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Exact magnetized particle orbits in a parabolic potential and their relation to ExB drifts, diocotron motion, Brillouin limit, stochasticity, axis v. non-axis encirclement, and canonical angular momentum PAUL BELLAN, Caltech — Analytic solutions are presented for the orbit of a charged particle in the combination of a uniform axial magnetic field and a parabolic electrostatic potential. These trajectories are shown to correspond to the sum of two individually rotating vectors with one vector rotating at a constant fast frequency and the other rotating in the same sense but with a constant slow frequency. These solutions are related to the diocotron mode, to Penning trap orbits, and to stochastic orbits. If the lengths of the two rotating vectors are identical, the particle has zero canonical angular momentum in which case the particle orbit will traverse the origin. Axis-encircling orbits are where the length of the vector associated with the fast frequency is longer than the vector associated with the slow frequency. Non-axis encircling orbits are the other way around.

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