Gravgård

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Alt som ikke kom med...

0.1 Tree level pion star

We introduce the new dimensionless variable $1 + x^2 = \mu_I^2/\bar{m}^2$. This is reminicent of the dimensionless Fermi momentum $x_f = p_f/m$ in {section: cold fermi star}. By an argument using a right triangle, we can vertify that $\cos a = b$ implies $\sin a = \sqrt{1 - b^2}$. Substituting the dimensionless variable into the free energy density, we get

$$\mathcal{F} = -\frac{u_0}{2}\left(1 + x^2 + \frac{1}{1 + x^2}\right). \tag{1}$$

We have introduced the characteristic energy density $u_0 = \bar{m}^2 f^2$. As we found in {section: cold fermi star}, pressure is given by negative the free energy density, normalized to $\mu_I = \bar{m}$, or $x = 0$. We choose $p_0 = u_0$, so the dimensionless pressure can be written

$$\tilde{p} = -\frac{1}{u_0}(\mathcal{F} - \mathcal{F}_{x=0}) = \frac{1}{2}\frac{x^4}{1 + x^2}. \tag{2}$$

The charge density corresponding to a chemical potential is given by minus the derivative of the free energy with respect to that chemical potential. We must, however, not assume any dependence of α on μ_I. The isospin density therefore is

$$n_I = -\frac{\partial \mathcal{F}}{\partial \mu_I} = f^2 \mu_I \sin^2\alpha = \frac{u_0}{\mu_I}\frac{2x^2 + x^4}{1 + x^2}.,\tag{3}$$

With this, the dimensionless energy density

$$\tilde{u} = -\tilde{p} + \frac{1}{u_0} n_I \mu_I = \frac{1}{2}\frac{4x^2 + x^4}{1 + x^4} \tag{4}$$

0.2 Feil analyse av three-flavor vakum

$$\frac{1}{4}\mathrm{Tr}\left\{\nabla_\mu \Sigma_\alpha \nabla^\mu \Sigma_\alpha^\dagger\right\} = -\frac{1}{2}\sin^2\alpha \left\{\mu_I^2\left[n_1^2 + n_2^2 + \frac{1}{4}(n_6^2 + n_7^2)\right] + \frac{1}{4}[\mu_I^2 + 3\mu_8^2][n_4^2 + n_5^2]\right\} \tag{5}$$

$$\frac{1}{4}\mathrm{Tr}\left\{\chi\Sigma^\dagger + \Sigma\chi^\dagger\right\} = M_1^2 \cos\alpha \tag{6}$$

$$\mathcal{H} = -\frac{1}{8}\sin^2\alpha\left[\mu_I^2\left(4a^2 + b^2 + c^2\right) + 3\mu_8^2(b^2 + c^2) + 2\sqrt{3}\mu_8\mu_I(b^2 - c^2)\right] + M_1^2\cos\alpha \tag{7}$$

$$= -\frac{1}{8}\sin^2\alpha\left[4\mu_I^2 a^2 + (\mu_I + \sqrt{3}\mu_8)^2 b^2 + (\mu_I - \sqrt{3}\mu_8)^2 c^2\right] \tag{8}$$

Choose, without loss of generality, $n_1 = n_4 = 0$, which leaves $n_2 = \cos\beta$, $n_5 = \sin\beta$, and thus

$$\Sigma = \exp\left\{i\alpha(\cos\beta\lambda_2 + \sin\beta\lambda_5)\right\} = \cos\alpha + i(\lambda_2\cos\beta + \lambda_5\sin\beta)\sin\alpha. \tag{9}$$