

## **Astronomy Talk 24<sup>th</sup> September 2016**

### **The First Billion Years**

This talk by the chairman covered the first billion years of the universe. It started with the Big Bang and how it displaced the Steady State theory, particularly explaining primordial abundances of elements and the CMB.

After this we looked at the so-called "Dark Ages", involving the universe becoming neutral through the first Recombination. This was followed by Reionisation, and the talk was largely about the period between these two epochs.

The expansion of the Universe and what the measure "z" means was covered, including how that shifts spectral lines. The 21cm line is at present the only way to look at Dark Ages, but it is red shifted up to 30 metres, which unfortunately is used on Earth for television etc.

The end of the Dark Ages was caused by early stars' radiation. The nuclear processes that cause them to differ from today's stars, especially how they could be so massive, were considered. Early galaxy formation was also looked at.

Analysis of spectral lines is a key guide. The hydrogen atom energy levels were explained, and then to show various categories of interesting early objects: Lyman-alpha emitters, Lyman break galaxies and objects showing the Gunn Peterson trough.

At present we are using ALMA (Atacama Large Millimetre/submillimetre Array) but it doesn't reach as far back as we'd like. Gravitational Lensing can help as it can enhance brightness up to 10-fold, particularly looking at quasars and Black Holes.

There are a lot of outstanding questions, and we hope that new instruments such as the SKA (Square Kilometre Array) and JWST (James Webb Space Telescope) etc. will shed much more light on this epoch.