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Alpha-driven localized cyclotron wave modes in nonuniform magnetic field: challenge views on resonance[1] K.R. CHEN, Z.H. TSAI, National Cheng Kung University, Tainan, Taiwan — Resonance is a fundamental issue in science. It requires precise synchronization. Our recent results impact our understanding of resonance. Relativistic ion cyclotron instability, driven by MeV ions whose Lorentz factor is very close to unity, requires a small negative frequency mismatch between harmonic ion cyclotron motion and wave. Thus, it is generally believed that it can not survive the nonuniformity of magnetic field such as in realistic devices. However, our simulations have shown that localized cyclotron waves are excited by the relativistic instability when the magnetic field is with a sinusoidal nonuniformity which is much larger than the frequency mismatch required. The localized waves do not overlap and appear as spatially separated wavelets. This indicates that resonance is a consequence of the need to drive instability for dissipating free energy and increasing the entropy. When a favorable wave eigen-frequency is collectively decided in a coherent means, a special wave form in real space is created for this purpose, even without boundary. The implications for developing a wavelet kinetic theory and for resonance physics will also be discussed.

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