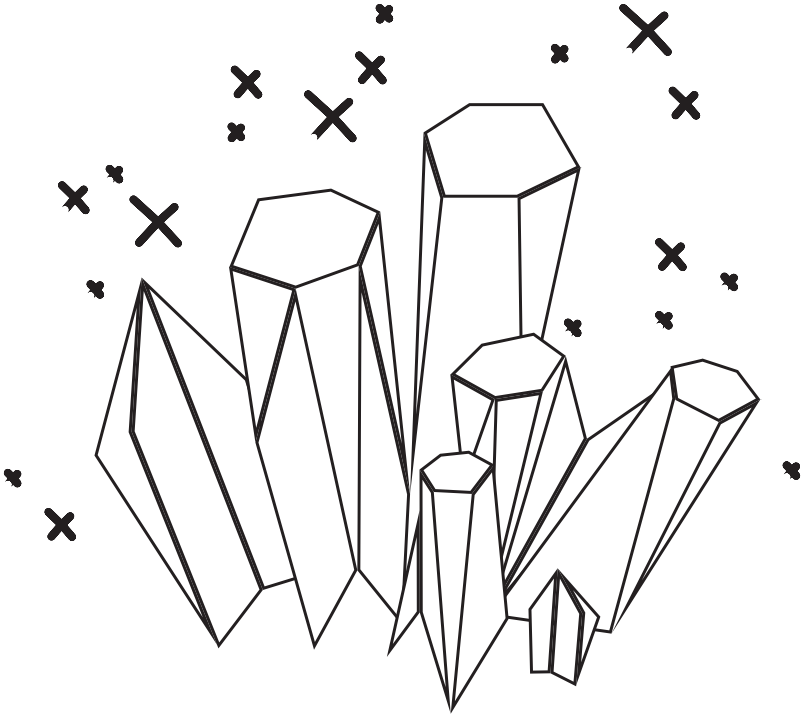
EUREKA
number
16
SNAIL MAIL



To:

IN THIS ISSUE...

MEET SIR CHARLES KAO

In the 1960s, most American homes had televisions, landline telephones were very common, and only a few researchers had begun to imagine an **internet**. Information was shared as electricity through very long copper cables. But a few people thought it might be possible to use light instead of electricity.

Sir Charles K Kao is the electrical engineer and physicist that discovered how to make **fiber optic cables**, which are cables of very thin and high quality glass. Light can move through fiber optic cables faster than electricity can move through copper wires. If all electronics upgraded to fiber optics, data would move really fast!

Fiber optic cables. Image from Wikimedia Commons.

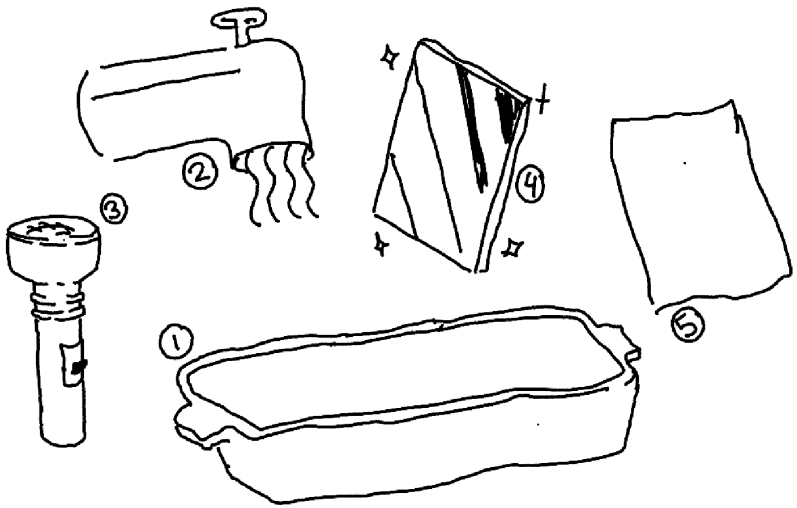
When Sir Kao published a paper with his discovery, he was invited to work at the ITT Lab in **Roanoke, Virginia**. He was originally from Shanghai, China, but went to school in England. Because the work he was doing was important to researchers in China, England, *and* the United States, he travelled a lot and had citizenship in all three countries. He was awarded a Nobel Prize in Physics in 2009, and Queen Elizabeth II knighted him in 2010 for his service in the communication world.

