Project 1 – The 3 body problem.

In this second assessment, you will write a program that solves the gravitational N-body problem for relatively small values of N.

The code should:

a) Implement a Verlet integration method to evolve in time positions and velocities of the different bodies. **[20 marks]**

b) Automatically calculate the total energy (potential + kinetic) and angular momentum of the bodies. **[10 marks]**

Using the code, you will:

c) Validate it by reproducing the well-known analytical solution of the gravitational two-body problem. Please avoid simplistic responses like "I get a circular orbit, hence my code is right". You need to validate your results against a mathematical model, and a set of general enough initial conditions (circular orbits, elliptic orbits, Kepler's laws, etc). In your validation you should check and show how well your code conserves both energy and angular momentum. **[30 marks]**

d) Then, you will use your program to simulate a three-body (gravitational) problem. Your objective will be to reproduce the periodic stable solutions shown here: 1303.0181.pdf (arxiv.org) **[40 marks]**

You will present your appropriately commented code and a report showing the results of your validation and investigation (questions c and d). A more detailed set of expectations for the report will be updated on ELE for this assessment.