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Positive and negative effective mass of relativistic particles in oscillatory and static fields[1] I.Y. DODIN, N.J. FISCH, Princeton University — A relativistic particle oscillating in high-frequency and/or static fields can be treated as a quasiparticle with an effective mass m_{eff}, which depends on the local parameters of the fields. Both ponderomotive and $\mu\nabla B$ forces, as well as magnetic drifts, are derived from $m_{\text{eff}} = m_{\text{eff}}(\mathbf{r}, \dot{\mathbf{r}})$, $\mathbf{r}$ being the coordinate of the oscillation center. The effective mass is not necessarily positive; thus, if a (weak) external force is applied, acceleration in the direction opposite to this force is possible. As an example, adiabatic average dynamics with $m_{\text{eff}} > 0$ and $m_{\text{eff}} < 0$ is demonstrated for a wave-driven particle in a dc magnetic field. Different energy states are realized in this case, yielding up to three branches of m_{eff} for a given magnetic moment and parallel velocity.

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