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Parallel Electric Field in Nonlinear Magnetosonic Waves in Tow- and Three-Component Plasmas SEIICHI TAKAHASHI, YUKIHARU OHSAWA, Department of Physics, Nagoya University, Nagoya 464-8602, Japan — With theory and electromagnetic particle simulations, we have studied the electric field parallel to the magnetic field, $E_{\|}$, in nonlinear magnetosonic waves in an electron-ion (e-i) plasma and in an electron-positron-ion (e-p-i) plasma. Our theory for the e-i plasma shows that the integral of $E_{\|}$ along the magnetic field, $F = -\int E_{\|} ds$, is given as $eF \sim \epsilon \Gamma_e T_e$ in small-amplitude ($\epsilon \ll 1$) pulses in a warm plasma with electron temperature T_e, where Γ_e is the specific heat ratio. In a cold plasma, it is given as $eF \sim \epsilon^2 m_i v_A^2$, where v_A is the Alfven speed. For the e-p-i plasma, F is large if the positron-to-ion density ratio n_{p0}/n_{i0} is small. These theoretical predictions were verified with simulations. Furthermore, the relation $n_{e0} eF \sim \epsilon(\rho v_A^2 + \Gamma_e p_{e0})(n_{i0}/n_{e0})$ is found to fit fairly well to the simulation results for shock waves with $\epsilon \sim O(1)$ in e-i and e-p-i plasmas, where ρ is the mass density and p_{e0} is the electron pressure. These results indicate that $E_{\|}$ can be strong in nonlinear magnetosonic waves.

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