MAGNETOSONIC SOLITONS IN NON-MAXWELLIAN SPACE PLASMAS: MAGNETIC HOLES OR MAGNETIC HUMPS

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A nonlinear theory of large-amplitude magnetosonic waves in high-β space plasmas is revisited. It is shown that depending on the shape of the equilibrium ion distribution function these waves can exist in the form of magnetic hump or magnetic hole. The basic parameter that controls the shape of the nonlinear structure is the wave dispersion which can be either positive or negative. A general dispersion relation for magnetosonic waves propagating perpendicular to the external magnetic field in a plasma with an arbitrary distribution function is derived. The new dispersion relation allows the treatment of of more general plasma equilibria such as the Dory-Guest-Harris (DHG) or Kennel-Ashour-Abdalla (KA) loss cone equilibria, as well as distributions with power law velocity dependence that are modelled by the family of κ-distributions. It is shown that in Maxwellian plasma the dispersion is negative, i.e. the phase velocity decreases with the increase in the wave number and thus the solitary solution in this case has the form of the magnetic hump. On the contrary in non-Maxwellian plasmas such as the Lorentzian or DGH plasmas this solution may have the form of the magnetic drop-out, or magnetic hole. The results of similar investigations based on nonlinear Hall-MHD equations are reviewed. The relevance of our theoretical results to the existing satellite wave observations is outlined.