Erratum: Nonlinear Zel'dovich Effect: Parametric Amplification from Medium Rotation [Phys. Rev. Lett. 118, 093901 (2017)]

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In our recent Letter, we obtained the condition $\omega_1 = \bar{m}\Omega$ for peak parametric gain, where ω_1 is the fundamental frequency, $\bar{m} = (m_1 + m_3)/2$ the mean of the signal and idler winding numbers, and Ω the medium rotation rate. This condition was derived using Eq. (8) for the wave vector mismatch by setting $\kappa = 0$ in the limit of large ring radius $R \rightarrow \infty$. We have subsequently realized that the above condition is incompatible with the requirement that $(\bar{m}\Omega/\omega_1)$ be less than unity in order to satisfy the paraxial approximation employed in our derivations.

Here we illustrate that the concepts and conclusions of our Letter remain intact within the paraxial approximation by reexamining the condition for peak parametric gain. In particular, setting $\kappa = 0$ in Eq. (8), the condition for peak gain may be written generally as

$$\omega_1 = \bar{m}\Omega + \omega_1 \left(\frac{n_1(m_1 - m_2/2)^2}{2(k_1 R)^2(n_1 - n_2)} \right), \quad (1)$$

with $m_2 = m_1 + m_3$. If the term in large parentheses, that we denote ξ , is close to but smaller than unity, then this enforces the condition that $(\bar{m}\Omega/\omega_1) = (1 - \xi)$ be less than unity, as required for the validity of the paraxial approximation. As an example, in Fig. 1 below we show the equivalent of Fig. 1 of the Letter for the same parameters and with $(n_2 - n_1) = -10^{-3}$, $m_1 = 95$, and $m_2 = 200$, for which $(\bar{m}\Omega/\omega_1) = 0.2$ at the peak. Thus, the nonlinear Zel'dovich effect still appears within the paraxial approximation, albeit with the condition in Eq. (1) for peak parametric gain. If we further write Eq. (1) as $\bar{\omega} = \bar{m}\Omega$ with $\bar{\omega} = (1 - \xi)\omega_1$, this generalizes Eq. (11) of our Letter for the peak gain.

FIG. 1. Parametric gain factor $|\exp(2gL)|$ vs the rotation rate Ω , and (b) the signal gain G_s (dashed line) and net gain G (solid line) both as functions of Ω . For these calculations $m_1 = 95$, $m_2 = 200$, and $(n_2 - n_1) = -10^{-3}$, all other parameters being the same as in our Letter.