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A parametric study of the effect of pressure anisotropy on slow nonlinear acoustic waves in high-β plasmas

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Solitary wave solutions arise naturally from one dimensional Hall-Magnetohydrodynamic (MHD) equations. These solutions have been recently identified as models for slow-mode solitary structures observed in the magnetosheath and other magnetospheric boundary layers, and as a model for magnetic holes (MH), which are localized depressions of magnetic field observed in the solar wind. We extend the analysis of the model of Stasiewicz, which is based on one dimesional Hall-MHD with an explicit pressure anisotropy. Applying the methods of the Sagdeev potential and direct numerical modelling, we performed parametric studies of highly oblique magnetoacoustic nonlinear waves in a high-β (ratio of kinetic to magnetic pressures) plasmas. We found that anisotropy is crucial for the existence of solitary structures in this model. Furthermore, if the perpendicular pressure is greater than the parallel pressure, there can be both field enhancing bright, and field depleting dark solitary structures, whereas increased parallel pressure compared to perpendicular pressure only allows for dark solitary structures. Combinations of the plasma parameters corresponding to the different regimes are determined.