Erratum

Critical ultrasound attenuation in isotropic systems

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In the first paragraph of Sect. 4.2., we stated erroneously that the terms proportional to $\text{Im} \left(\Psi^* \frac{\delta H}{\delta \Psi^*} \right)$ vanish for $T > T_\lambda$. In fact, one has

$$\text{Im} \left(\Psi^* \frac{\delta H}{\delta \Psi^*} \right) = \Psi^2 \Delta \Psi^1 - \Psi^1 \Delta \Psi^2.$$

Consequently, the phonon self-energy has an additional contribution, and thus equations (4.6d) and (4.8b) have to be replaced by

$$\begin{aligned} \Sigma(\mathbf{k}, \omega) = & -2\Gamma_0' k^2 \gamma_\rho^2 \langle (\tilde{\Psi}^1 \Psi^1 + \tilde{\Psi}^2 \Psi^2)_{\mathbf{k}, \omega} \rangle \\ & \cdot ((\Psi^1)^2 + (\Psi^2)^2)_{-\mathbf{k}, -\omega} \rangle_{\text{irr}} \\ & + (2\Gamma_0'' k^2 \gamma_\rho^2 + c_0(\alpha_0 - 1) k^2 \gamma_\rho) \Sigma_1(\mathbf{k}, \omega) \\ & + 2c_0 M i \omega \int_{\mathbf{k}_1, \mathbf{k}_2} (k_2^2 - k_1^2) \delta(\mathbf{k}_1 + \mathbf{k}_2 + \mathbf{k}) \\ & \cdot [2\Gamma_0' \gamma_\rho \langle (\tilde{\Psi}^1 \Psi^1 + \tilde{\Psi}^2 \Psi^2)_{\mathbf{k}, \omega} \cdot (\Psi_{\mathbf{k}_1}^1 \Psi_{\mathbf{k}_2}^2)_{-\omega} \rangle_{\text{irr}} \\ & + (2\Gamma_0'' \gamma_\rho + c_0(\alpha_0 - 1)) \langle (\tilde{\Psi}^1 \Psi^2 - \tilde{\Psi}^2 \Psi^1)_{\mathbf{k}, \omega} \\ & \cdot (\Psi_{\mathbf{k}_2}^1 \Psi_{\mathbf{k}_2}^2)_{-\omega} \rangle_{\text{irr}}] \\ = & \frac{\Sigma_{\text{red}}}{1 + G_0 \Sigma_{\text{red}}} \end{aligned}$$

and

$$\begin{aligned} \Sigma_F(\mathbf{k}, \omega) = & 2\Gamma_0' k^2 \gamma_\rho^2 \langle (\tilde{\Psi}^1 \Psi^1 + \tilde{\Psi}^2 \Psi^2)_{\mathbf{k}, \omega} \rangle \\ & \cdot ((\Psi^1)^2 + (\Psi^2)^2)_{-\mathbf{k}, -\omega} \rangle_F \\ & + (2\Gamma_0'' k^2 \gamma_\rho^2 + c_0(\alpha_0 - 1) k^2 \gamma_\rho) \\ & \cdot \langle (\tilde{\Psi}^1 \Psi^2 - \tilde{\Psi}^2 \Psi^1)_{\mathbf{k}, \omega} \rangle_F \\ & \cdot ((\Psi^1)^2 + (\Psi^2)^2)_{-\mathbf{k}, -\omega} \rangle_F \\ & + 2c_0 M i \omega \int_{\mathbf{k}_1, \mathbf{k}_2} (k_2^2 - k_1^2) \delta(\mathbf{k}_1 + \mathbf{k}_2 + \mathbf{k}) \\ & \cdot [2\Gamma_0' \gamma_\rho \langle (\tilde{\Psi}^1 \Psi^1 + \tilde{\Psi}^2 \Psi^2)_{\mathbf{k}, \omega} \cdot (\Psi_{\mathbf{k}_1}^1 \Psi_{\mathbf{k}_2}^2)_{-\omega} \rangle_F \\ & + (2\Gamma_0'' \gamma_\rho + c_0(\alpha_0 - 1)) \\ & \cdot \langle (\tilde{\Psi}^1 \Psi^2 - \tilde{\Psi}^2 \Psi^1)_{\mathbf{k}, \omega} \cdot (\Psi_{\mathbf{k}_1}^1 \Psi_{\mathbf{k}_2}^2)_{-\omega} \rangle_F]. \quad (4.8b) \end{aligned}$$

