



SKA - MAKING THE INVISIBLE, VISIBLE

DID YOU KNOW THAT OPTICAL TELESCOPES ONLY ALLOW US TO SEE A VERY SMALL PORTION OF THE LIGHT ENERGY FROM THE UNIVERSE. THE REST IS THERE, BUT INVISIBLE TO OUR EYES.

SO HOW DO WE STUDY IT - IF WE CAN'T SEE IT?

BY USING SPECIAL INSTRUMENTS WHICH CAN - LIKE THE **SQUARE KILOMETRE ARRAY** WHICH COLLECTS INVISIBLE RADIO WAVES AND TURNS THEM INTO IMAGES.

WHAT? MAKING THE INVISIBLE, VISIBLE! THIS I HAVE TO SEE.



ACTIVITY: BREAKING VISIBLE LIGHT INTO ITS COLOURS

YOU WILL NEED:

- WIDE FLAT CONTAINER (E.G. LUNCH BOX OR ICE-CREAM TUB)
- WATER
- MIRROR
- WHITE PAPER
- SUNLIGHT

WHAT TO DO:

1 FILL YOUR CONTAINER ABOUT $\frac{3}{4}$ FULL WITH WATER. PLACE YOUR MIRROR IN THE WATER AT AN ANGLE.

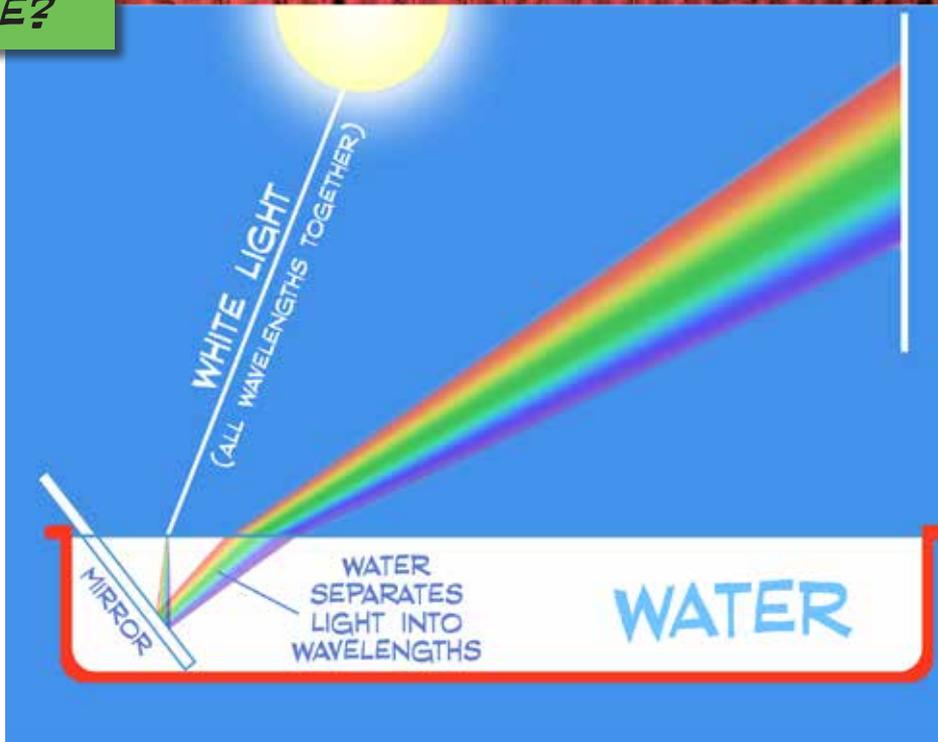
2 PLACE THE CONTAINER IN THE SUN, SO THAT THE SUN CAN SHINE ON THE PART OF THE MIRROR UNDER THE WATER.

3 HOLD THE PAPER WHERE THE SUNLIGHT IS REFLECTED FROM THE MIRROR. ADJUST THE ANGLE OF THE MIRROR UNTIL YOU GET A CLEAR SPECTRUM.

YOU COULD USE A STRONG TORCH INSTEAD OF SUNLIGHT.

