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## Space Charge Tracking in Accelerators (12'+3')

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The interactions between charged particles are derived from the relativistic Lienard-Wiechert four-potential. This expression is usually broken into field components and solved statically (Coulombic). However, to study high-intensity, high-precision beams, one can simulate bunch dynamics by incorporating the full potential into a Lorentz-covariant Hamiltonian.

Methods are shown for building an explicit (requiring no solvers), symplectic (ensuring long-term stability) integrator from such a Hamiltonian. A method is also shown which places particles on an extruded Archimedian-spiral coordinate system, which can reduce the number of calculation steps needed versus the typical rectilinear-mesh approach.

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