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Semiclassical ensembles of instanton-dyons describe the deconfinement and chiral phase transitions, in the usual and deformed QCD

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Instanton-dyons are topological solutions of YM equations at finite temperatures. Their semiclassical ensembles were studied by a number of methods, including direct Monte-Carlo simulation, for SU(2) and SU(3) theories, with and without fermions. We present these results and compare them with those from lattice studies. We also consider two types of QCD deformations. One is by adding operators with powers of the Polyakov line, affecting deconfinement. Another is changing quark periodicity condition, affecting the chiral transition. Another paper is using inverse direction, from lattice configurations (with realistic quark masses) looking at zero and near-zero Dirac modes. It turned out that those revealing the shape of the modes, in excellent agreement with analytic instanton-dyon theory. Summarizing both we conclude that QCD phase transitions are well described in terms of such semiclassical objects.

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