Erratum: Rotatory power reversal induced by magnetic current in bi-isotropic media [Phys. Rev. B 106, 144430 (2022)]

Pedro D. S. Silva and Manoel M. Ferreira, Jr.

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We point out that there are some mistakes in Secs. III B 2 and III B 3 of the original paper, which deal with the electromagnetic propagation in a bi-isotropic medium endowed with an antisymmetric magnetic conductivity. We begin by rewriting the refractive indices of Eq. (52), for null Ohmic conductivity, as

$$n_{\pm} = cA + ic\tilde{A}_{\pm} \mp \mu c\alpha'' - \frac{i\mu c}{2\omega} b\cos\theta, \tag{1a}$$

with the corrected definitions,

$$A = \frac{1}{\sqrt{2}}\sqrt{|f(\omega)|}\sqrt{\sqrt{1+\frac{g^2}{\omega^2 f(\omega)^2}} + \mathrm{sgn}[f(\omega)]}, \tag{1b}$$

$$\tilde{A}_{\pm} = \pm\frac{\mathrm{sgn}[g]}{\sqrt{2}}\sqrt{|f(\omega)|}\sqrt{\sqrt{1+\frac{g^2}{\omega^2 f(\omega)^2}} - \mathrm{sgn}[f(\omega)]}, \tag{1c}$$

$$f(\omega) = \mu\epsilon + \mu^2\alpha''^2 - \frac{\mu^2 b^2\cos^2\theta}{4\omega^2}, \tag{1d}$$

$$g = \mu^2\alpha'' b\cos\theta. \tag{1e}$$

The rotatory power (RP), for all frequency domains, is now given by

$$\delta = \omega\mu\alpha'', \tag{2}$$

instead of Eqs. (56) and (57) of the original paper. Hence Fig. 2 of the original article is properly replaced by Fig. 1 herein, which presents no discontinuity in the rotatory power. Also, the rotatory power sign is strictly given by the sign of the magnetoelectric parameter α'', without sign reversion.

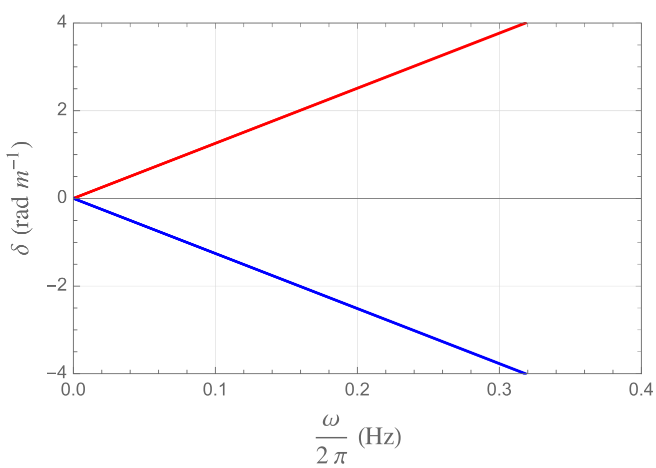

FIG. 1. Rotatory power of Eq. (2). Here, we have used $\mu = 1\ \mathrm{H\,m^{-1}}$, $\epsilon = 2\ \mathrm{F\,m^{-1}}$, $b = 1\ \Omega^{-1}\,\mathrm{s}^{-1}$, and $\alpha'' = 2\ \mathrm{F\,s^{-1}}$ (red line) and $\alpha'' = -2\ \mathrm{F\,s^{-1}}$ (blue line), the same values of the original paper.

