Reply to the comments of Verheest

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In the comments on our paper[1] Verheest has misunderstood and misinterpreted what was presented in our paper. It is important to realize the basic motive of our paper which is explicitly stated in our paper.

We feel that the criticisms made in the comment are unsubstantial. The only correct points in Verheest's comments are the following.

(i) Elaborations made by Verheest (which is the main bulk of his comments) to justify our *own brief remark given after Eq. (17) of our paper* (and perhaps overlooked by Verheest) that in the limit $k \to 0$, our evolution equation reduces to the standard DNLS. We have pointed out in our paper[1] that the form of the derivative nonlinear Schrödinger (DNLS) equation derived by us is valid when both ϵ (smallness parameter in our perturbation expansion scheme) and k (central wave number) are comparable (i.e., of the same order). So usually DNLS should be retrieved from our set of equations in the limit $k \ll \epsilon$ and $\mu \approx O(\sqrt{\epsilon})$. We have already shown that q_2 indeed goes to zero under the limit $k \to 0$. Verheest's (re) derivation simply vindicates our assertion and also affirms that the equation derived by us has wider applicability and thus is more general than the usual DNLS. The term $|B|^2(\partial B/\partial \xi)$ [misprinted in the comment as $|B|(\partial B/\partial \xi)$] is not spurious. This term has a coefficient that has the same order as ϵ as the other terms [if $k \sim O(\epsilon)$] and it definitely occurs under the conditions for which our equations are derived. The contribution from Braginskii pressure tensor is evident by the presence of Γ in this term. It should be realized that the relative ordering between ϵ (or μ) and k are not prefixed (neither it is sacrosanct nor sanctified) rather they should be determined by a particular experimental situation to which a particular physical problem is addressed. It is more sensible to have a nonlinear evolution equation where the lowest-order contributions from all prototype nonlinear terms are retained. We stated in our paper, "Eq. (16) is the slow space-time evolution equation for the Alfvén wave when both ϵ (spectral width) and the central wave number k are of the same order. It is to be noted that the term containing cubic nonlinearity is of the same order as the other two terms of the rhs of Eq. (16) when the powers of k in the expressions for q_1, q_2, and q are taken into account."

(ii) There is indeed a sign error (presumably due to an oversight at the time of proofreading) in the expression for q. The expression for q should read

$$q = + \frac{k^2[1 - \Gamma(k^2/R_i)]}{2D_\omega(v_g^2 - \beta)} \times \left[1 - v_g\left(\frac{k}{\omega} + \frac{k}{\omega + \Gamma k^2}\right)\right] \to + \frac{k}{4(1-\beta)} \to 0,$$

for $k \to 0$, $\omega \to 0$, $\omega/k \to 1$.

About the other inexact statements we add the following.

(1) Verheest has stated that only the scalar pressure term contributes to the nonlinear term. One can see that this can never be true. If one goes through the derivation of Eqs. (10)–(16) (which indeed involves a large amount of algebra) one is convinced that nonlinear terms are changed by the presence of the nondiagonal terms of Braginskii pressure tensor. These terms are characterized by the factor Γ, and indeed the nonlinear terms contain the factor Γ. The importance of these terms are more significant when the value of plasma β is high.

(2) Verheest truly says that the Braginskii model modifies the dispersion through the inclusion of Γ. If this is so, any standard literature[2,3] on the derivation of various nonlinear evolution equation will show that the nonlinear term contains the effect of dispersion through the term D_ω ($D_\omega = \partial D/\partial \omega$). The notion that the Braginskii model (i.e., nondiagonal terms of Braginskii pressure tensor) modifies the dispersion but only the scalar pressure contributes to the nonlinear terms is plainly preposterous.

[1]B. K. Som, B. Dasgupta, V. L. Patel, and M. R. Gupta, Phys. Fluids B **1**, 2340 (1989).
[2]K. Nishikawa and C. S. Liu, in *Advances in Plasma Physics* (Wiley, New York, 1976), Vol. 6, pp. 55–59.
[3]B. K. Som, M. R. Gupta, and B. Dasgupta, J. Phys. Soc. Jpn. **47**, 1296 (1979).

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