ZCE 111
Assignment 13

Q1: Coulomb charge scattering in 3D

Develop a code based on velocity Verlet algorithm (see the sample code verlet_algorithm_2D_coulomb_scatterings.nb as a reference) to simulate the scattering process of a fixed charge Q = +1 unit, located at ($r_{20}\sin\theta_2\sin\phi_2$, $r_{20}\cos\phi_2$, $r_{20}\sin\theta_2\cos\phi_2$, by a moving charge q=+1 unit (with mass m = 1 unit), initially located at (0,0,0), and is shooting towards Q with an initial speed v_0=1 unit. In your simulation, set $k = \frac{1}{4\pi\epsilon_0} = 1$, *r20*= 1 unit, $\theta_2 = \phi_2 = 45^\circ$.

Q2: Charge moving in a magnetic field

A charge (mass m and charge q) moving with velocity $\mathbf{v} = (v_x, v_y, v_z)$ in a magnetic field $\mathbf{B} = (B_x, B_y, B_z)$ experiences a velocity-dependent Lorentz force $\mathbf{F} = (F_x, F_y, F_z) = q\,\mathbf{v} \times \mathbf{B}$. Develop a code based on the Störmer-Verlet integration algorithm to simulate the dynamical path of the charge particle moving through the magnetic field. Assume: $q = +1$ unit, mass $m = 1$ unit, initially located at (0,0,0), initial velocity (v_{0x}, v_{0y}, v_{0z}), $v_{0x} = v_{0y} = 0.1$ unit, $v_{0z} = 0.05$ unit, $\mathbf{B} = (0, 0, B_z)$, $B_z = 0.1$ unit. You should see a helical trajectory circulating about the z-direction.

(my code: verlet_algorithm_3D_coulomb_helix.nb)