Stargazey Pie

A slice of Highlands astronomical life!

April is the month of the **AGM**. All the papers were sent out by either e-mail or snail mail.

After Arthur welcomed us all he gave apologies for members unable to attend the AGM. Next the minutes from 2011 and the Trustee' Annual Report were adopted. Paul explained that the higher funds were due to our Gift Aid refund for last year coming only in March 2011 and thus had to be included in this year's accounts. As our balance is very healthy it was decided to keep membership subscriptions unchanged.

The position of Secretary remains vacant although Pat Williams has agreed to carry on for the time being but would like to train someone up for the position before she moves to Edinburgh next year. Arthur pointed out we cannot function without a Secretary.

Proposed changes and additions to the Constitution were adopted and this brought the AGM to a close.

The observatory report was delivered by Paul. He said we had had a 50-50 season with some good nights and others not so good. The telescope was to have some vital maintenance performed on it now we were at the end of the observing season but Solar Saturdays were starting again this Saturday so do come along and join us as the Sun was particularly active at the moment.

Next Colin Mansfield gave us a short presentation of **two other ways of measuring the age of the universe**. Last month Bill Leslie gave a practical demonstration involving the membership of how to find Hubble's Constant and thus measure the age of the universe. Colin has discovered two other ways we can do this.

One uses uranium 238. Astronomers looked at the spectra of a star, which is known to be old because it contains so little 'metal' (astronomers use metal for any element heavier than hydrogen and helium), and found traces of uranium 238. They could then calculate how long ago the star was born and from this date the universe to about 12.5 billion years ago, give or take three billion years.

The second method uses the gradual cooling of white dwarf stars allowing their temperature and luminosity to determine their age. Because of their stability and predicted rate of cooling, this can be used to determine the age of the universe to about 12.8 billion years.

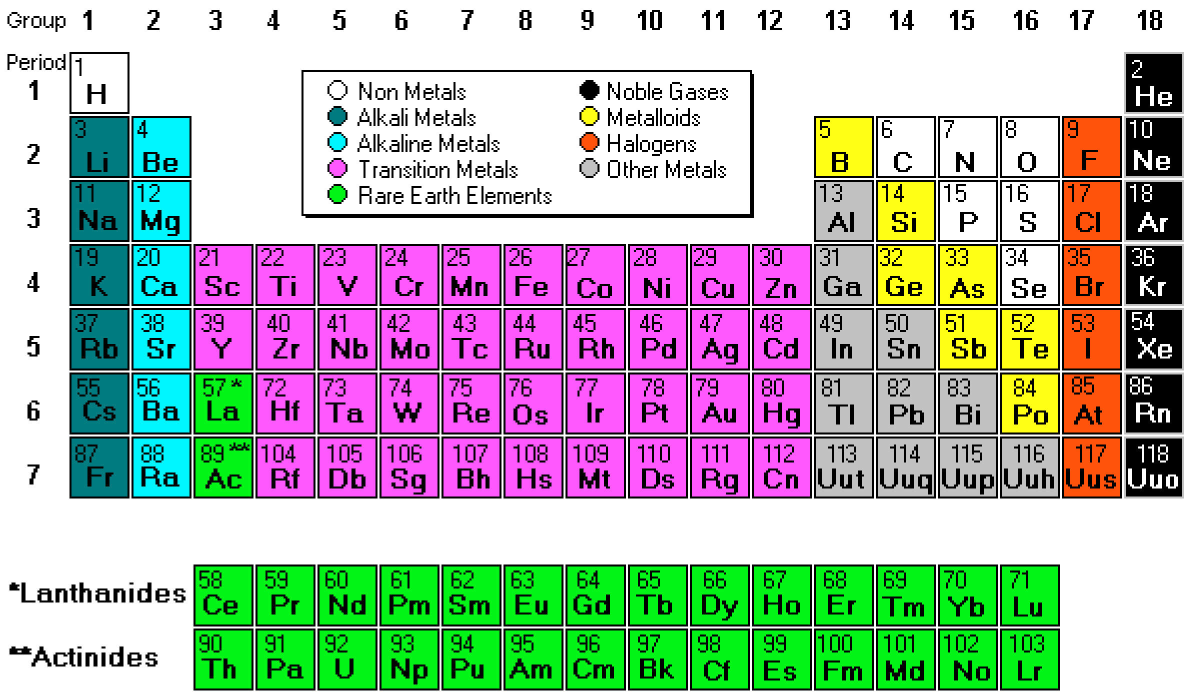
Both methods give similar values to the mean value of the Hubble's Constant measured during Bill's talk of 12.88 billion years.

Main Event – 'Elements of Surprise' by Arthur Milnes

Arthur's talk was about the creation, abundance and use of three of the simplest elements: lithium, beryllium and boron.

For 2000 years it was thought that everything was made up of just four elements: fire, earth, air and water. Today we know that all matter is made from chemical elements – a pure substance consisting of the same atom.

Dmitri Mendeleev arranged all the elements into a table so they formed groups but also so they were in order of increasing atomic number. The atomic number is the number of atoms in a nucleus. An atom consists of protons and usually neutrons.



The first of the three elements Arthur discussed was **Lithium**. It has three protons and is the lightest and least dense, silvery-white metal. It is almost unstable and is classed as an alkali metal as it reacts violently with water. It is the 31st most abundant element and although there are huge amounts in the ocean it is not economic to extract.

Today it is used in the airline industry, batteries and as a medicine to treat bipolar disorder.

It was one of the first elements to be created in the Big Bang along with hydrogen and helium. It seems that older stars have less lithium and younger stars more lithium than expected. Lithium is destroyed at temperatures higher than 2.4 million degrees and therefore is easily destroyed in star interiors but this helps distinguish brown dwarfs from red dwarfs. Brown dwarfs are considered failed stars whereas red dwarfs are burning hydrogen (and considered proper stars) and are therefore too hot to contain lithium. However, some lithium rich stars have been found but not explained.

The twilight glow on Earth is due to lithium in the atmosphere being struck by cosmic rays.

The second element mentioned was **Beryllium.** It has four protons with three, four, five or six neutrons but only the form with five neutrons is stable. It is another very light silvery-white metal and as an alkaline earth or alkaline metal it is chemically less active than lithium but is highly toxic. It is found in a number of minerals such as emerald.

Being very light and strong it is used in the aircraft industry and also the James-Webb telescope. It is necessary for the atomic bomb.

None survived the Big Bang and although beryllium was formed momentarily it has a very short half-life and is therefore extremely rare. It is produced through spallation in which protons and neutrons are lost when hit by energetic particles. This can happen during supernova explosions when oxygen, carbon and nitrogen are broken up and also in Earth's upper atmosphere by cosmic ray spallation of oxygen.

Boron was the last element considered. It has five protons and is stable with either five or six neutrons. As a metalloid it is half way between a metal and a non-metal. Amorphous boron is a brown powder whereas crystalline boron is black.

It is used as shielding in nuclear reactors, as an antibiotic, in household laundry and cleaning products, is an essential plant nutrient and is even used in cancer treatments.

It cannot be created in stars and is therefore produced through cosmic ray spallation making it very rare in the universe. On Earth it only exists in various mineral forms like Borax.

None of these three elements is made in stars and it is probably spallation that is responsible for producing almost all the lithium, beryllium and boron in the universe.

Thank you Arthur for an interesting talk on a little known subject.

<u>Next time</u>

Next month we have Ken Kennedy from Dundee to talk to us about observing the Moon - something we perhaps don't do enough of. Until then, clear skies.

Pauline Macrae