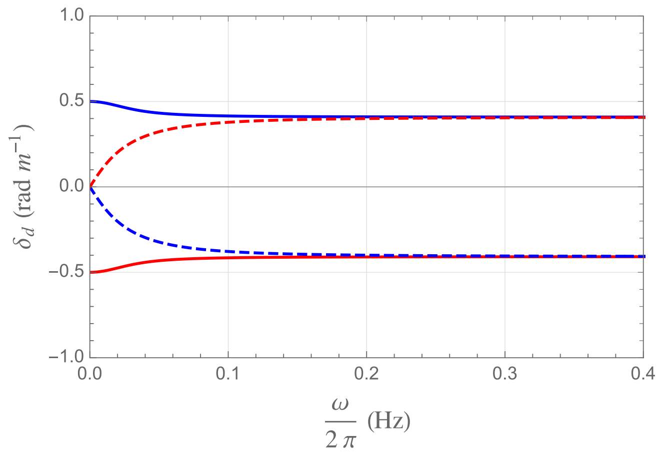

FIG. 2. Dichroism coefficient of Eq. (3) in terms of $\omega/(2\pi)$. The solid curves represent the dichroism coefficient for $\cos\theta = 1$, and the dashed lines indicate (3) for $\cos\theta = -1$. Here, we have used $\mu = 1\ \mathrm{H\,m^{-1}}$, $\epsilon = 2\ \mathrm{F\,m^{-1}}$, $b = 1\ \Omega^{-1}\,\mathrm{s^{-1}}$, and $\alpha'' = 2\ \mathrm{F\,s^{-1}}$ (red lines) and $\alpha'' = -2\ \mathrm{F\,s^{-1}}$ (blue lines), the same values of the original paper.

The dichroism coefficient of Eq. (59) should read

$$\delta_d = -\frac{\omega}{2}(\tilde{A}_+ - \tilde{A}_-), \tag{3}$$

whose plot is here shown in Fig. 2 (replacing Fig. 3 of the paper). The plots of Fig. 2 reveal that $\delta_d|_{\alpha''<0} = -\delta_d|_{\alpha''>0}$, a kind of mirror symmetry associated with the sign of α''.

Considering the case with non-null Ohmic conductivity, the refractive indices (60) become

$$n_\pm = cA'_\pm + icA''_\pm \mp \mu c\alpha'' - \frac{i\mu c}{2\omega} b\cos\theta, \tag{4a}$$

where

$$A'_\pm = \frac{1}{\sqrt{2}}\sqrt{|f(\omega)|}\sqrt{\sqrt{1 + \frac{g_\pm^2}{\omega^2 f(\omega)^2}} + \mathrm{sgn}[f(\omega)]}, \tag{4b}$$

$$A''_\pm = \pm\frac{\mathrm{sgn}[g_\pm]}{\sqrt{2}}\sqrt{|f(\omega)|}\sqrt{\sqrt{1 + \frac{g_\pm^2}{\omega^2 f(\omega)^2}} - \mathrm{sgn}[f(\omega)]}, \tag{4c}$$

$$g_\pm = \mu^2\alpha'' b\cos\theta \pm \mu\sigma. \tag{4d}$$

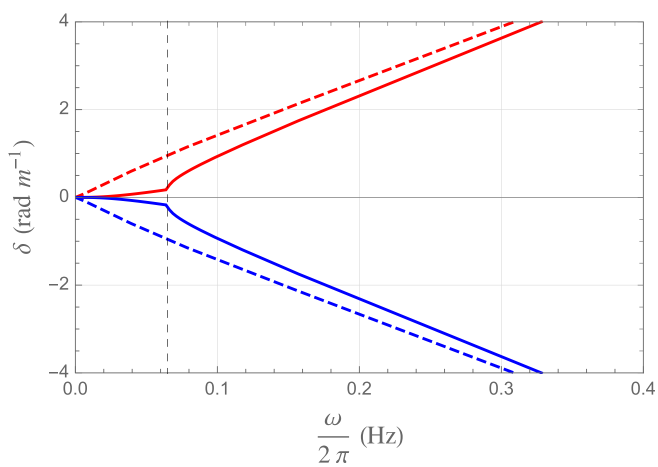

FIG. 3. Rotatory power of Eq. (5). The solid curves represent the RP for $\cos\theta = 1$, and the dashed lines indicate (5) for $\cos\theta = -1$. Here, we have used $\mu = 1\ \mathrm{H\,m^{-1}}$, $\epsilon = 2\ \mathrm{F\,m^{-1}}$, $b = 2\ \Omega^{-1}\,\mathrm{s^{-1}}$, $\sigma = 4\ \Omega^{-1}\,\mathrm{m^{-1}}$, and $\alpha'' = 2\ \mathrm{F\,s^{-1}}$ (red lines) and $\alpha'' = -2\ \mathrm{F\,s^{-1}}$ (blue lines). The vertical dashed line is given by $\omega_0/(2\pi) = 1/(4\pi\sqrt{6})$ Hz, defined by Eq. (53).

