysis as axial QED_2 in an effective AdS_2 metric.

Presenter: TELEM, Ofri (The Hebrew University of Jerusalem)