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Presentation Title: Measuring Redshift to a New Level of Accuracy
Research focus: The Rate of Acceleration of Expansion of the Universe
School: School of Mathematics and Physics. The University of Queensland
Presentation Type: Research Paper

Definition: **Redshift** is an increase in the wavelength, and corresponding decrease in the frequency and photon energy, of electromagnetic radiation.
Active Galactic Nucleus (AGN) is a compact region at the center of a galaxy that has a much higher than normal luminosity over at least some portion of the electromagnetic spectrum.

Abstract:

Using data collected from the Anglo-Australian Telescope we are analysing spectral data from different categories of galaxies to determine redshift to a new level of accuracy. The galaxy redshifts will be used to make the most detailed measurement of the Universe's expansion history to date and will lead to a better understanding of the physics behind the acceleration of the expansion of the Universe.

We use the Marz software, written by Samuel Hinton, to redshift FITS files containing typically approximately 300 spectra per file from 2dF on the Anglo-Australian Telescope. There are 400 optical fibres, but some are used as guide fibres or sky fibres and others are put on targets we are monitoring that don't need redshifting, such as AGN, so not all the fibres appear in the files being redshifted. To each spectrum we assign a redshift and a quality flag.

Choosing the quality flag for a redshift is the most important part of the redshifting process and requires the identification of various types of bodies and sources of error, such as noise, or contamination by a nearby bright star.

Identifications levels are:

1. Spectrum is a star. Stars will sometimes have a small negative redshift due to their peculiar velocity if they are moving towards us.
2. Very clear redshift match (>99.9%). Matched on multiple lines. For an absorption line galaxy, a correlation coefficient >5 is likely.
3. Confident redshift match (>95%). Matched on multiple lines or single very strong line.
4. Possible redshift match. Not used for science.
5. No significant signal, or no plausible matches to the apparent lines seen.

Absorption-line galaxies need to be matched on many relatively weak lines requiring cross-correlation. The cross-correlation coefficient can be a good guide when classifying absorption line galaxies Also, the shape of the continuum is important when matching absorption-line galaxies.

Emission-line galaxies are usually most easily matched by identifying the strongest emission lines. Often, we can see strong emission lines even when the galaxies are too faint to detect any continuum, which means we can often find higher-redshift emission-line galaxies than absorption-line galaxies. When identifying emission lines, the ratio of the line strengths is important

Students: Lead PhD student Anthony Carr, Year 12 student Harry Van Der Ark

Figure 1. Sample of Spectral Data being analyzed.

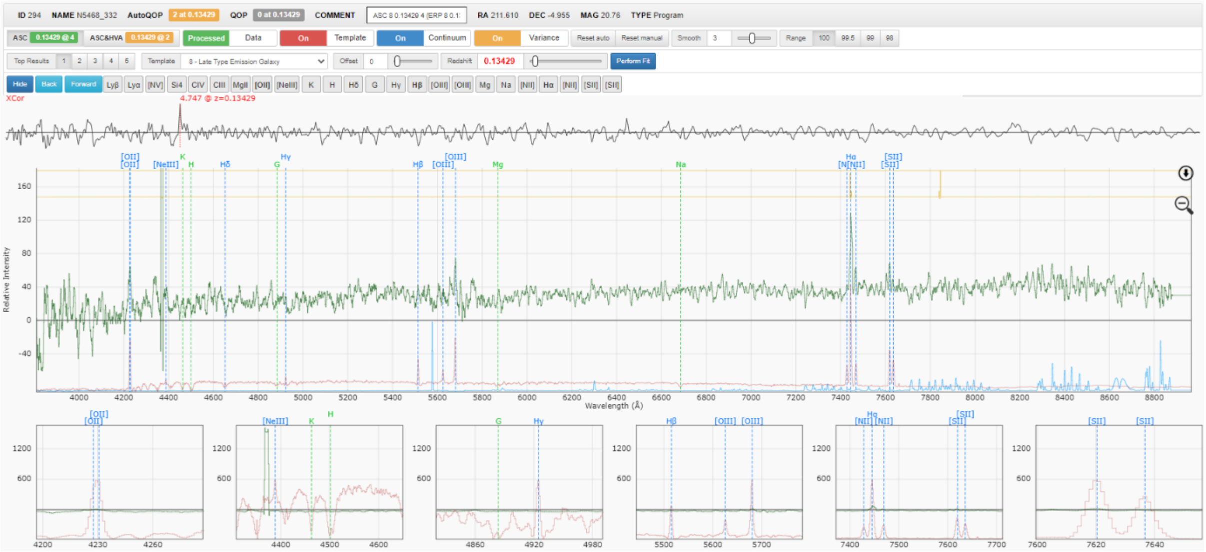

Figure 2. Sample of a High Accuracy Redshift match.