Title: Visualising n-body simulations in virtual reality **Prefix:** phsh_04	
Supervisor(s): Simon Hanna **Postdoc Adviser (if any):**	**MSci/BSc:** BSc
Suitable to run as an MSci and a BSc project concurrently?:	
Theme: Theoretical Physics	**Credit Points if MSci:**
Prerequisites/Co-Requisites: Second or third year computing	
Existing Risk Assessment(s) for this Activity:	

Description

There are many examples of n-body simulations spanning areas of physics from astrophysics to quantum mechanics. Often, visualisation is an important aid to understanding the processes that are being observed, whether the bodies being modelled are stars in a galaxy or fish in a shoal. Usually such visualisations are limited to images or videos. However the availability of inexpensive virtual reality (VR) headsets renders the possibility of an immersive experience when studying simulation results.

The aim of the current project is to produce a visualisation code suitable for such a VR representation. The idea will be to couple this code to the output of a simple n-body simulation such as a Newtonian galaxy simulation or a rule-based swarm simulation. As well as walking around within the simulation, there will be opportunities for the user to interact with the simulation e.g. by introducing a predator near a shoal of fish, or a gravitational perturbation near a galaxy. The write-up should

(Above) An n-body Newtonian simulation of a galaxy and (below) a rule-based simulation of a shoal of fish.

include an assessment of the usefulness of VR compared with more traditional representations of scientific results. An overall objective will be to generate code that might be used as part of an open-day demonstration.

Literature Work

- Learn about n-body simulations, particularly in the context of particle-based simulations using simple potentials or sets of rules.
- Review methods of performing rapid n-body simulations.
- Review literature on applications of VR in data visualisation.

Skills Training

- Obtain suitable libraries and programming interfaces for developing code to drive a Quest 2 headset.
- Familiarize with programming language and produce simple demonstration program.
- Formulate and discuss a project plan for first three weeks of research.
- Complete risk assessment