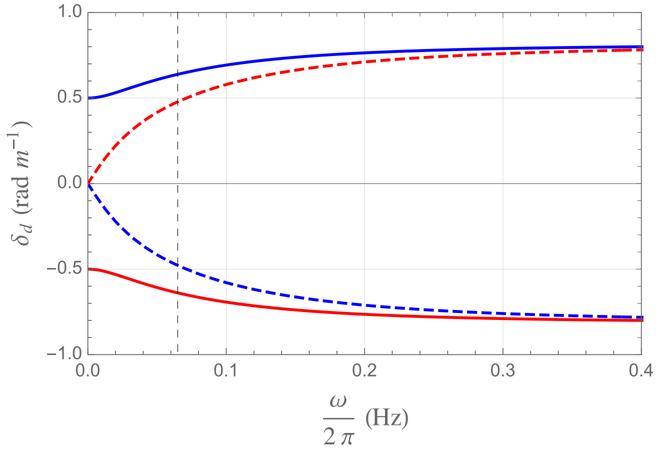

FIG. 4. Dichroism coefficient of Eq. (6). The solid curves illustrate dichroism for $\cos\theta = 1$, and the dashed lines depict (6) for $\cos\theta = -1$. Here, we have used $\mu = 1$ H m^{-1}, $\epsilon = 2$ F m^{-1}, $b = 2\ \Omega^{-1}$ s^{-1}, $\sigma = 4\ \Omega^{-1}$ m^{-1}, and $\alpha'' = 2$ F s^{-1} (red lines) and $\alpha'' = -2$ F s^{-1} (blue lines). The vertical dashed line is given by $\omega_0/(2\pi) = 1/(4\pi\sqrt{6})$ Hz, defined by Eq. (53).

In this case, the rotatory power for the entire frequency domain is given by

$$\delta = -\frac{\omega}{2}(A'_+ - A'_- - 2\mu\alpha''), \tag{5}$$

which substitutes Eqs. (63) and (65) of the original paper. The RP (5) is now plotted in Fig. 3, which replaces Fig. 4 of the paper.

Figure 3 shows the RP for two opposite propagation senses. For parallel propagation along the **b** axis, $\theta = 0$, the propagation is nonlinear for $\omega < \omega_0$, with ω_0 of Eq. (53), and approximately linear for $\omega > \omega_0$. On the other hand, for antiparallel propagation along the **b** direction, $\theta = \pi$, the RP is very nearly linear for the frequency domain examined. Comparing the present Figs. 1 and 3, we point out that for $\sigma \neq 0$, one can distinguish between parallel ($\theta = 0$) and antiparallel ($\theta = \pi$) particular cases, by the linearity level of the RP for small frequencies.

The dichroism coefficient of Eqs. (66) and (67) now becomes

$$\delta_d = -\frac{\omega}{2}(A''_+ - A''_-), \tag{6}$$

here depicted in Fig. 4, which replaces Fig. 5 of the paper.

After correcting these points, part of our conclusion of the paper should be changed as follows: Differently from the isotropic scenario of Sec. III A, where the rotatory power sign changes due to the isotropic magnetic conductivity, we have shown that for the antisymmetric magnetic conductivity of Sec. III B, there does not occur a rotatory power sign reversal, with and without Ohmic conductivity. Thus, the specific medium described by this particular scenario does not undergo handedness reversal. Therefore, in the context of a bi-isotropic medium, only the isotropic magnetic conductivity can enable rotatory power reversal. This conclusion suggests that the anisotropies in a magnetic current in bi-isotropic media can prevent rotatory power (and handedness) reversal for the propagation regime of left-handed (LCP) and right-handed circularly polarized (RCP) waves. These results introduce a possible way to distinguish between isotropic and antisymmetric magnetic currents supported in bi-isotropic media. All other results and conclusions of the original paper remain valid and unchanged.