

## **Astronomy Talk 10<sup>th</sup> January 2017**

### **Probing the Dark Universe**

We welcomed Dr David Bacon from the Portsmouth Institute of Cosmology and Gravitation again, to talk about this mysterious subject. He first introduced us to the Institute, and then immediately went on to cover the scale of the universe, from the solar system up, eventually showing how the universe consists of strings of galaxy clusters and huge voids.

We then looked at the evidence for Dark Matter. There are several pointers, including the rotation rate of galaxies and distortions causing gravitational lensing. The distribution of mass in the Bullet Cluster shows that dark matter doesn't interact with itself. The strings and voids we see have been very successfully modelled in simulations which use small particles as the dark matter objects. All of the above imply there's about 5 times as much dark matter as normal matter. Alas we've found no sign of it in the LHC.

Dark Energy's a different kettle of fish. Galaxies have been seen moving apart faster and faster a time goes on, implying energy to give them that acceleration. However, we haven't got a clue what it is. Ideas include the vacuum energy of space (looks right in principle but quantitatively a problem), extra particles with extremely low mass (seems unlikely) and modifications to the theory of gravity. Unfortunately different studies have produced incompatible results, so we're not getting very far yet.

Based on our best guess, we're left concluding the universe is 4.9% ordinary matter, 26.8% dark matter and 68.3% dark energy. Maybe. Lots of new telescopes and surveys are in train which will hopefully help to resolve this question.

An excellent talk making a very complex subject both interesting and explained with great clarity.