In the low-temperature phase, one has

$$\text{Im} \left(\Psi^* \frac{\delta H}{\delta \Psi^*} \right) = \pi \Delta \sigma - \sigma \Delta \pi - m_0 \Delta \pi.$$

The equations of motion for s and ρ displayed in Eq. (5.3a) therefore read

$$\frac{\partial s}{\partial t} = \kappa \Delta \frac{\delta H}{\delta s} - 2\alpha c_0 (\pi \Delta \sigma - \sigma \Delta \pi - m_0 \Delta \pi) + \theta_s$$

and

$$\begin{aligned} M \frac{\partial^2 \rho}{\partial t^2} = & DM \Delta \frac{\partial \rho}{\partial t} + \Delta \frac{\delta H}{\delta \rho} \\ & + 2c_0 \left(M \frac{\partial}{\partial t} - DM \Delta \right) \\ & \cdot (\pi \Delta \sigma - \sigma \Delta \pi - m_0 \Delta \pi) + \theta_\rho, \end{aligned}$$

and the self-energy, Eq. (5.4b), becomes

$$\begin{aligned} \Sigma_F = & -2\Gamma_0' k^2 \gamma_\rho^2 \langle (\tilde{\sigma}(\sigma + m_0) + \tilde{\pi}\pi)_{\mathbf{k}, \omega} \rangle \\ & \cdot ((\sigma^2 + 2\sigma m_0) + (\pi)^2)_{-\mathbf{k}, -\omega} \rangle_F \\ & + (2\Gamma_0'' k^2 \gamma_\rho^2 + c_0(\alpha_0 - 1) k^2 \gamma_\rho) \\ & \cdot \langle (\tilde{\sigma}\pi - \tilde{\pi}(\sigma + m_0))_{\mathbf{k}, \omega} \cdot ((\sigma^2 + 2\sigma m_0) + (\pi)^2)_{-\mathbf{k}, -\omega} \rangle_F \\ & - 2c_0 m_0 M i \omega k^2 [2\Gamma_0' \gamma_\rho \\ & \cdot \langle (\tilde{\sigma}(\sigma + m_0) + \tilde{\pi}\pi)_{\mathbf{k}, \omega} \cdot \pi_{-\mathbf{k}, -\omega} \rangle_F \\ & + (2\Gamma_0'' \gamma_\rho + c_0(\alpha_0 - 1)) \\ & \cdot \langle (\tilde{\sigma}\pi - \tilde{\pi}(\sigma + m_0))_{\mathbf{k}, \omega} \cdot \pi_{-\mathbf{k}, -\omega} \rangle_F \\ & + 2c_0 M i \omega \int_{\mathbf{k}_1, \mathbf{k}_2} (k_2^2 - k_1^2) \delta(\mathbf{k}_1 + \mathbf{k}_2 + \mathbf{k}) \\ & \cdot [2\Gamma_0' \gamma_\rho \langle (\tilde{\sigma}(\sigma + m_0) + \tilde{\pi}\pi)_{\mathbf{k}, \omega} \cdot (\sigma_{\mathbf{k}_1} \pi_{\mathbf{k}_2})_{-\omega} \rangle_F \\ & + (2\Gamma_0'' \gamma_\rho + c_0(\alpha_0 - 1)) \langle (\tilde{\sigma}\pi - \tilde{\pi}(\sigma + m_0))_{\mathbf{k}, \omega} \\ & \cdot (\sigma_{\mathbf{k}_1} \pi_{\mathbf{k}_2})_{-\omega} \rangle_F]. \quad (5.4b) \end{aligned}$$

None of our conclusions is affected by these changes.