ASTR 206 Lecture Notes

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1 The Project

The main part of this course is The Project: to create a working N-body code. We have a specific science problem in mind: modelling gravitational wave events in a small black hole cluster.
The minimal code should:

1. Accurately evolve the motion of particles under gravity.
2. Have some way of visualising results.

How will we know we have achieved goal 1?
A good way is to ensure that we correctly solve a simpler problem with an analytic solution. Thus we will add a new intermediate requirement:

1. Recover the known analytic solutions for evolution of a binary.
2. Accurately evolve the motion of particles under gravity.
3. Have some way of visualising results.

Possible extensions are:

1. Identify objects that are about to merge by GW emission.
2. Scale to more than a few hundred objects.
3. Include the accretion of gas onto black holes (this one is hard!).
4. Have a fancy 3D way of visualising results.

1.1 Tasks To Do

- Make project decisions.
- Generate initial particle positions and velocities.
- Compute forces between particles.
- Evolve particles with forces.

How should we decide which algorithms to use? Initially we have only 2 particles.