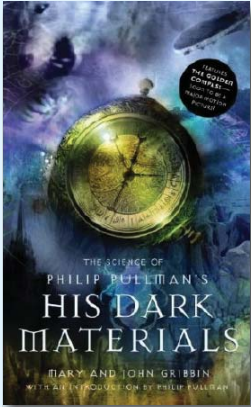


Big Bang Books



The Science of Philip Pullman's His Dark Materials

Mary and John Gribbin

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Summary

In Philip Pullman's trilogy, His Dark Materials, Lyra and Will go on a fantastical adventure. But many of the weird and wonderful things that they encounter, including the subtle knife, the amber spyglass and parallel universes, have a basis in real science. His Dark Materials is a story based on discovering hidden truths, which is exactly what science is.

Mary and John Gribbin are award-winning science writers and in The Science of Philip Pullman's His Dark Materials they reveal that far from simply being the product of Pullman's vivid imagination, the action throughout the trilogy can be explained by current science. But rather than spoiling the sense of mystery and other-worldliness created throughout the story, the revelations increase our wonder of the natural world. The dust in Lyra's world is the same as dark matter in ours; the ghostly northern lights are the result of charged particles interacting with the Earth's atmosphere; quantum entanglement could hold the key to developing an earthly lodestone resonator; and every time you make a decision, you could be creating another world.

Even if you haven't read the trilogy, the parallels between the story and cutting edge science are drawn with great clarity and Lyra and Will's adventures are used as starting points for exploring how our world works. Throughout the book, the Gribbins definitely prove that fact is weirder than fiction.

Some things to do

The northern lights are generated by charged particles in the atmosphere, but you can see for yourself the effect that electrons have by using them to bend water. And if you want to check that light is affected by all materials it travels through, not just Iceland Spar, have a go at making a sunset in a glass.

To make a sunset in a glass you will need:

A large clear, straight-sided glass

Water

Milk

Teaspoon

Torch

Darkened room

1. Fill the glass about $\frac{2}{3}$ full of water, add half a teaspoon of milk and stir.
2. In a darkened room, shine the torch down onto the top of the water whilst looking through the side of the glass. Can you see the blue colour?
3. Then try shining the torch through the side of the glass whilst looking through the opposite side. What colours can you see now?
4. Finally, shine the torch up through the bottom of the glass and peer down through the water. What a lovely sunset!
5. The milk particles in the water scatter the light from the torch like dust and molecules in the atmosphere scatter light from the sun. The further the light has to travel through the water, the more of the blue light has been scattered, leaving only red light for you to see. Just like at sunset.

To bend water you will need:

Nylon comb

Running water from a tap

1. Turn the tap on to give a very thin stream of water.
2. Run the comb through your hair several times.
3. Slowly bring the comb near water about 8-10 cm below the tap.
4. When the comb is about 3cm from the water it will bend towards the comb.
5. What happens? Objects can develop an electrical charge when rubbed together. Your comb becomes charged and attracts the water molecules in the stream.

Fascinating Physics Facts

There are some amazing facts in *The Science of His Dark Materials*. Some of them are written here, but can you find any more in the book? Which fact is the most amazing to you? Make a bookmark with your favourite fact on it.

- We're all made out of stardust.
- About 90% of the Universe is missing – we can't detect it but we know it must be there.
- If every star in the Milky Way was a grain of salt they would fill an Olympic sized swimming pool.
- Oxygen molecules in the air move at about 500 metres per second – 50 times faster than the fastest 100 metre sprinters.
- Light travels at 300,000,000 metres a second. This means it can travel a huge 9.5 million million kilometres in a year. The distance light can travel in a year is called a 'light year'. The nearest star to the Earth, apart from the Sun, is just over 4 light years away.
- The Earth is a big magnet and its influence, or field, extends out into space.
- Pi is an irrational number – if you write it as a decimal, it has no end. The current record for calculating the decimal digits of pi stands at over 1 trillion digits. But this level of accuracy isn't needed in everyday life. Calculating the Earth's radius using pi with just 10 decimal places gives an error of less than 0.2 mm.

Some things to talk about

Was it surprising to you that so many of the ideas in *His Dark Materials* have a basis in the real world?

Did finding out about the science in *His Dark Materials* change how you felt about the trilogy? If so, how?

His Dark Materials is all about uncovering hidden truth. What question about the world would you most like to find the answer to?

Is there anything in our world that we take for granted that you think Lyra and Will would find strange? How would you explain it to them?

Some more books to read

His Dark Materials trilogy: Northern Lights, The Subtle Knife and The Amber Spyglass
Philip Pullman. Scholastic.

Uncle Albert and the Quantum Quest *Russell Stannard*. ISBN 0571226809. Faber and Faber.

It's True! Space Turns You into Spaghetti *Heather Catchpole and Vanessa Woods*. ISBN 1741146259.
Allen & Unwin

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