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2.3.1.1 System of Point Particles 2.3.1.2 Continuous System of Fields; 2.3.2 Poisson Brackets and Conservation Laws; 2.3.3 Canonical Transformations; 2.4 Elementary Electrodynamics; 2.4.1 Maxwell's Equations; 2.4.2 Energy and Momentum of the Electromagnetic Field; 2.4.2.1 Energy and Poynting's Theorem; 2.4.2.2 Momentum and Maxwell's Stress Tensor; 2.4.2.3 Angular Momentum; 2.4.3 Plane Electromagnetic Waves in Vacuum; 2.4.4 Potentials and Gauge Symmetry; 2.4.4.1 Lorenz Gauge; 2.4.4.2 Coulomb Gauge; 2.4.4.3 Retarded Potentials; 2.4.5 Survey of Electro- and Magnetostatics; 2.4.5.1 Electrostatics
2.4.5.2 Magnetostatics 2.4.6 One Classical Particle Subject to Electromagnetic Fields; 2.4.7 Interaction of Two Moving Charged Particles; Further Reading; 3 Concepts of Special Relativity; 3.1 Einstein's Relativity Principle and Lorentz Transformations; 3.1.1 Deficiencies of Newtonian Mechanics; 3.1.2 Relativity Principle of Einstein; 3.1.3 Lorentz Transformations; 3.1.3.1 Definition of General Lorentz Transformations; 3.1.3.2 Classification of Lorentz Transformations; 3.1.3.3 Inverse Lorentz Transformation; 3.1.4 Scalars, Vectors, and Tensors in Minkowski Space
3.1.4.1 Contra and Covariant Components 3.1.4.2 Transformation Properties of Scalars, Vectors, and Tensors; 3.2 Kinematic Effects in Special Relativity; 3.2.1 Explicit Form of Special Lorentz Transformations; 3.2.1.1 Lorentz Boost in One Direction; 3.2.1.2 General Lorentz Boost; 3.2.2 Length Contraction, Time Dilation, and Proper Time; 3.2.2.1 Length Contraction; 3.2.2.2 Time Dilation; 3.2.2.3 Proper Time; 3.2.3 Addition of Velocities; 3.2.3.1 Parallel Velocities; 3.2.3.2 General Velocities; 3.3 Relativistic Dynamics; 3.3.1 Elementary Relativistic Dynamics
3.3.1.1 Trajectories and Relativistic Velocity

Sommario/riassunto

Einstein proposed his theory of special relativity in 1905. For a long time it was believed that this theory has no significant impact on chemistry. This view changed in the 1970's when it was realized that (nonrelativistic) Schrodinger quantum mechanics yields results on molecular properties that depart significantly from experimental results. Especially when heavy elements are involved, these quantitative deviations can be so large that qualitative chemical reasoning and understanding is affected. For this to grasp the appropriate many-electron theory has rapidly evolved. Nowadays relativist...