$SU(2)_f$ NJL model with Meson Loops: The Gap Equation at Finite Temperature

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Motivation

The goal is to study the influence of meson degrees of freedom on the restoration of chiral symmetry in a consistent approach.

The effective action formalism is used to calculate the $SU(2)_f$ Nambu−Jona-Lasinio *gap* equation with one-boson loop corrections at finite temperature.

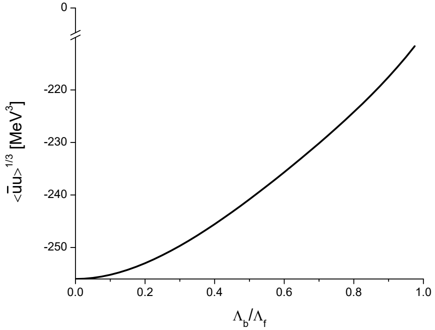
This formalism was only used by (Florkowski and Broniowski, 1996) however, to solve the *gap*, several approximations were made.

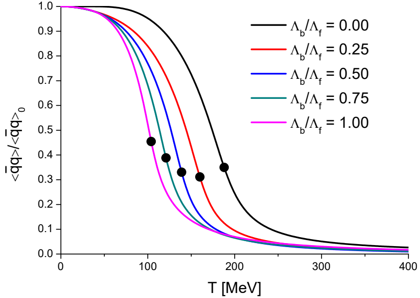
One can obtain the following *gap* equation:

$$
\begin{aligned}
& g_S^{-1}(S-m) - 4N_c N_f S f_0(S) \\
& + 2N_c N_f S \int \frac{d^4 q}{(2\pi)^4} \left\{ 4 f_1(S,q) + 2 f_1(S,0) - 2\left[q^2 + 4S^2\right] f_2(S,q) \right\} \tilde{K}_\sigma(S,q) \\
& + 6N_c N_f S \int \frac{d^4 q}{(2\pi)^4} \left\{ 2 f_1(S,0) - 2q^2 f_2(S,q) \right\} \tilde{K}_\pi(S,q) = 0.
\end{aligned}
$$

The parameters are fixed to reproduce: $\langle\bar{\ell}\ell\rangle^{\frac{1}{3}} = -256$ MeV, $m_\pi = 135$ MeV and $f_\pi = 93$ MeV.

Λ_b/Λ_f	m[MeV]	Λ_f[MeV]	$g_S^2\Lambda_f$	T_c[MeV]
0.00 (MFA)	4.62	690.32	2.01	188
0.25	4.62	698.60	2.03	160
0.30	**4.62**	**701.78**	**2.04**	**155**
0.50	4.62	717.38	2.07	139
0.75	4.62	740.86	2.13	121
1.00	4.61	770.92	2.21	104





Conclusions

- The inclusion of meson fluctuations brings the pseudo critical temperature of the chiral transition to lower values;
- A set of parameters is found such that $T_c \simeq 155$ MeV;

Further Work

- Extend the formalism to the $SU(3)_f$ and include the Polyakov loop;

Thank you for your attention!

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