LorentzTrack Particle Orbit Code

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1 What it does

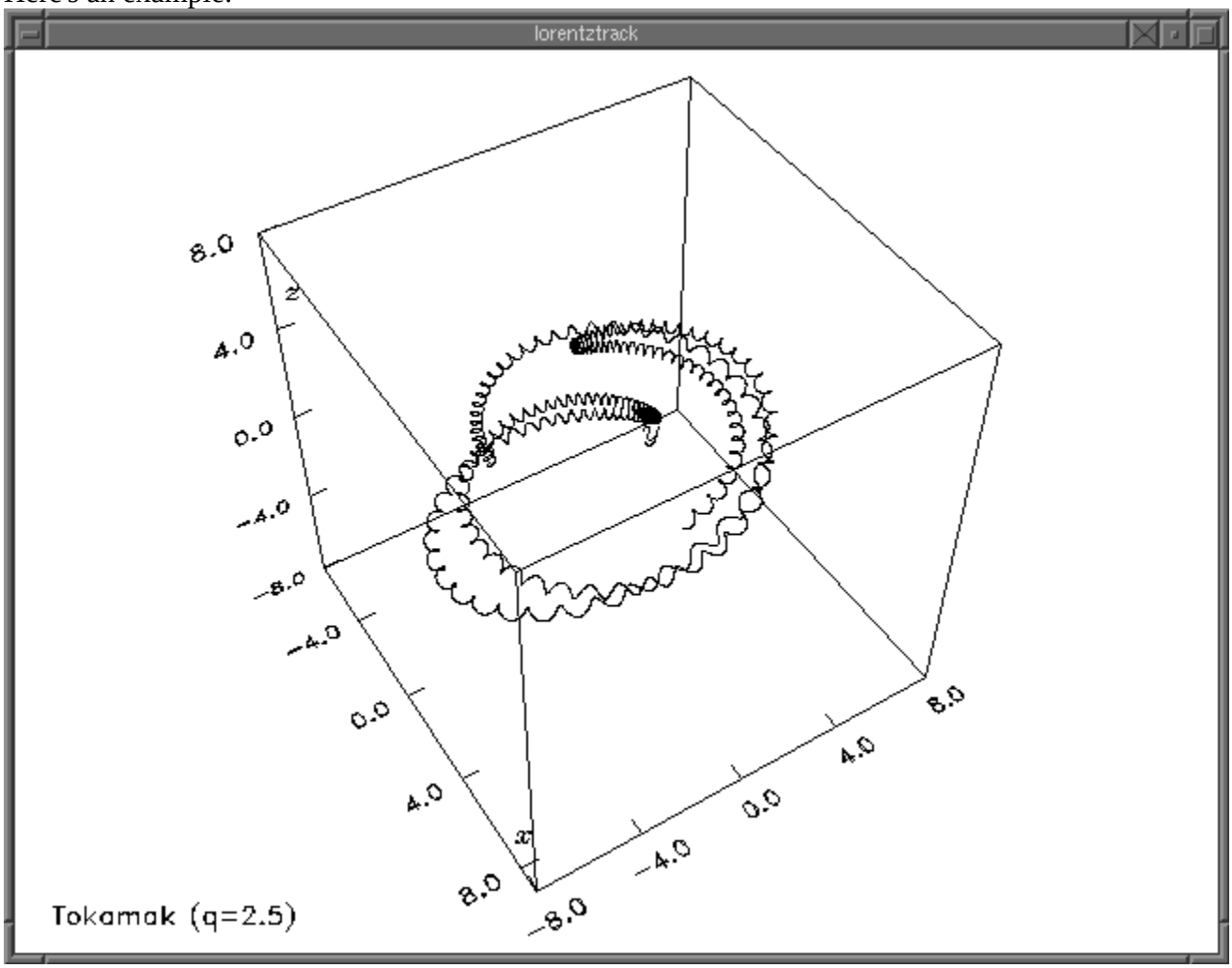
The code LorentzTrack is a simple fortran code that solves for the orbit of a charged particle in specified electric and magnetic fields, using a fourth order Runge-Kutta numerical technique. It plots the orbit in a 3-D perspective plot with simple animation. The user can control the position of the viewer, the initial position and velocity of the particle, and choose the field configuration from a list of built-in cases.

2 How to run it

Type in to the terminal the stuff in `fixed width font` below:

1. Log in to athena on a Sun workstation (the only ones for which the program is so far compiled).
2. `add 22.611j`
3. `cd /mit/22.611j/particle_orbits`
4. `lorentztrack uniform.dat`
5. Watch the plot in the graphics window that will pop up.
6. To change the view of the 3D plot, drag the mouse in the window.
7. To terminate, click in the graphics window without dragging; then click again.

Here's an example:



3 Input file

The data files in that directory ending with `.dat` are different examples. Replace `uniform.dat` in the above command line with the name of the file which contains the case you want. They are simple text files that can be read by any editor. The first line is a comment/description.

If you want to change the input parameters, copy the data files to your own directory and edit them there. You should not be able to change the ones in the locker. In addition to the first line, which is ignored by the code, there are input numbers for the case (integer) the initial position (3 floats) and velocity (3 floats), the step size (don't exceed 0.2) the number of steps (integer) and the approximate time duration of the animation (seconds, float).

4 Equations and units

The equation solved is the non-relativistic equation of motion for a particle with q/m = 1. Typical order of magnitude of the magnetic fields is 1, so the cyclotron frequency is thus also of order 1. Perpendicular velocities of order 1 therefore give rise to Larmor radii of order 1. An electric field of magnitude 1 would give a drift velocity of magnitude E/B = 1. That is rather large for comfort, so generally we'll use smaller electric fields.

The code resides in lorentztrack.f.

It is not terribly long; feel free to examine it or even hack up your own version if you like.

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