Sir Charles Kao, thank you for your hard work in the field of fiber optics! Many inventors today are inspired by your hard work and we'll be using fiber optic cables for many years into the future.

"Ideas do not always come in a flash, but by diligent trial-and-error experiments that take time and thought."
-Sir Charles K Kao (4 November 1933 – 23 September 2018)

DIY RAINBOWS

What if I told you that there was a way to see a rainbow without waiting for the perfect rain? That's right, it's totally possible! Get ready to do a little bit of science!



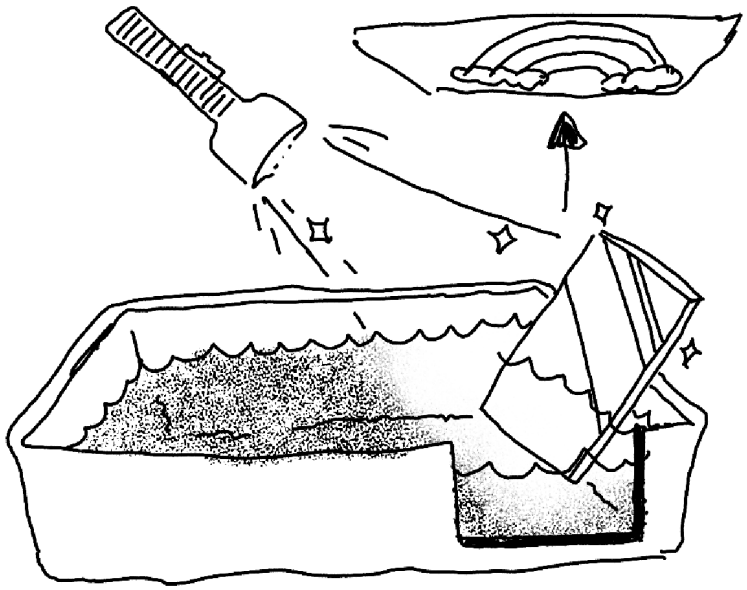
Here's what you're going to need:

A shallow pan,
Water,
A flashlight like the one on a phone, or the perfect beam of sunlight,
A mirror,
And a piece of white paper (This booklet!)

The setup is pretty simple:

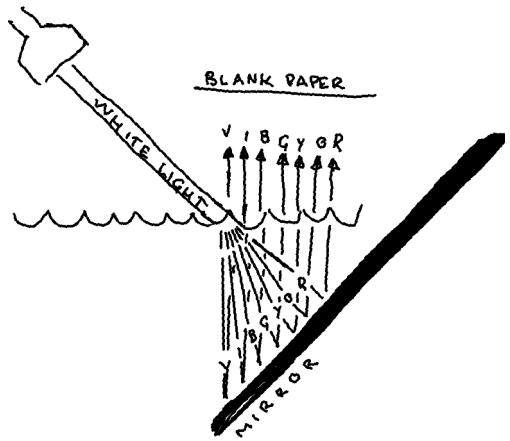
1. Fill the pan halfway full with water
2. Place the mirror the water at an angle,
3. Shine the light into the water so it hits the mirror
4. Fold this issue in half and hold the Rainbow Zone page above the mirror!

When everything is lined up correctly, you'll be able to project a rainbow onto this issue!



THE RAINBOW ZONE

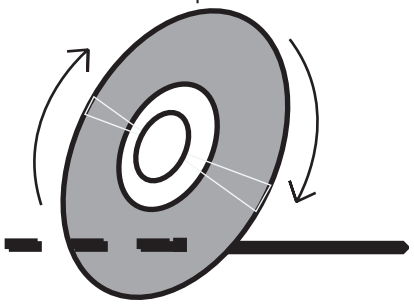
How is this happening?
Believe it or not, white light contains all the colors The surface of the water acts like a prism that splits up thewhite light from the flashlight into each individual color. The role of the mirror is to reflect each color back up so we can see it on the paper!



Catch your rainbow here by tracing it and filling in all of the colors you can see. What happens when you move the page?

