TEACHER RESOURCE

SCIENCE CONTENT/ CURRICULUM LINK
PLANET EARTH AND BEYOND – OBSERVING STARS, INVESTIGATING IN SCIENCE.

STARDOME OBSERVATORY & PLANETARIUM
FACTS, RESOURCES AND ACTIVITIES ON...

STAR COLOURS

Looking up at the stars at night we notice that they're not all the same colour. But it's not always easy to see their different colours, because our eyes aren't good at distinguishing the colour of dim objects, especially in darkness.

To see faint stars at night we need to wait for our eyes to change to 'night vision', which is when we see just black and white. So when we look at two stars that are the same brightness but different colours, the redder of the two stars will appear fainter. Conversely, you will see more faint stars in a group of blue stars than in a group of red stars.

Our perception of star colours is also affected by our individual eyesight, atmospheric turbulence, local sky conditions and light pollution, and by interstellar dust between our Solar System and distant stars.

The constellation of Orion, from Betelgeuse at bottom left to Rigel at top right, with the Horsehead Nebula near the right-most belt star. Credit: Rogelio Andreo (deepskycolors.com/about.html).

As stars get hotter in the centre, their surface can become cooler because the whole star will grow bigger (increasing the surface area).

Really hot stars look blue-white because we can't see the ultraviolet light they are emitting.

However, the stars do appear to range from red through orange, yellow, white, to blue-white. This may seem like a rainbow, where the sequence of colours is caused by changes to white light (i.e. refraction, diffraction). But in stars, the colours we see result from the temperature of the gases (mostly hydrogen) at the surface of the star, and we don't see any green stars.

Red stars are cooler and blue stars are hotter.

However, heat from a star comes from deep within, where it so dense that light can take up to a million years to make its way up to the surface. The bigger the star, the greater its gravity, which squeezes the centre more, raising the temperature. The core of our Sun is about 15 million °C, but the radiation cools as it rises until it's only about 5,500 °C, giving it a yellow-white appearance at the surface.

The Sun is very gradually getting hotter as it gets older. This increased radiation also makes it grow very gradually bigger, which results in a greater surface area, spreading out the heat. So, although the Sun will be much hotter (and will start burning helium), it will actually appear cooler in a few billion years, because it will bloat into a red giant type star – larger than the orbit of Venus!

A supergiant star, such as Betelgeuse, is more than 1 billion °C at its centre. The star would swallow the orbit of Mars and most of the Asteroid Belt, yet its surface is cooler than the Sun, at around 3,200 °C.

Check out these other resources...

- Introduction to star colours: http://naasbeginners.co.uk/AbsoluteBeginners/Star_Colours.htm
- Colours of the Orion nebula and constellation: https://apod.nasa.gov/apod/ap101023.html

DISCUSSION POINTS

What makes planets appear different colours in the night sky?

What are rods and cones for in our eyes?

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ACTIVITY

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STAR COLOURS

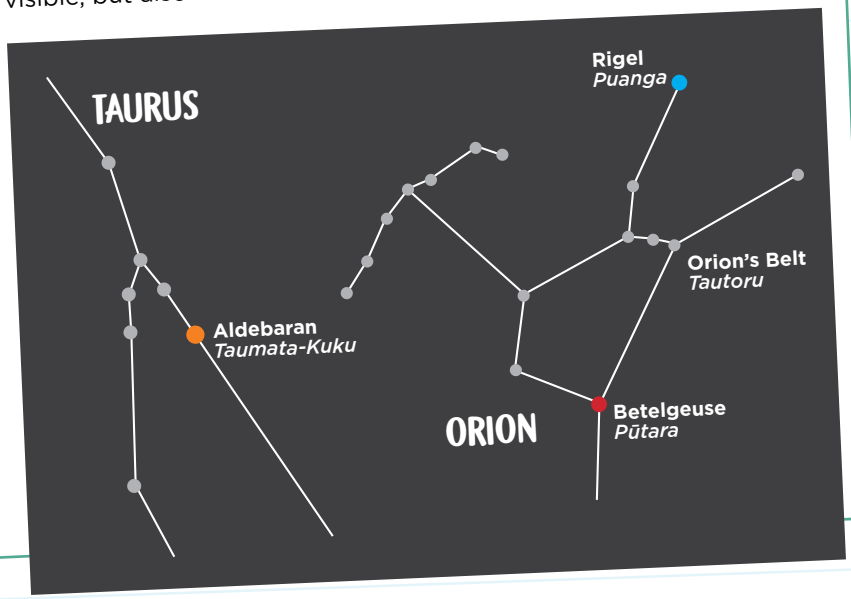
Encourage students to get outside and look up!

ACTIVITY ONE

STAR SPOTTING

Most stars are faint – their colours are subtle, and not easy to see clearly. A good introduction can be gained by observing the constellations of Orion and Taurus. The three brightest stars (Betelgeuse, Rigel and Aldebaran) have definite differences in hue (red, blue and orange) that are visible on a clear dark night.

Using binoculars or a telescope not only makes fainter stars visible, but also enhances the different colours of the stars.



Star colours can be enhanced by defocusing the image during a time exposure. This photo by famous Australian astrophotographer David Malin shows the constellation of Orion, from Betelgeuse at top left to Rigel at bottom right. The three blue belt stars, with the Orion nebula below, are between these stars, in a line side by side. Credit: David Malin.

ACTIVITY TWO

PHOTOGRAPHING THE NIGHT SKY

Astrophotography reveals colours and details that are invisible to the human eye. Modern digital techniques use software to 'stack' images of the same field, adding the faint light of the stars to make them stand out against the background (increased signal-to-noise ratio). Filters can also be used to enhance image quality.

Even without astrophotographic software, the different colours of the brighter stars can be obtained fairly easily using inexpensive equipment. A DSLR camera and sturdy tripod with shutter release can produce surprisingly good results. To see some images taken by both beginners and experts in New Zealand see astronomy.org.nz/new/public/gallery.aspx

A dark site far away from light pollution always helps of course, as do skies clear of cloud, dust, smoke, water vapour and turbulence.

TAKE A PHOTO OF YOUR ACTIVITY AND SEND IT TO US. WE'D LOVE TO SEE IT! EDUCATION@STARDOME.ORG.NZ

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