(De)confinement phase transition: the mutual influence between Polyakov loop and Gribov Horizon

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The phase transition of SU(2) gauge theory is analysed at finite temperature, by means of Polyakov loop in the Background Field Gauge formalism. In addition Gribov ambiguities, present in the Landau-De Witt gauge, are taken into account. With this, a modified gluon propagator arises, displaying c.c. poles.

Both the Gribov parameter λ and the parameter associated to the Polyakov loop r are functions of temperature by minimizing the effective action.

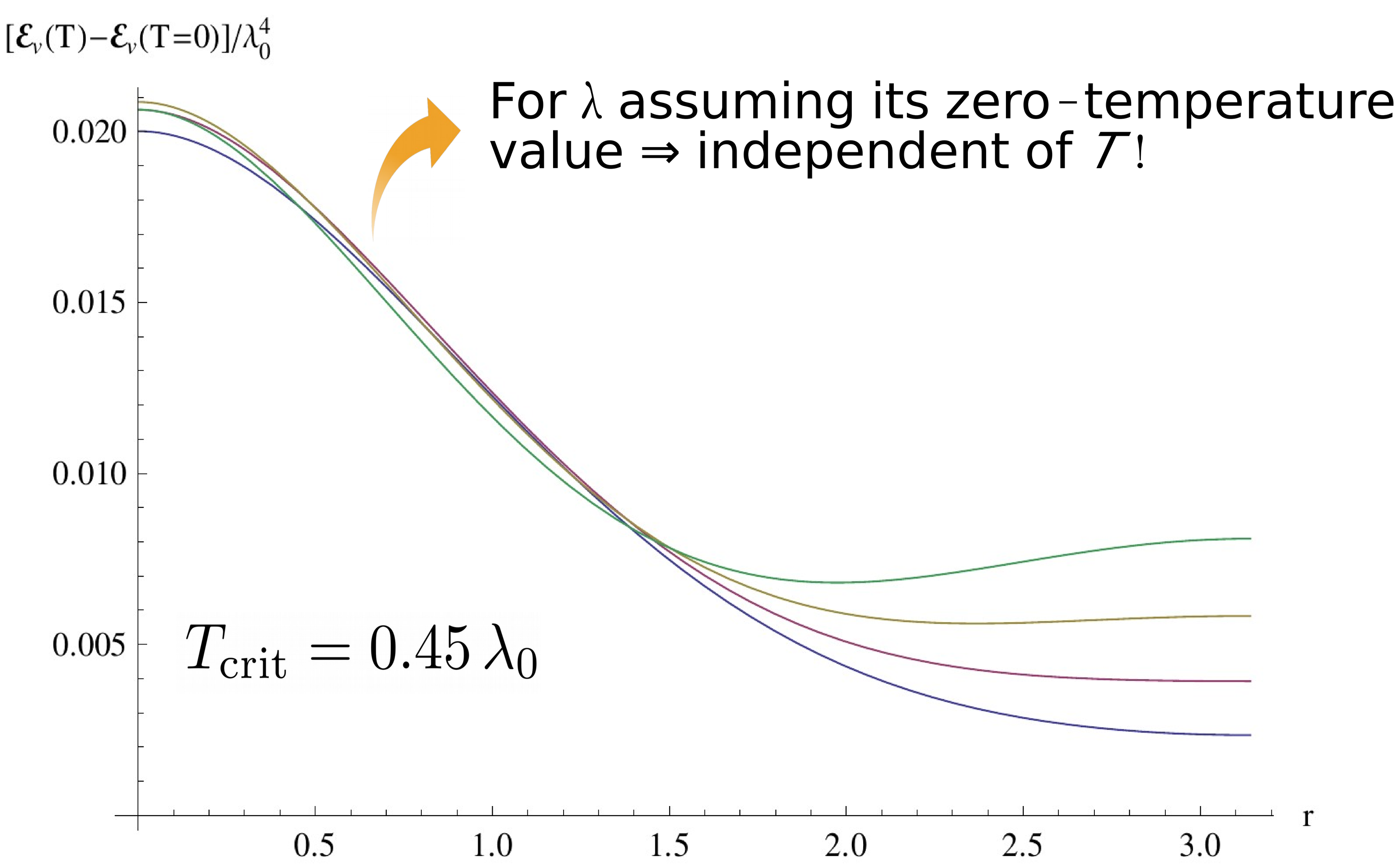
- The Polyakov Loop:

