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Simultaneous trapping of EMIC and MS waves by background plasmas

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Abstract: Electromagnetic ion cyclotron waves and fast magnetosonic waves are found to be simultaneously modulated by background plasma density: both kinds of waves were observed in high plasma density regions but vanished in low density regions. Theoretical analysis based on Snell's law and linear growth theory have been utilized to investigate the physical mechanisms driving such modulation. It is suggested that the modulation of fast magnetosonic waves might be due to trapping by plasma density structures, which results from a conservation of the parameter Q during their propagation. Here $Q = nr\sin\psi$, with n the refractive index, r the radial distance, and ψ the wave azimuthal angle. As for electromagnetic ion cyclotron waves, the modulation might be owed to the ion composition difference between different plasma density regions. Our results indicate the alternative mechanism for simultaneous appearance of electromagnetic ion cyclotron waves and fast magnetosonic waves (rather than wave excitations of both two wave emissions), which might take combined effects on the evolution of radiation belt electrons.