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Confinement from Interacting $SU(3)$ Instanton-dyons

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Confinement remains one of the most interesting and challenging nonperturbative phenomena in non-Abelian gauge theories. Recent semiclassical (for $SU(2)$) and lattice (for QCD) studies have suggested that confinement arises from interactions of statistical ensembles of instanton-dyons with the Polyakov loop. In this talk, I will present recent work which has extended the study of semiclassical ensembles of dyons to the $SU(3)$ Yang-Mills theory. It will be shown that such interactions do generate the expected first-order deconfinement phase transition. The properties of the ensemble, including the dyon correlations and densities, and the topological susceptibility, are studied over a range of temperatures above and below T_c . Additionally, the dyon ensemble is studied in the Yang-Mills theory containing an extra trace-deformation term. It will be shown that such a term causes the theory to remain confined even at high temperatures.

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