Title page

* Name
* Title for talk

Overview of talk

* Reduced 3 body
* Application – aim is to explore the stellar formations that occur after galaxies interact closely with each other
* Setup
* Galaxy generation
* Increase complexity

Principle of reduced 3 body problem

* The principle of the reduced 3 body problem is to have two massive bodies that interact with each other through gravity.
* You can then have one or more test particles that interact with only these two bodies and not with each other. This means the problem does not become the N body problem.

Application

* The 3 body problem can be applied to colliding galaxies by modelling the cores as the two massive point particles that contain all the mass of the galaxy.
* Test particles are then stars which interact with these two cores.

Initial setup

* Model the two colliding galaxies as MW and Androm.
* Do this so real world values for galactic parameters (Radii of stellar disk, tot. mass, separation and linear velocity) can be used.
* We will model the galactic cores as point particles with the entirety of the galactic mass concentrated in this point, numerically solve this problem given initial conditions of velocity to see how stellar cores interact with each other

Galaxy generation

* To generate the stars, random values are sampled for r (radius from core), theta (angle in disk) and z (distance above or below disk).
* The linear velocity of each star calculated depending on its radial distance. Equation derived from equating force of gravity to centripetal force. Not accurate due to spiral galaxies having a flat rotation curve.
* Each stars initial position and velocity
* These are then adjusted for movement of the galactic core

Numerical Simulation

* The differential equation which is then solved for each star

Simulation

* This is the current model used to generate the galaxy, as you can see this is for the stars only interacting with one core showing that the method used for generation produces stable orbits.

Improve accuracy to real world

* Model dark halo as a function of r
  + No longer consider mass contained in point particles
  + Velocity of star depends on mass enclosed
  + Mass given by integral
  + Density given by NFW profile (Navarro–Frenk–White)
  + C, concentration parameter, r200 radius at which density drops to 200x
  + M200 ∼ 1012 M­sun; Wilkinson & Evans 1999; Klypin et al. 2002; McMillan
  + 2011; Piffl et al. 2014b), we have r200 = 210 kpc and rs = kpc at 68% confidence.
* Softening
  + Plummer Potential
  + Spreads out the potential
  + No singularity at r = 0
  + The results of our study indicate that the softening length ǫ in N-body simulations should be a factor of 1.5−2 smaller than the mean distance between particles in the densest regions to be resolved. In this case, the time-step must be adjusted to the chosen (on average, the particle must travel a distance smaller than one-half during one time-step).
* Generate more realistic galactic structures
  + Spirals with arms, Spherical/Ovoidal elliptical with random

SUMMARY

* Project aims to investigate the effects on the stellar structure of galaxies after they have collided or had a close encounter.
* This will be done by making use of the restricted 3 body
* Further aims to increase the complexity of the model are to simulate a dark matter curve, soften the gravitational potential and generate more complex galactic strucures.