

Overview of the 'Big Ideas'

The activities in this science resource support the Square Kilometre Array (SKA) Project, a proposed large array of radio telescopes. All the activities are aspects of a single 'big idea' about astronomy: that everything we know about the universe is from "messages" in the electromagnetic radiation (EMR) we receive from beyond planet Earth. This 'big idea' is divided into various components, each the focus of an activity. Some of these components are revisited at higher levels. This overview shows the relationship between the components of

the 'big idea' and the seven activities at each level. For higher levels the relevant lower level activity may provide a useful introduction to that particular topic.

The activities were written and illustrated by Tony Mander and Ian Tennant, Christchurch, and the document produced by User Friendly Resources.

	Yr 7 & 8	Level 4	Level 5	Level 6	Level 7	Level 8
The foundation 'big idea': Everything we know about the universe is from "messages" in the electromagnetic radiation (EMR) we receive from beyond planet Earth.	EMR Spectrum 1: Colour conveys information. 3: Colours in white light can be separated for information.	3: EMR has common properties, a wide spectrum, and we utilise all the EMR bands.	6: Frequency and intensity of EMR is proportional to temperature. 7: Colour emitted by an object is related to its temperature.	1: Each element has a unique emission 'fingerprint'. 3: EMR is a form of energy and can be detected by induced electric currents.		1: A spectrometer is used to measure light wavelengths.
	Attributes of Waves 6: Properties of different frequencies of EMR.	1: All waves can be described by wavelength, frequency, amplitude, period, and speed.	5: Different wavelengths contain specific information (comparing a digital camera and an infrared thermometer).		2: Interference can be used to measure the wavelength of an EMR signal. 5: Out of phase signals will cancel each other.	3: Young's double-slit diffraction with radio waves.
	Behaviour of Waves	2: Waves transport energy, but not the medium; have characteristic waveforms. 5, 6, 7: Properties of reflection, refraction, and dispersion.		4: Different materials absorb or transmit radio waves differently.		6: Determining the angular resolution of the eye and applying the concept to radio telescope resolution.
	Extracting Information 2: Flashes of light convey information. 4, 5: Information can be carried by EMR we can't see (IR, radio).				6: Modelling how random signals can be removed from 'real' signals.	4: Sound spectrum analysis to model how computers analyse the radio spectrum.
	Receiving EMR Signals 7: Weak signals can be overwhelmed by stronger signals.	4: Intensity is inversely proportional to the square of the emitter distance.	1, 2, 3: A satellite TV is really a radio telescope: aiming using coordinates, finding the signal, how the dish shape collects and focuses the signals.	7: A radio telescope may be used to locate a distant source of EMR.	1: Radio aerials are designed for specific wavelengths. 4: Manipulating data to show how random signals can be removed from 'real' signals.	5: Utilising resonance in a loop aerial to improve signal reception.
	Radio Waves		4: Time (a base SI unit) is a coordinate for specifying a celestial EMR signal location; it is based on the Earth's motion.	2: Radio is a large proportion of the EMR spectrum; each band is used in specific ways. 5: EMR may be polarised (using radio waves).	3, 7: Radio aerials are highly directional; designed for specific signals. 6: Aerial design is important in receiving and transmitting radio signals.	2: A Yagi aerial can be used to find a signal direction and to extend the range of a signal. 7: Considering signal energy as proportional to the square of the signal voltage.
	Curriculum Links Nature of science: understanding, investigating and communicating. Physical world: exploring the common phenomena of EMR and everyday applications, and how physics knowledge is utilised.			NCEA Links: Achievement Standards L6: 90254, 90520, 90257, 90258, 90259, 91038; L7: 90941, 90942, 90943, 90946, 90936, 90937, 90938, 90138; L8: 90520, 90523, 90774.		