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Kyoto University
The $\eta$ decay into $3\pi$ in asymmetric nuclear medium

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• P. 1 Abstract: In the third line from the bottom, the words “shows only · · · at $\rho_0$” should be replaced by “is less enhanced with a factor about two at $\rho_0$”.

• P. 11: Equation (43) should be replaced by

$$
\mathcal{M}_{\eta \to \pi^0\pi^+\pi^-} = -\frac{m_1^2}{3\sqrt{3}f^2} \left(1 + \frac{4c_1}{f^2} \rho \right) \left(1 + \frac{3(s-s_0)}{m_\eta - m_\pi^0}\right) + \sin \theta^{(0)} \mathcal{M}^{(4)_{\text{vac}}}_{\eta \to \pi^0\pi^+\pi^-} + \left\{ -\frac{s-s_0}{f^2} \frac{1}{m_\eta - m_\pi^0} \left(\frac{g_A^2 m_\eta^2}{4\sqrt{3}f^2} + \frac{2 cs m_\pi^2}{\sqrt{3}f^2}\right) + \frac{g_A^2}{48\sqrt{3}f^4} (m_\eta - 3E_{\pi^0}) - \frac{2cs m_\pi^2}{3\sqrt{3}f^4}\right\} \delta \rho

\frac{m_1^2}{m_\eta - m_\pi^0} \left(\frac{2 (c_2 - \frac{s_0^2}{8m_\eta})}{f^4}\right) \rho \left\{ (m_\eta - E_{\pi^0})^2 - \frac{m_\eta^2 + E_{\pi^0}^2 + E_{\pi^+}^2 + E_{\pi^-}^2}{3} \right\} + \frac{2cs \rho}{f^4} (s-s_0) \right\}
$$

(1)

• P. 13 and 14: Accordingly, Fig. 5 in P. 13 and Fig. 7 in P. 14 are replaced with Figs. 1 and 2, below. The added terms are found to make about 10 percent changes at most. The respective figure captions and the main conclusions are not altered.

![Normalized decay width](image-url)

Fig. 1.
Fig. 2.

0. P. 12 and 13: From Eq. (45) to (49), the overall prefactor 3! coming from the combinatorics of the final state three \( \pi^0 \) should be multiplied.

0. P. 13: In accordance with the correction of Eq. (49), the third and fourth terms in the second line of Eq. (50) should be multiplied by the factor 3!.

0. P. 15: Figures 9 and 10 should be replaced by Figs. 5 and 6, respectively.

0. P. 16: The phrase “in terms of \( \cdots \) decay constant \( f^{**} \)” just above Eq. (53) should be replaced by “in terms of the in-medium quark condensate \( \langle \bar{q}q \rangle_\rho \).”

0. P. 16: Due to the change of the Eq. (43), Eq. (53) should read

\[
M_{\eta \to \pi^0 \pi^+ \pi^-} = -\frac{m_1^2}{3\sqrt{3} f^2} \left( 1 - \frac{\sigma_{\pi N} \rho}{f^2 m_\pi^2} \right) \left( 1 + \frac{3(s - s_0)}{m_\pi^2 - m_\pi^0} \right) + \sin \theta^{(0)} M^{(4)\text{vac}}_{\eta \to \pi^0 \pi^+ \pi^-} \\
+ \left\{ \frac{s - s_0}{f^2} - \frac{1}{m_\eta^2 - m_\pi^2} \left( \frac{g_\eta^2 m_\eta^2}{4\sqrt{3} f^2} + \frac{2\cos m_\pi^2}{\sqrt{3} f^2} \right) + \frac{g_\eta^2}{48\sqrt{3} f^2} (m_\eta - 3E_{\pi^0}) - \frac{2\cos m_\pi^2}{3\sqrt{3} f^2} \right\} \delta \rho \\
- \frac{m_1^2}{\sqrt{3} f^2} \left( \frac{2\left( c_2 - \frac{g_\eta^2}{8\pi \rho} \right)}{f^4} \right) \rho \left( m_\eta - E_{\pi^0} \right)^2 - \frac{m_\pi^2 + E^2_{\pi^0} + E^2_{\pi^+} + E^2_{\pi^-}}{3} + \frac{2c_3 \rho}{f^4} (s - s_0) \\
= -\frac{m_1^2}{3\sqrt{3} f^2} \langle \bar{q}q \rangle_\rho \left( 1 + \frac{3(s - s_0)}{m_\pi^2 - m_\pi^0} \right) + \sin \theta^{(0)} M^{(4)\text{vac}}_{\eta \to \pi^0 \pi^+ \pi^-} \\
+ \left\{ \frac{s - s_0}{f^2} - \frac{1}{m_\eta^2 - m_\pi^2} \left( \frac{g_\eta^2 m_\eta^2}{4\sqrt{3} f^2} + \frac{2\cos m_\pi^2}{\sqrt{3} f^2} \right) + \frac{g_\eta^2}{48\sqrt{3} f^2} (m_\eta - 3E_{\pi^0}) - \frac{2\cos m_\pi^2}{3\sqrt{3} f^2} \right\} \delta \rho \\
- \frac{m_1^2}{\sqrt{3} f^2} \left( \frac{2\left( c_2 - \frac{g_\eta^2}{8\pi \rho} \right)}{f^4} \right) \rho \left( m_\eta - E_{\pi^0} \right)^2 - \frac{m_\pi^2 + E^2_{\pi^0} + E^2_{\pi^+} + E^2_{\pi^-}}{3} + \frac{2c_3 \rho}{f^4} (s - s_0) \right) .
\]

(2)

0. P. 14: Figures 6 and 8 should be replaced by Figs. 3 and 4, respectively.

0. P. 15: Figures 9 and 10 should be replaced by Figs. 5 and 6, respectively.

0. P. 16: The words beginning from “where \( f^{**} = f^2 \left( 1 - \frac{\sigma_{\pi N} \rho}{f^2 m_\pi^2} \right) \)” just below Eq. (53) to “the pion decay constant“; the fourth line below Eq. (53) should be removed.

0. P. 17: The word “slightly” appearing at the fourth line of the third paragraph of Sect. 5 should be removed.
Fig. 3.

![Normalized decay width vs Proton number density](image1)

Fig. 4.

![Normalized decay width vs Nuclear asymmetry α](image2)

Fig. 5.

![Normalized decay width vs Nuclear asymmetry α](image3)
Fig. 6.