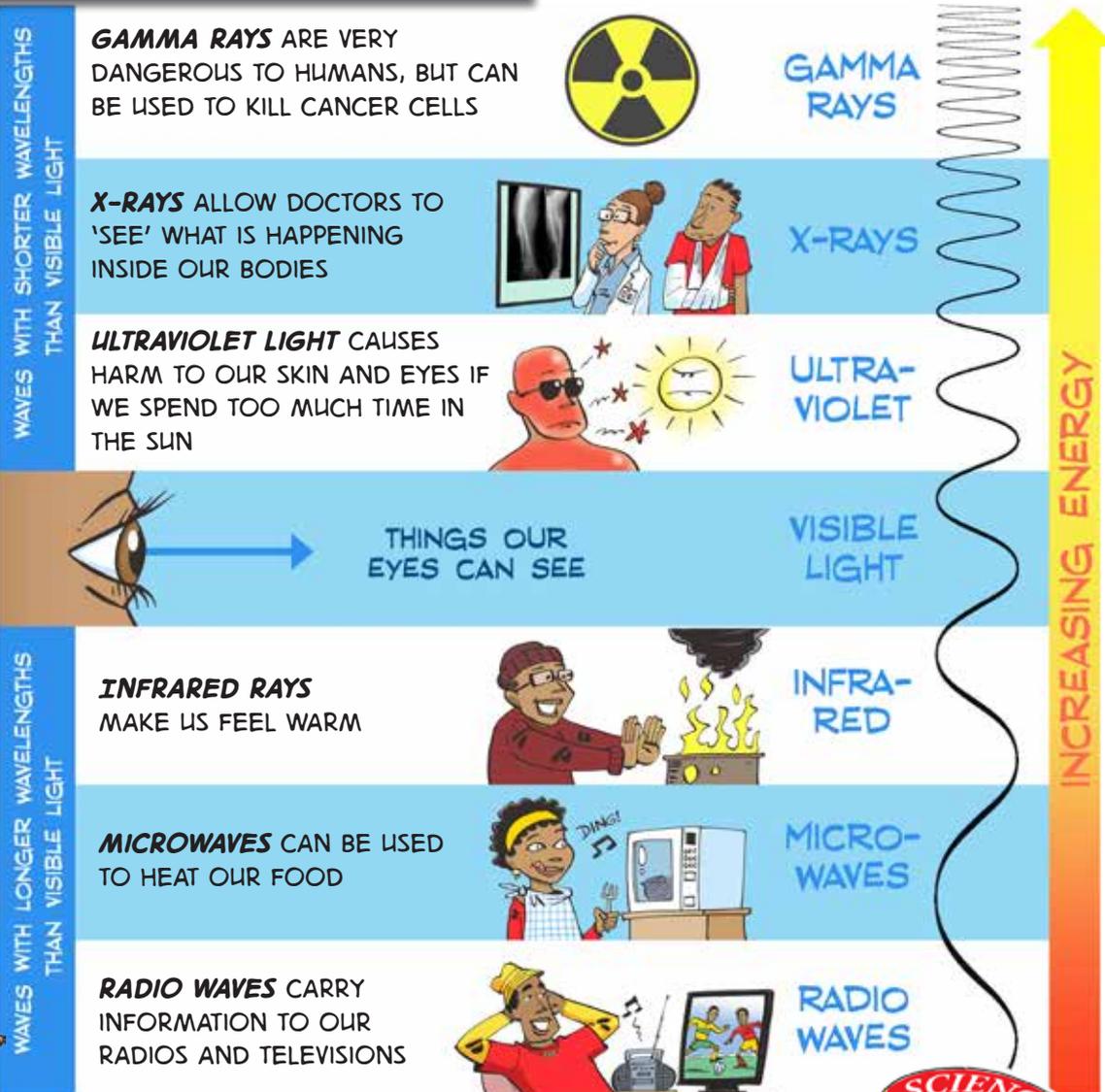
WHAT'S HAPPENING HERE?

- LIGHT FROM THE SUN IS MADE UP OF MANY WAVELENGTHS. SOME WAVELENGTHS ARE DETECTED BY OUR EYES AS DIFFERENT COLOURS.
- WHEN WE SEE ALL THESE WAVELENGTHS TOGETHER, THE LIGHT APPEARS WHITE.
- WHEN LIGHT ENTERS WATER AT AN ANGLE, IT IS BENT (REFRACTED). THE DIFFERENT WAVELENGTHS SPREAD OUT (DISPERSE) BECAUSE THEY ARE BENT THROUGH DIFFERENT ANGLES.
- EACH RAY OF LIGHT IS REFLECTED BY THE MIRROR. WHEN IT REACHES THE WATER SURFACE, IT IS BENT AGAIN AS IT LEAVES THE WATER.
- YOU CAN SEE THE SEPARATE COLOURS WHEN THE LIGHT SHINES ON THE PAPER.



