

CORRIGENDUM

Properties of Alfvén Solitons in a Finite-Beta Plasma

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By STEVEN R. SPANGLER AND JAMES P. SHEERIN

Department of Physics and Astronomy, The University of Iowa,
Iowa City, Iowa 52242

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In the aforementioned paper we obtained an equation for non-linear Alfvén waves in a finite- β plasma, and investigated envelope soliton solutions thereof. The purpose of this note is to point out an error in the derivation of the soliton envelopes, and present corrected expressions for these solitons.

The error arises from our assumption of translational invariance of both the envelope and phase of an envelope soliton expressed in equations (16) and (17). Rather, the phase is related to the amplitude by

$$\theta_y = \frac{1}{2\mu} (V_E - 1) - \frac{3\alpha}{4\mu} u^2,$$

where $y \equiv x - V_E t$ is a comoving co-ordinate, and all other quantities are defined in the above paper.

The consequences of this corrected form for the soliton phase are as follows.

(i) The form of the pseudopotential given in (18) is correct, but the expression for the coefficient B in (19) is not. The correct expression is

$$B = -\frac{(V_E - 1)}{32(1 - \beta)\mu^2}.$$

The coefficients A and C are correct.

(ii) The general expression for the soliton envelope given in (20) is correct, but the error in the coefficient B alters the final envelope expression. Two solitons result, whose envelopes are described by

$$u^2(\xi) = (u_{\max}^2) \left[\frac{2^{\frac{1}{2}} \pm 1}{2^{\frac{1}{2}} \cosh \xi \pm 1} \right],$$
$$u_{\max}^2 = \mp 8(2^{\frac{1}{2}} \mp 1)(V_E - 1)(1 - \beta),$$
$$\xi \equiv [(V_E - 1)/\mu] y.$$

(iii) The obvious requirement that u_{\max}^2 be positive leads to the following constraints on V_E and β . If the upper sign in the above equation is chosen, then $V_E > 1$ if $\beta > 1$, and $V_E < 1$ if $\beta < 1$. If the lower sign is chosen, $V_E > 1$ if $\beta < 1$, and $V_E < 1$ if $\beta > 1$.

The corrected soliton expressions have been verified by numerical calculation.