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Recent progress in understanding deconfinement and chiral symmetry breaking transitions

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While the crucial role of gauge topology was recognized from 1970's, confinement was associated with monopoles and chiral symmetry breaking with instantons. Recognizing presence of non-zero holonomy, van Baal and others discovered splitting of the instantons into their constituents —the instanton-dyons. Several groups now work out properties of their ensembles, which generate both the deconfinement and chiral phase transitions. The results of mean field and numerical simulations are in good agreement with lattice data for QCD-like theories. Furthermore, introducing variable phases for quark periodicity conditions — known as flavor holonomies —one can switch quark coupling to different dyons, which dramatically change both transitions. First lattice studies of modified —so called Z_N -symmetric QCD —have also found these effects, thus confirming the instanton-dyon mechanism.

Summary

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