AST 384C: Computational Astrophysics

"Final Project" (due by 5pm central time on Tuesday, May 6)
note: **no late assignments will be accepted**, as grades are due on May 7

Complete the following questions by submitting (documented) code and any accompanying answers / plots in a github repository. Email me the repository link once you've committed your solutions. Make sure to clearly document your code; when in doubt, over-explain!

1. **Can LLMs replace you (or at least, your answers to homework problems)?**
   Using the AI of your choice (e.g. Chat-GPT, Claude, etc.), redo the following problems:

   - HW1, problem 2 (generating the positions & velocities), no need to do efficiency tests
   - HW2, problem 1 (4th-order RK for Kepler problem) with $e = 0.96$
   - Hogg & Foreman-Mackey, problem 2 (M-H algorithm with a Gaussian likelihood)

   In each case, describe how easy (or hard) it was to get the LLM to give a solution, whether the initial solution was right, and discuss how it compares to your solution. Can AI replace your brain for doing HW? If so, for what kinds of problems?

2. **Revisiting the gravity calculation** *(Do not use LLMs for this problem.)*
   In HW 3, you used brute force or kd-trees to compute the gravitational force for a random set of 3D postions assuming vacuum boundary conditions. Redo the brute force version problem for $N = 10^5$ but now assume *periodic* boundary conditions, i.e., the box wraps around such that coordinate $x^i = 100$ is equivalent to $x^i = 0$. What changes about your calculation? How does the timing change? How would you use do this with a KDTree (just sketch out some ideas, no need to go into great detail.