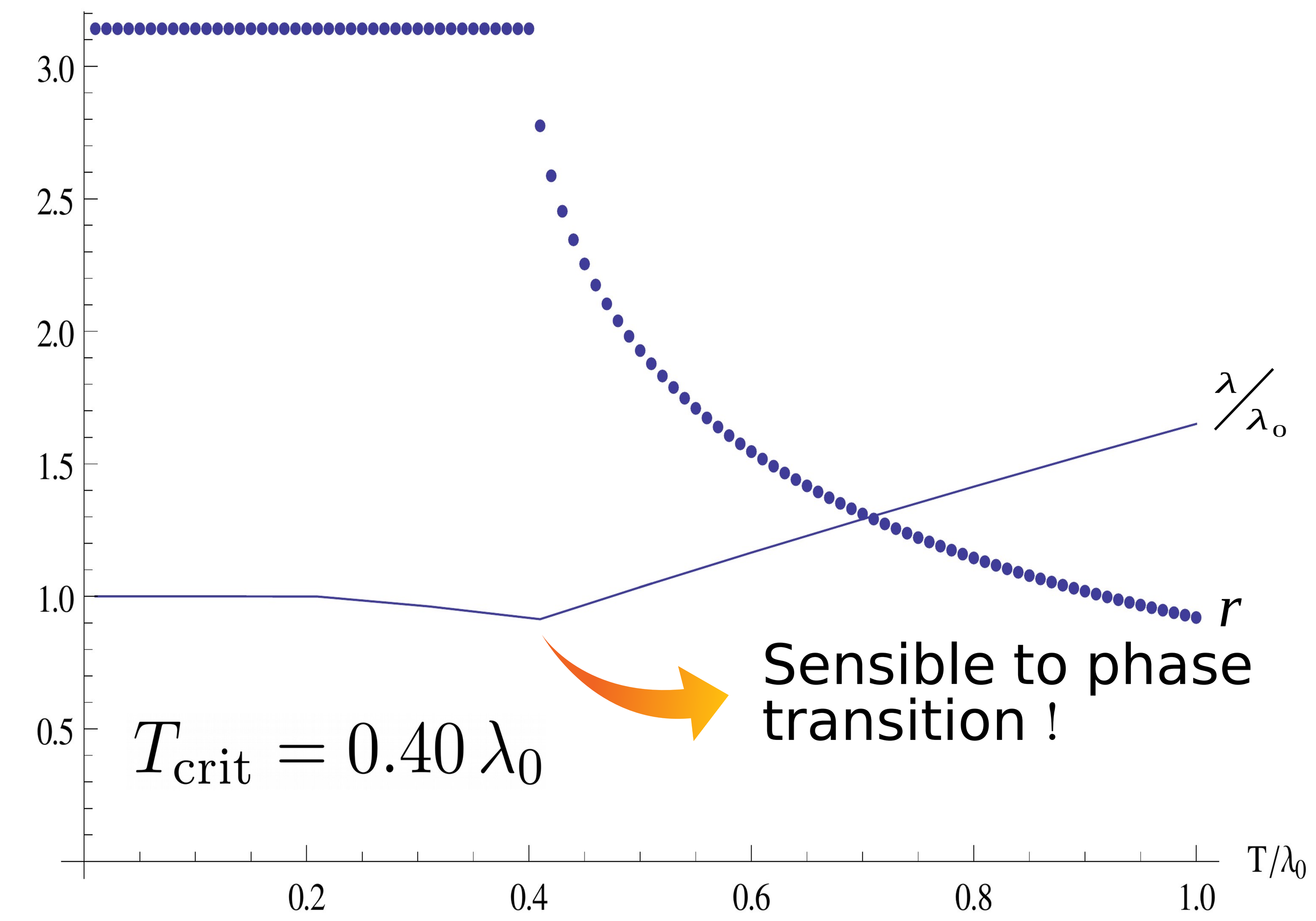
$$\mathcal{P} = \frac{1}{N}\,\mathrm{tr}\left\langle P e^{ig\int_0^\beta dt\ \ A_0(t,x)}\right\rangle$$

