

Application of Dromion Solutions in Auroral Plasmas

S. S. GHOSH¹, A. SEN² and GURBAX S. LAKHINA¹

¹Indian Institute of Geomagnetism, Kalamboli, New Panvel(W), Navi Mumbai, 410 218, India

²Institute for Plasma Research, Bhat, Gandhinagar, 382 428, India

Dromions are localized, nonlinear, two dimensional structures with an exponential decay in both space dimensions which arise as exact solutions of a class of two dimensional nonlinear partial differential equations. While the mathematical aspects of dromions has been studied in detail [1], their possible physical applications have received scant attention so far. In the present work, the authors have obtained dromions solutions for 2D electron acoustic wave waves [2]. Assuming the ion temperature (T_i) of 100 eV and the ambient plasma density (n_0) of 1 cm^{-3} , the shape and size of the analytic solution has been estimated which show good agreement with recent satellite observations which show (Table 1). It is proposed that dromions may provide an alternate paradigmatic model for recently observed bipolar structures in auroral plasmas.

Table 1. Comparison between analytical solution of dromion and satellite observations

$T_i=100\text{eV} ; n_0=1\text{cm}^{-3}$	Analytic estimation	Satellite observations
Amplitude	$\cong 0.75\text{ mV/m}$	1 mV/m
Width	$\cong 166.8\text{ m}$	100 – 1000 m
Shape (Width ratio)	$\rho \cong 0.888$	$\rho \cong 1$ (nearly spherical)

References

[1] A. S. Fokas and P. M. Santini, *Phys. Rev. Lett.*, **63**, .1329 (1989).
[2] S. S. Ghosh, A. Sen and G.S. Lakhina, *Nonlin. Process. Geophys.*, **9**, 463 (2002).