PHYS 240 homework #18 – due Apr 12 2013, 5:00pm, upload to Canvas

Traffic flow

1. In class we discussed a traffic flow problem, with "stop-light" initial conditions, and outlined a code to solve it numerically. Now write this code, `traffic.py`, which offers the choice of either the FTCS, Lax, or Lax-Wendroff methods. You should set up the problem with numerical values that represent the real-world problem. The code should provide three plots:

- 1D $\rho(x)$ at two or more time snapshots, *with the analytic solution also shown for comparison*
- 2D $\rho(x,t)$ as a contour plot
- 2D $\rho(x,t)$ as a "surface" plot

Extra credit for also providing an animation.

2. Try out the three different methods for solving the problem, showing some relevant plots and deciding which is the most accurate and efficient.

3. Discuss the 2D solution and the meaning of any interesting features that you see. Make sure that you plot over long enough timescales to get a sense of the asymptotic behavior of the system.

4. Include any discussion and plots in a report generated in LaTeX and submitted in PDF format. Also submit your Python code separately.