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Parallel Electric Field and Particle Acceleration in Oblique Magnetosonic Shock Waves SEIICHI TAKAHASHI, YUKIHARU OHSAWA, Department of Physics, Nagoya University, Nagoya 464-8602, Japan — The electric field parallel to the magnetic field, $E_{\|}$, in nonlinear magnetosonic waves is studied with theory and particle simulations, and its results are applied to the investigation of the effect of $E_{\|}$ on particle acceleration in shock waves. In the ideal MHD, $E_{\|}$ is zero, and it was generally thought that $E_{\|}$ was quite weak. Our studies, however, show that it can be strong in nonlinear magnetosonic waves. In a shock wave with its amplitude $\epsilon \sim O(1)$, the magnitude of the integral of $E_{\|}$ along the magnetic field, $F = -\int E_{\|} ds$, is given as $eF \sim \epsilon(m_i v_A^2 + \Gamma_e T_e)$, where Γ_e is the specific heat ratio. Furthermore, particle motions in three acceleration mechanisms are calculated with two different test particle methods: In the first method, the total electric field $\boldsymbol{E}$ is used in the equation of motion, while in the second one, $E_{\|}$ is omitted. Comparison of these calculations confirms that $E_{\|}$ is unimportant in the incessant acceleration of relativistic ions. However, $E_{\|}$ is essential for the acceleration of trapped electrons and for the acceleration of positrons along the magnetic field.

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