TEACHER RESOURCE

SCIENCE CONTENT/ CURRICULUM LINK
PLANET EARTH AND BEYOND - OBSERVING STARS AND INVESTIGATING IN SCIENCE

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

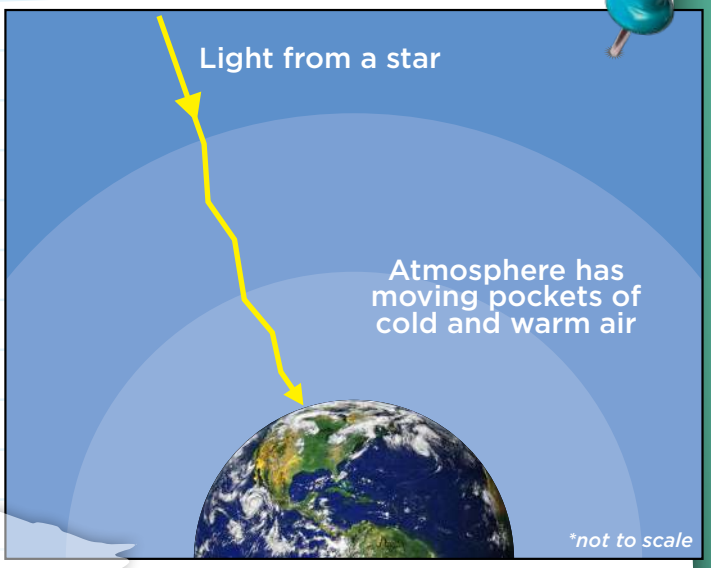
STAR TWINKLING

Except for the Sun, stars are too distant to see their round shape. Even astronauts orbiting Earth see stars that are just points of light without any edges.

Astronauts observe perfectly steady points, unaffected by Earth's atmosphere. However, we see stars that twinkle to various degrees, producing the dancing, romantic, mysterious faint lights of the nursery song we all know.

'Twinkling' is an effect called scintillation, which is the distortion of starlight by changing air masses. Layers of warmer and cooler air have different densities, which refract (bend) light at different angles. Further scintillation is enhanced by the turbulence of moving and changing air masses.

The higher a star is in the sky, the less atmosphere you are looking through. As you observe stars at lower altitudes, eventually reaching the horizon, the starlight is traversing increasingly longer paths through the atmosphere. The starlight is increasingly distorted, producing more twinkling, and becoming dimmer (an effect called 'extinction').



Adaptive optics uses an artificial star created with lasers.

Twinkling is similar to shimmering images above hot roofs and roads on hot summer days.

Star images are also badly affected by the different air temperatures near an observatory, especially at sunset. The dome or telescope room needs to be opened up at dusk to dissipate the heat of the day. Depending on the surrounding landscape and other nearby buildings, it can take several hours for convection currents to subside and the air to settle.

All these effects combined affect 'astronomical seeing', which is a measure of the degree of blurring of celestial images. While there is a technical procedure for recording the seeing at a location at any particular time, amateur observers often use the Pickering Scale. This ranges from '1', where the image is dancing wildly and there is no central star point, to '10', where there is a clear completely stationary point.

The Antoniadi Scale is also used, which ranges from 'I' (perfect image without quivering) to 'V' (hardly able to draw a rough sketch).

To help overcome these difficulties, many observatories are built on mountain peaks, which are above much of the cloud cover and moisture in the atmosphere.

Astronomers have also developed the technology of 'adaptive optics', which adjusts the shape of telescope mirrors in real time, compensating for the distortions caused by the atmosphere.

Check out these other resources...

- en.wikipedia.org/wiki/Astronomical_seeing
- The Pickering astronomical seeing scale: damianpeach.com/pickering.htm

DISCUSSION POINTS

Is cloud cover more or less at night-time compared with daytime?

Where in New Zealand is cloud cover lowest during the year?

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ACTIVITY

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STAR TWINKLING

ACTIVITY ONE

CLASS ACTIVITY: WAVE FRONTS

In groups, children will use ropes and themselves to investigate the nature of light in these interactive activities.

Follow this article from NASA's Spaceplace for further instructions. Your students will investigate:

- Wave fronts – the wave nature of light in space
- Turbulence – the disturbance of light waves in the atmosphere
- Mirroring – the reflection of waves
- Adaptive optics how mirrors can fix distorted wave fronts

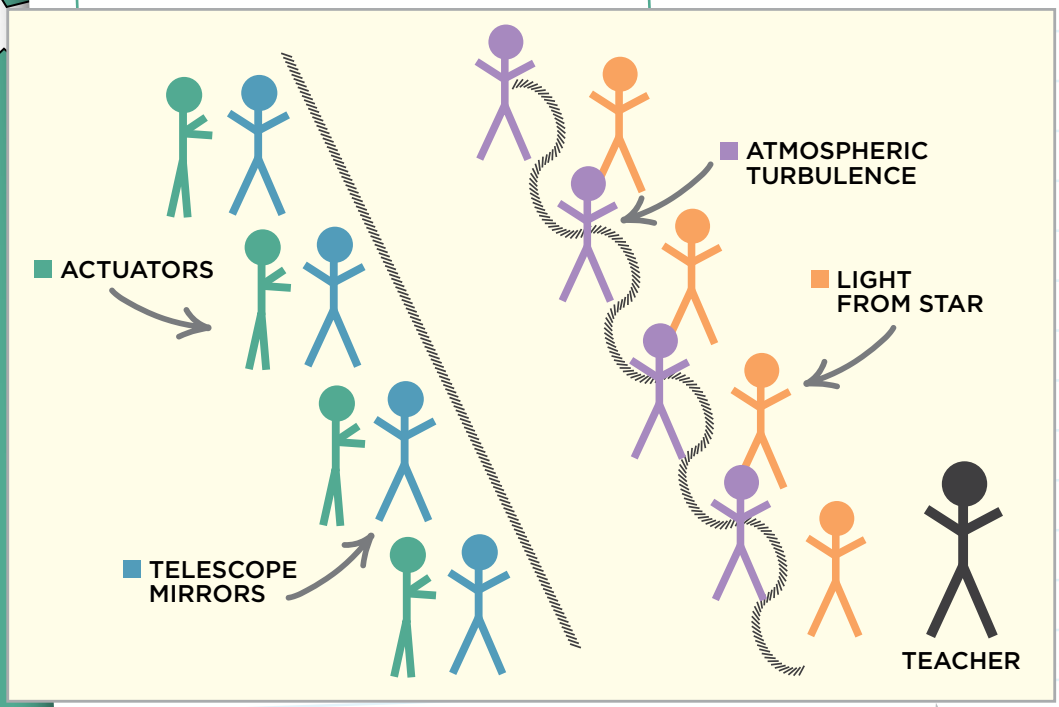
spaceplace.nasa.gov/review/classroom-activities/pdf/adaptive_optics.pdf

ACTIVITY TWO

NIGHT-TIME OBSERVING

Encourage students to look up at night to further their understanding on 'twinkling' stars

- Compare the twinkling of stars on nights that are clear and still with nights that are breezy or stormy. Try to observe the same stars in different conditions for a direct comparison.
- Compare the effects on the twinkling of a star from observing unaided, with binoculars, telescopes with increasingly larger lenses or mirrors, and with increasing magnification.
  - Does increasing the magnification overcome twinkling?
  - Try using large binoculars (15×, 25×, 30×) on a tripod
  - Is there a difference using telescopes with lenses or mirrors?



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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