




Find Solutions for your Plasma Diagnostics

- Knowledge,
- Experience,
- Expertise

Click Here

AIP Physics of Plasmas

HOME

BROWSE

MORE ▾

[Home](#) > [Physics of Plasmas](#) > [Volume 28, Issue 9](#) > [10.1063/5.0059437](https://doi.org/10.1063/5.0059437)



< PREV

NEXT >

 No Access

Submitted: 09 June 2021

Accepted: 03 September 2021

Published Online: 23 September 2021

Description limit for soliton waves due to critical scaling of electrostatic potential

Physics of Plasmas 28, 092115 (2021); <https://doi.org/10.1063/5.0059437>

 F. E. M. Silveira^{1,a)},  M. H. Benetti^{1,b)},  I. L. Caldas^{2,c)}, and  K. N. M. M. Santos^{2,d)}

[View Affiliations](#)

[View Contributors](#)



 PDF

We provide a formulation that describes the propagation of solitons in a nondissipative, nonmagnetic plasma, which does not depend on the particular electron density distribution considered. The Poisson equation in the plasma sheath is expressed in terms of the Mach number for ions entering the sheath from the plasma and of a natural scale for the electrostatic potential. We find a class of reference frames with respect to which certain functions become stationary after arbitrary small variations of the Mach number and potential scale, that is, by determining the critical values of those quantities based on a variational method. It is shown that the critical Mach number defines the limits for the applicability of the reductive perturbation technique to a given electron density distribution. Based on our provided potential scale, we show that the Taylor expansion of the suprathermal electron distribution around equilibrium converges for all possible values of the spectral κ -index. In addition, owing to the admissible range for the critical Mach number, it is found that the reductive perturbation technique ceases to be valid for $3/2 < \kappa \leq 5/2$. In the sequel, we show that the technique is not valid for the deformation q -index of nonextensive electrons when $q \leq 3/5$. Furthermore, by assuming that the suprathermal and nonextensive solitons are both described with respect to the same critical reference frame, a relation between κ and q , which has been previously obtained on very fundamental grounds, is recovered.

ACKNOWLEDGMENTS

F.E.M.S. is partially supported by São Paulo Research Foundation



supported by Coordination of Superior Level Staff Improvement (CAPES) under a graduate scholarship. I.L.C. is partially supported by São Paulo Research Foundation (FAPESP) under Grant No. 18/03211-6, and National Council for Scientific and Technological Development (CNPq) under Grant No. 302665/2017-0. KNMMS is supported by National Council for Scientific and Technological Development (CNPq) under a MSc scholarship.

The authors have no conflicts to disclose.

SELECT YOUR ACCESS

INDIVIDUAL ACCESS

If you have an individual subscription, a subscription provided by one of AIP's Member Societies, have claimed access to a Conference Proceeding, or have made an individual purchase, sign in below.

Username:

Password

Remember me

LOG IN

[Forgot password?](#)

INSTITUTIONAL ACCESS



Access through
Wiley



PDF

Access via the Wiley is not supported.

Please [choose one of the other](#) institutional login options

PURCHASE

Standard PPV for \$35.00

ADD TO CART

**Journal of
Mathematical Physics**



YOUR RESEARCH
Belongs Here

Resources

AUTHOR

LIBRARIAN

ADVERTISER

General Information

ABOUT

CONTACT



 PDF

PRIVACY POLICY

TERMS OF USE

FOLLOW AIP PUBLISHING:



Website © 2021 AIP Publishing LLC.

Article copyright remains as
specified within the article.

Scitation



PDF