

Phase structure of the Quark-Meson model

Rui Wen,¹ Yong-rui Chen,¹ and Wei-jie Fu^{1,*}

¹*School of Physics, Dalian University of Technology, Dalian, 116024, P.R. China*

PACS numbers: 11.30.Rd, 11.10.Wx, 05.10.Cc, 12.38.Mh

I. INTRODUCTION

* wjfu@dlut.edu.cn

A

II. 2 FLAVOR QUARK MESON MODEL

The effective action of the quark-meson model reads

$$\Gamma_k[\Phi] = \int_x \{ Z_{q,k} \bar{q} (\gamma_\mu \partial_\mu - \gamma_0 \mu) q + \frac{1}{2} Z_{\phi,k} (\partial_\mu \phi)^2 + k_k \bar{q} (T^0 \sigma + i \gamma_5 T \cdot \pi) q + V_k(\rho) - c\sigma \} \quad (1)$$

$$\rho = \frac{1}{2} \phi^2$$

$$\bar{m}_\pi = \frac{V'_k(\rho)}{k^2 Z_{\phi,k}} \quad (2)$$

$$\bar{m}_\sigma = \frac{V'_k(\rho) + 2\rho V''_k(\rho)}{k^2 Z_{\phi,k}} \quad (3)$$

$$\bar{m}_q = \frac{h_k^2 \rho}{2k^2 Z_{q,k}^2} \quad (4)$$

with the Wetterich equation

$$\begin{aligned} \partial_t V_k(\rho) = & \frac{k^4}{4\pi^2} \{ (N_f^2 - 1) l_0^B(m_{\pi,k}, \eta_{\phi,k}; T) \\ & + l_0^B(m_{\sigma,k}, \eta_{\phi,k}; T) \\ & - 4N_c N_f l_0^F(m_{q,k}, \eta_{q,k}; T, \mu) \} \end{aligned} \quad (5)$$

here $l_0^{B/F}$ are threshold functions which are defined as

$$\begin{aligned} l_0^B(\bar{m}_{\phi,k}^2, \eta_{\phi,k}) = & \frac{2}{3} \frac{1}{\sqrt{1 + \bar{m}_{\phi,k}^2}} \left(1 - \frac{\eta_{\phi,k}}{5} \right) \\ & \left(\frac{1}{2} + n_B(\bar{m}_{\phi,k}^2, T) \right) \end{aligned} \quad (6)$$

$$\begin{aligned} l_0^F(\bar{m}_{q,k}^2, \eta_{q,k}) = & \frac{1}{3} \frac{1}{\sqrt{1 + \bar{m}_{q,k}^2}} \left(1 - \frac{\eta_{q,k}}{4} \right) \\ & \left(1 - n_F(E - \mu) - n_F(E + \mu) \right) \end{aligned} \quad (7)$$

$$\eta_{\phi,k} = \frac{1}{6\pi^2} \left\{ \frac{4}{k^2} \rho (V'_k(\rho))^2 \right\} \quad (8)$$

III. RESULTS

A. phase diagram at chiral limit

IV. SUMMARY AND DISCUSSIONS

In this work, we have studied

ACKNOWLEDGMENTS

We thank the members of the fQCD collaboration [?] for work on related projects. The work was supported by the National Natural Science Foundation of China under Contracts Nos. 11775041.

