**Erratum: Constituent quark-light vector mesons effective
couplings in a weak background magnetic field**
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Several coupling constants of axial mesons to constituent quarks were defined incorrectly in this paper. Besides the corrected axial mesons-constituent quarks coupling constants, a few vector mesons-constituent quarks coupling constants are rewritten differently below. The numerical results presented in that paper are not modified since they were done for the vector mesons couplings.

The leading vector or axial mesons-photon couplings to constituent quarks in the long wavelength local limit, by omitting the spacetime dependencies, as presented in Eqs. (12)–(18), should be written as

$$I_{FF} = 2g_1 i \epsilon_{ij3} (F_{\mu\nu} \mathcal{G}_i^{\mu\nu} j_p^j + F_{\mu\nu} \mathcal{F}_i^{\mu\nu} j_s^j), \quad (12)$$

$$I_{FFm} = g_1 \left[F_{\mu\nu} \mathcal{F}_3^{\mu\nu} j_s + F_{\mu\nu} \mathcal{F}^{\mu\nu} j_s^3 + F_{\mu\nu} \mathcal{G}_3^{\mu\nu} j_p + F_{\mu\nu} \mathcal{G}^{\mu\nu} j_p^3 \right. \\ \left. + \frac{1}{3} (F_{\mu\nu} \mathcal{G}^{\mu\nu} j_p + F_{\mu\nu} \mathcal{F}^{\mu\nu} j_s + F_{\mu\nu} \mathcal{G}_i^{\mu\nu} j_p^i + F_{\mu\nu} \mathcal{F}_i^{\mu\nu} j_s^i) \right], \quad (13)$$

$$I_{VA} = 2i \epsilon_{ij3} (g_2 A_\rho V_i^\rho j_s^j + g_{2A} A_\rho \bar{A}_i^\rho j_p^j), \quad (14)$$

$$I_{VAm} = g_2 [A^\nu V_\nu^3 j_s + A^\nu V_\nu j_s^3] + g_{2A} [A^\rho \bar{A}_\rho^3 j_p + A^\mu \bar{A}_\mu j_p^3] \\ + \frac{g_2}{3} [A^\nu V_\nu j_s + A_\rho V_i^\rho j_s^i] + \frac{g_{2A}}{3} [A^\mu \bar{A}_\mu j_p + A^\mu \bar{A}_\mu^i j_p^i], \quad (15)$$

$$I_{VF} = i \epsilon_{ij3} (g_3 F_{\rho\delta} V_i^\rho j_{j,V}^\delta + g_{3A} F_{\rho\delta} \bar{A}_i^\rho j_{j,A}^\delta), \quad (16)$$

$$I_{AF} = i \epsilon_{ij3} (g_3 \mathcal{F}_{\rho\delta}^i A^\rho j_{j,V}^\delta + g_{3A} \mathcal{G}_{\rho\delta}^i A^\rho j_{j,A}^\delta), \quad (17)$$

where the effective coupling constants have been defined in Euclidean momentum space as

$$g_1 = N_c d_1 e M^* (\alpha g^2) \text{Tr}'((\tilde{S}_0(k) \tilde{S}_0(k) \tilde{S}_0(k) R(k))), \quad (18)$$

$$g_2 = 6N_c d_1 e M^* (\alpha g^2) \text{Tr}'((\tilde{S}_0(k) \tilde{S}_2(k) R(k))), \quad (19a)$$

$$g_{2A} = 6N_c d_1 e M^* (\alpha g^2) \text{Tr}'((\tilde{S}_0(k) \tilde{S}_{2A}(k) R(k))), \quad (19b)$$

$$g_3 = \frac{g_2}{M^*}, \quad g_{3A} = \frac{g_{2A}}{M^*}, \quad (20a)$$

where

$$\tilde{S}_0(k) = \frac{1}{k^2 + M^{*2}}, \quad \tilde{S}_2(k) = \frac{k^2 - M^{*2}}{(k^2 + M^{*2})^2}, \quad \tilde{S}_{2A}(k) = \frac{k^2 + M^{*2}}{(k^2 + M^{*2})^2}.$$

Therefore the leading axial mesons-photon couplings to constituent quarks axial currents are not exactly the same as the corresponding chiral partners vector mesons-photon couplings to constituent quarks vector currents and photons.

