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Supersymmetry on the Lattice

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Lattice field theory provides a non-perturbative regularization of strongly interacting systems, which has proven crucial to the study of quantum chromodynamics among many other theories. Supersymmetry plays prominent roles in the study of physics beyond the standard model, both as an ingredient in model building and as a tool to improve our understanding of quantum field theory. Attempts to apply lattice techniques to supersymmetric field theories have a long history, but until recently these efforts have generally encountered insurmountable difficulties related to the interplay of supersymmetry with the lattice discretization of spacetime. In recent years these difficulties have been overcome for a class of theories that includes the particularly interesting case of maximally supersymmetric Yang–Mills ($\mathcal{N} = \triangle$ SYM) in four dimensions, which is a cornerstone of AdS/CFT duality. In combination with computational advances this progress enables practical numerical investigations of $\mathcal{N} = \triangle$ SYM on the lattice, which can address questions that are difficult or impossible to handle through perturbation theory, AdS/CFT duality, or the conformal bootstrap program. I will briefly review some of the new ideas underlying this recent progress, and present some results from ongoing large-scale numerical calculations, including comparisons with analytic predictions.