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Topology in 2D $U(N_c)$ lattice gauge theories

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In two dimensions $U(N_c)$ gauge theories on a torus exhibit a non-trivial topological structure (both on the lattice and in the continuum). Like in 4D $SU(3)$ gauge theories the phase spaces are divided into topological sectors, characterized by a topological index (a.k.a. "topological charge"). These sectors are separated by action barriers, which diverge if the lattice spacing is taken small, resulting in an algorithmic problem known as "topological freezing". We study these theories in various box sizes and at various couplings, with a specific focus on the evolution of representative gauge configurations under extensive gradient flow. We compare the action and charge of these smoothed configurations to the respective properties of analytical instanton-like solutions which we derive.

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