

## Confinement Phase Transition with Quasi-particle model and its Gravitational wave signal

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It is challenging to build a model that can correctly and unifiedly account for the deconfinement phase transition and thermodynamics of the hot  $SU(N)$  pure Yang-Mills (PYM) system, for any  $N$ . In this article, we slightly generalize the massive PYM model to the situation with a quasigluon mass  $M_g(T)$  varying with temperature, inspired by the quasigluon model. In such a framework, we can acquire an effective potential for the temporal gauge field background by perturbative calculation, rather than adding by hand. The resulting potential works well to describe the behavior of the hot PYM system for all  $N$ , via the single parameter  $M_g(T)$ . Moreover, under the assumption of unified eigenvalue distribution, the  $M_g(T)$  fitted by machine learning is found to follow  $N$ -universality. We will also use this model to discuss the gravitational wave from the confinement phase transition which is generated by possible pure- Yang-Mills dark sector.

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