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Landau Levels in Lattice QCD

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The spectrum of the two-dimensional continuum Dirac operator in the presence of a uniform background magnetic field consists of Landau levels, which are degenerate and separated by gaps. On the lattice the Landau levels are spread out by discretization artefacts, but a remnant of their structure is clearly visible (Hofstadter butterfly). If one switches on a non-Abelian interaction, the butterfly structure will be smeared out, but the lowest Landau level will still be separated by a gap from the rest of the spectrum. In this talk we discuss how the eigenmodes of the four-dimensional QCD Dirac operator are built out of the two-dimensional eigenmodes of the Dirac operator diagonalized on each slice at fixed (z,t) . In particular, starting from this decomposition, we consider how well certain physical quantities are approximated by using only the two-dimensional eigenmodes belonging to the lowest Landau level.

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