The following B_0 -dependent anisotropic vector mesons-constituent quark couplings emerge:

$$I_{FF} \rightarrow 2g_1^B i\epsilon_{ij3} [\mathcal{G}_i^{xy} j_p^j + \mathcal{F}_i^{xy} j_p^j], \quad (23)$$

$$I_{FFm} \rightarrow g_1^B \left[\mathcal{F}_3^{xy} j_s + \mathcal{F}_s^{xy} j_3 + \mathcal{G}_3^{xy} j_p + \mathcal{G}_p^{xy} j_3 + \frac{1}{3} (\mathcal{G}^{xy} j_p + \mathcal{F}^{xy} j_s + \mathcal{G}_i^{xy} j_p^i + \mathcal{F}_i^{xy} j_s^i) \right], \quad (24)$$

$$I_{VA} \rightarrow 2i\epsilon_{ij3} [g_{2A}^B \bar{A}_i^y j_p^j + g_2^B V_i^y j_s^j], \quad (25)$$

$$I_{VAm} \rightarrow g_2^B [V_y^3 j_s + V_y j_s^3] + g_{2A}^B [\bar{A}_y^3 j_p + \bar{A}_y j_p^3] + \frac{g_2^B}{3} (V_y j_s + V_i^y j_s^i) + \frac{g_{2A}^B}{3} (\bar{A}_y j_p + \bar{A}_y^i j_p^i), \quad (26)$$

$$I_{VF} \rightarrow i\epsilon_{ij3} [g_3^{B_1} V_i^x j_{j,V}^y + g_{3A}^{B_1} \bar{A}_i^x j_{j,A}^y], \quad (27)$$

$$I_{AF} \rightarrow i\epsilon_{ij3} [g_3^{B_2} \mathcal{F}_{y\delta}^i j_{j,V}^\delta + g_{3A}^{B_2} \mathcal{G}_{y\delta}^i j_{j,A}^\delta], \quad (28)$$

where the effective coupling constants have been defined in the long wavelength limit,

$$g_1^B = 6N_c d_1 M^* (eB_0) (\alpha g^2) Tr'((\tilde{S}_0(k) \tilde{S}_0(k) \tilde{S}_0(k) R(k))), \quad (29)$$

$$g_2^B = 6N_c d_1 (eB_0) M^* (\alpha g^2) Tr' \left(\left(-\tilde{S}_0(k) \frac{\partial}{\partial q_x} S_2(k; k+q) R(k) \right) \right)_{q=0}, \quad (30a)$$

$$g_{2A}^B = 6N_c d_1 (eB_0) M^* (\alpha g^2) Tr' \left(\left(-\tilde{S}_0(k) \frac{\partial}{\partial q_x} S_{2A}(k; k+q) R(k) \right) \right)_{q=0}, \quad (30b)$$

$$g_3^{B_1} = 6N_c d_1 (eB_0) (\alpha g^2) Tr'((\tilde{S}_0(k) \tilde{S}_2(k) R(k))), \quad (31a)$$

$$g_{3A}^{B_1} = 6N_c d_1 (eB_0) (\alpha g^2) Tr'((\tilde{S}_0(k) \tilde{S}_{2A}(k) R(k))), \quad (31b)$$

$$g_3^{B_2} = 6N_c d_1 (eB_0) (\alpha g^2) Tr' \left(\left(-\tilde{S}_0(k) R(k) \frac{\partial}{\partial q_x} \tilde{S}_2(k; k+q) \right) \right)_{q=0}, \quad (32)$$

$$g_{3A}^{B_2} = 6N_c d_1 (eB_0) (\alpha g^2) Tr' \left(\left(-\tilde{S}_0(k) R(k) \frac{\partial}{\partial q_x} \tilde{S}_{2A}(k; k+q) \right) \right)_{q=0}, \quad (32a)$$

where the functions were defined as

$$\tilde{S}_2(k; k+q) = \frac{k \cdot (k+q) - M^{*2}}{(k^2 + M^{*2})((k+q)^2 + M^{*2})}, \quad \tilde{S}_{2A}(k; k+q) = \frac{k \cdot (k+q) + M^{*2}}{(k^2 + M^{*2})((k+q)^2 + M^{*2})}, \quad \tilde{S}_0(k) = \frac{1}{k^2 + M^{*2}}.$$

The corresponding gauge-type coupling constants of vector and axial mesons to constituent quarks in the vacuum as presented in Refs. [1,2] are correctly written as

$$L_{v-q} = g_{r1} V_i^\mu(x) j_\mu^{V,i}(x) + g_{a1} \bar{A}_i^\mu(x) j_\mu^{A,i}(x) + g_{v1} V^\mu(x) j_\mu(x) + g_{f1} \bar{A}_\mu(x) j_A^\mu(x), \quad (34)$$

where the dimensionless coupling constants were found to be

$$g_{r1} = g_{v1} = 4id_1 N_c (\alpha g^2) \text{Tr}'((\bar{S}_2(k) \bar{\bar{R}}(k))), \quad (35a)$$

$$g_{a1} = g_{f1} = 4id_1 N_c (\alpha g^2) \text{Tr}'((\bar{S}_{2A}(k) \bar{\bar{R}}(k))). \quad (35b)$$

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- [1] F. L. Braghin, Light vector and axial mesons effective couplings to constituent quarks, [Phys. Rev. D **97**, 054025 \(2018\)](#).
- [2] F. L. Braghin, [Phys. Rev. D **101**, 039901 \(2020\)](#).