- The Vacuum Energy:

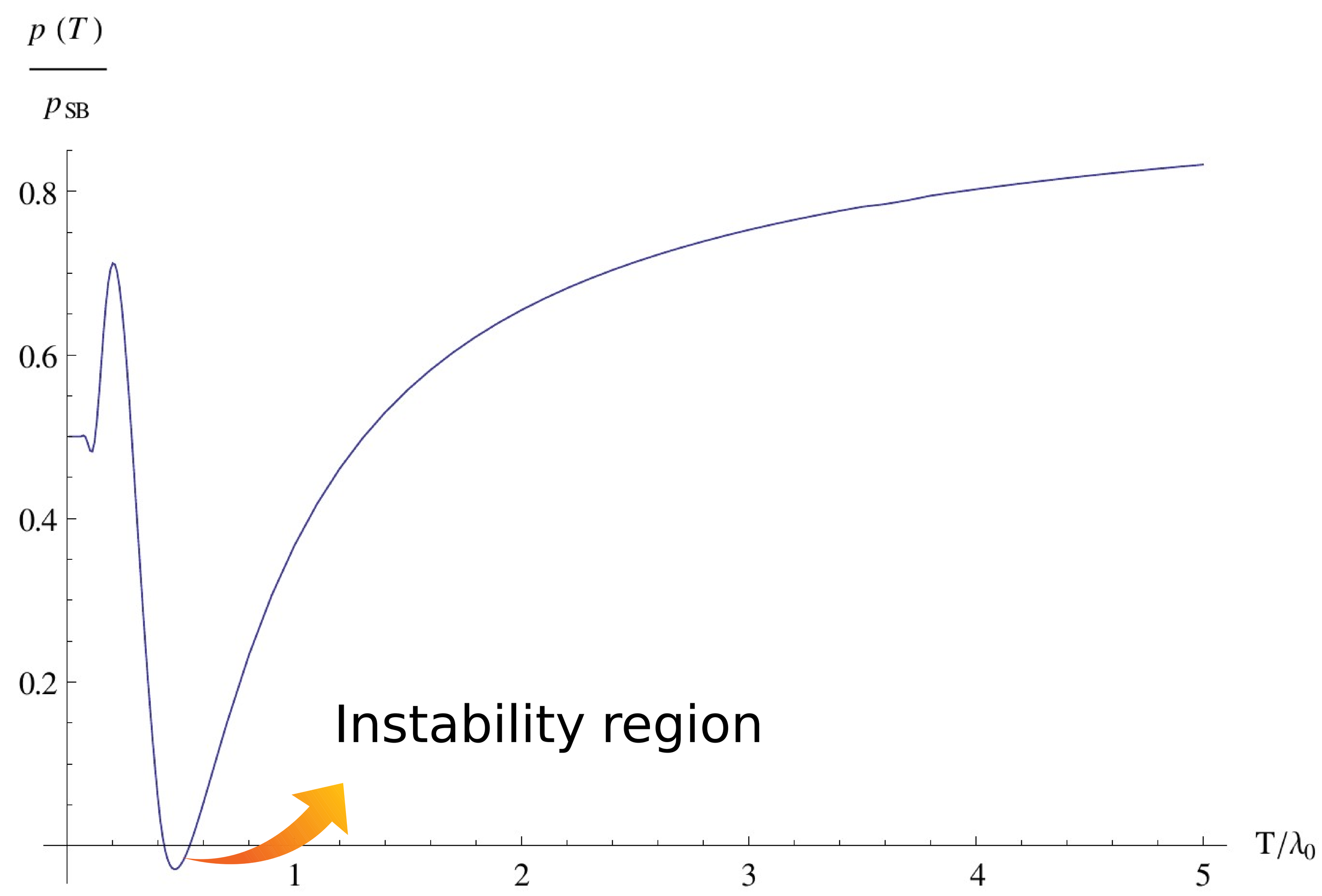
$$\beta V \mathcal{E}_v = -\frac{d(N^2-1)}{2Ng^2}\lambda^4 + \frac{1}{2}(d-1)\,\mathrm{tr}\ln\frac{D^4+\lambda^4}{-D^2} - \frac{1}{2}\,\mathrm{tr}\ln(-D^2)$$

