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The deconfinement phase transition in Sp(2N) gauge theories and the density of states method

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First order phase transitions in the early universe might produce a detectable background of gravitational waves. As these phase transitions can be generated by new physical sectors, it is important to quantify these effects. Many non-Abelian pure Yang-Mills gauge theories are known to have first order deconfinement phase transitions, with properties that can be studied with lattice simulations. Despite the recent surge of interest in Sp(2N) gauge theories as a candidate for models of physics beyond the standard model, studies of these theories at finite temperature are still very limited. In this contribution, I will present preliminary results for an ongoing numerical investigation of the thermodynamic properties of the deconfinement phase transition in Sp(4) gauge theory using the linear logarithmic relaxation algorithm. This method enables us to obtain a highly accurate determination of the density of states, allowing for a precise reconstruction of thermodynamic observables. In particular, it gives access to otherwise difficult to determine quantities such as the free energy of the system, including its metastable and unstable branches, hence providing an additional direct observable to study the dynamics of the phase transition.

Topical area

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