THE ELECTROMAGNETIC SPECTRUM

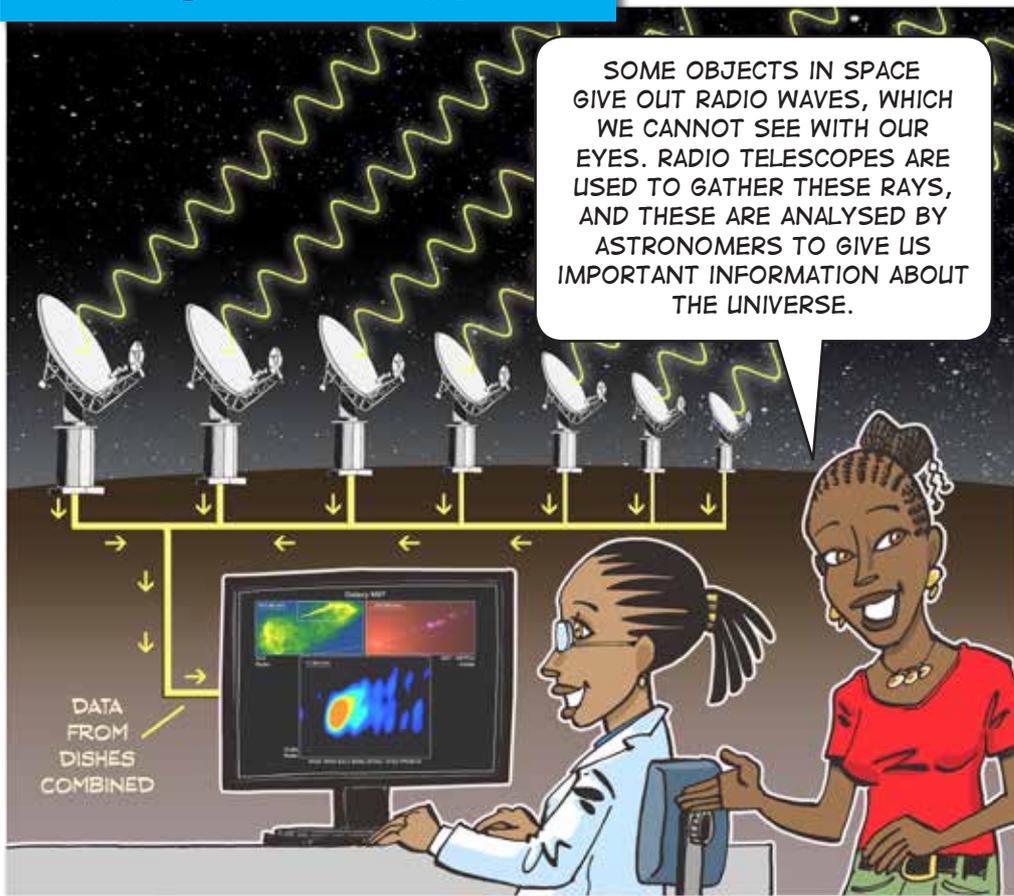
- OUR EYES CAN SEE ONLY A SMALL SECTION OF THE FULL RANGE OF WAVELENGTHS IN SUNLIGHT. THIS IS CALLED THE **VISIBLE LIGHT SPECTRUM**.
- THE FULL RANGE OF WAVES IN SUNLIGHT IS CALLED THE **ELECTROMAGNETIC SPECTRUM**.
- THE SHORTER THE WAVELENGTH, THE HIGHER THE ENERGY OF THE WAVES.



THE SKA TELESCOPE

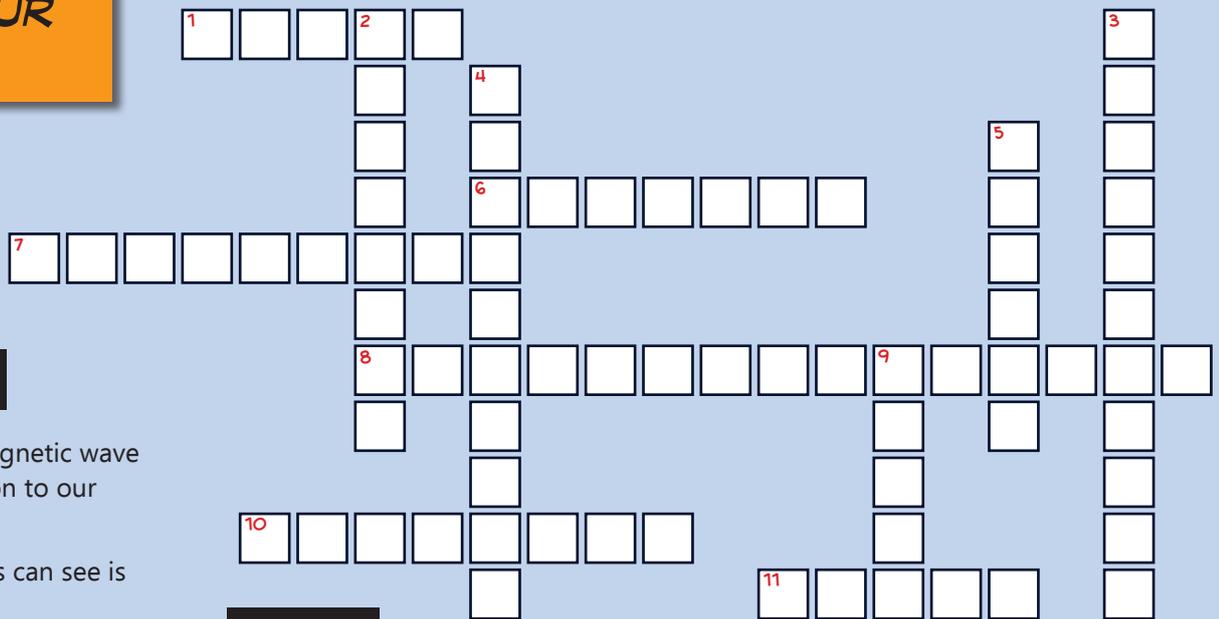
SOME OBJECTS IN SPACE GIVE OUT RADIO WAVES, WHICH WE CANNOT SEE WITH OUR EYES. RADIO TELESCOPES ARE USED TO GATHER THESE RAYS, AND THESE ARE ANALYSED BY ASTRONOMERS TO GIVE US IMPORTANT INFORMATION ABOUT THE UNIVERSE.