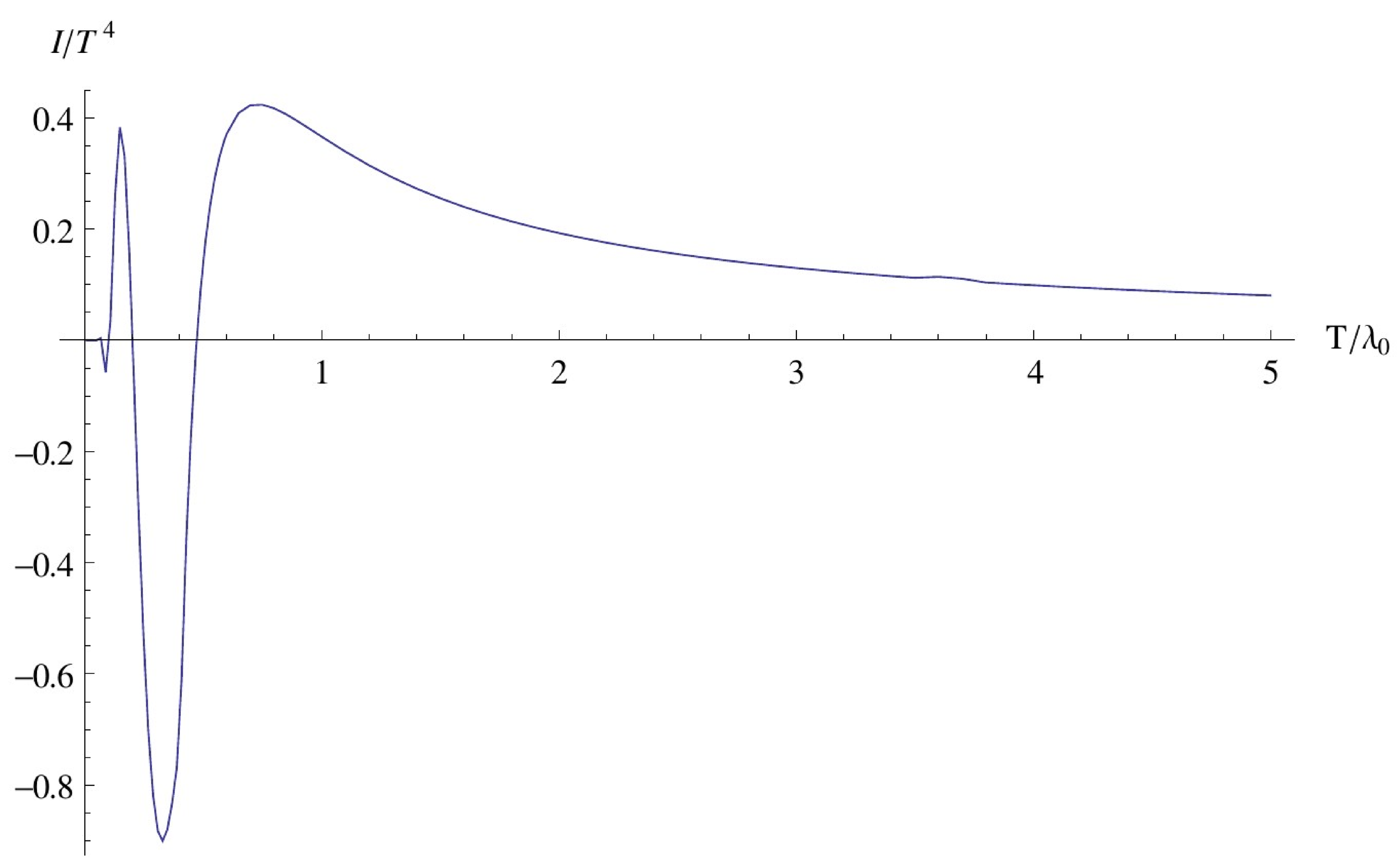
Then we get...





Expected oscillatory behaviour





NOTE: For the Refined Gribov-Zwanziger (RGZ) scheme we found a considerably smaller instability region, even not considering the temperature dependence of every parameter.