IN SOUTH AFRICA THE WORLD'S LARGEST RADIO TELESCOPE IS BEING BUILT, CALLED THE **SQUARE KILOMETRE ARRAY (SKA)**. THOUSANDS OF RADIO TELESCOPE DISHES WILL BE USED TO GATHER THE WAVES FROM SPACE. THE DISHES WILL BE ARRANGED IN A SPIRAL LAYOUT OVER THOUSANDS OF KILOMETRES ACROSS AFRICA. THE DOTS ON THIS MAP OF SOUTHERN AFRICA SHOW WHERE MOST OF THE DISHES WILL BE BUILT.



PUZZLE YOUR MIND!!!

COMPLETE THE CROSSWORD PUZZLE. ALL THE ANSWERS APPEAR IN THIS WORKSHEET.



ACROSS

- The type of electromagnetic wave that carries information to our televisions.
- The light that our eyes can see is called _____ light.
- The type of electromagnetic wave that is used to heat our food.
- The full range of waves in sunlight is called the _____ spectrum.
- When white light is split into its colours, this is called the visible light _____.
- _____ allow doctors to see an image of the inside of our bodies.

DOWN

- The type of electromagnetic wave that makes us feel warm.
- The type of electromagnetic wave that can cause harm to our skin.
- The smaller the _____ of light, the higher its energy.
- The Square Kilometre Array (SKA) uses thousands of radio telescope _____ to gather information from outer space.
- _____ rays can be used in medicine to kill cancer cells.



CAREERS:

- ASTRONOMER
- SYSTEM ENGINEER
- RADIOGRAPHER (MEDICAL IMAGING)



Sphesihle Makhathini is a Physics PhD student at Rhodes University, and his research is in the area of Astronomy and Space Science. He is working out the best way to position the SKA radio telescope dishes on the ground, so that they capture the most useful information for science.

CURRICULUM LINKS

- GRADE 8: **ENERGY & CHANGE** (VISIBLE LIGHT)
- GRADE 10: **WAVES, SOUND & LIGHT** (ELECTROMAGNETIC SPECTRUM)

THINK AND DISCUSS ...

WE USE **MICROWAVES** TO COOK FOOD. CELL PHONES USE MICROWAVES TO COMMUNICATE WITH CELL PHONE TOWERS. DO YOU THINK THE MICROWAVES CAN AFFECT YOUR HEALTH?



LINKING YOUR KNOWLEDGE

LOOK AT EACH OF THESE IMAGES:



Light dispersed by the shiny surface of a CD



White light dispersed into different colours by a prism



Rainbow

CAN YOU THINK OF OTHER SITUATIONS WHERE LIGHT IS SPLIT INTO THE COLOURS OF THE SPECTRUM?

ANSWERS: Across: 1. Radio 6. Visible 7. Microwave 8. Electromagnetic 10. Spectrum 11. X-rays
Down: 2. Infrared 3. Ultraviolet 4. Wavelength 5. Dishes 9. Gamma

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The Department of Science and Technology contributes to increased well-being and prosperity through science, technology and innovation. For more information visit: www.dst.gov.za

The SKA project is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. The Square Kilometre Array will be the world's largest and most sensitive radio telescope, about 50 times more sensitive, and up to 10 000 times faster (in terms of its survey speed) than the best radio telescopes of today. For more information visit: www.ska.ac.za



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