CD, DVD, BLU-RAY OH MY!

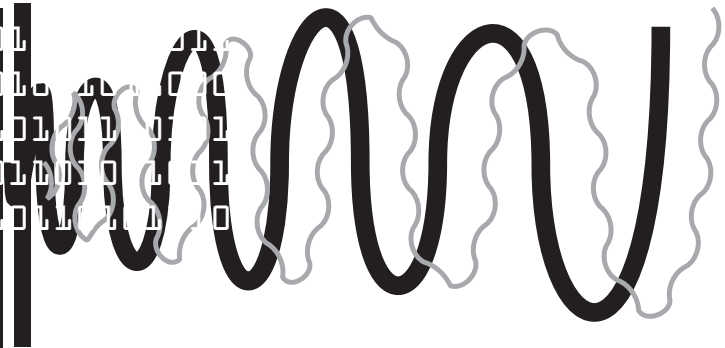
Inside every CD and DVD player there is a tiny laser that scans the reflective backing layer of the disc. The **laser beam scanner** (red light) shines on the back of the CD when it spins...



and reflects light back onto the **photocell** ...

which converts the disc information into **binary code**. ...

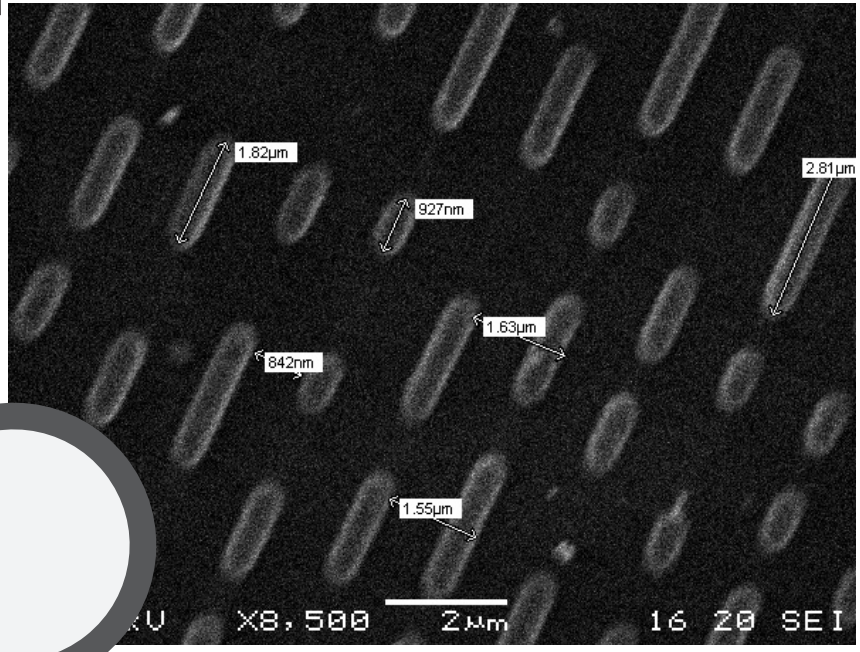
Within the disc reader there is an electronic circuit called the **digital to analog convertor (DAC)**. The DAC decodes these binary numbers and converts them back into a changing pattern of electric currents that the loudspeaker transforms into **sound**.



DID YOU KNOW?

When you put a CD (compact disk) or a DVD (digital versatile disk) under a microscope you can see the tiny grooves that the laser beam scanner reads. A **pit** represents a binary zero, and a **land** is a binary 1.

One laser is used to etch those marks, and a different kind of laser is used to read them!



A picture of a DVD under a microscope by user:Jduno on the Wikimedia Commons. JDuno says "The cd is upside down, so we see bump and not a hole."

SEE YOU NEXT MONTH!

Thank you for participating in this month's Snail Mail! Did you know you can sign up a friend for free? Tell us your favourite part and get involved with other Eureka programs! You can share your projects and drawings with us directly at: codeva.info/SubmitYourSnailMail

Sincerely Yours
The Snail Mail Team

Layout & Design:
Natasha Blush, Pepper Blush

Activity Contributors & Creative Consultants:
Thomas Brownell, Natasha Blush, Pepper Blush

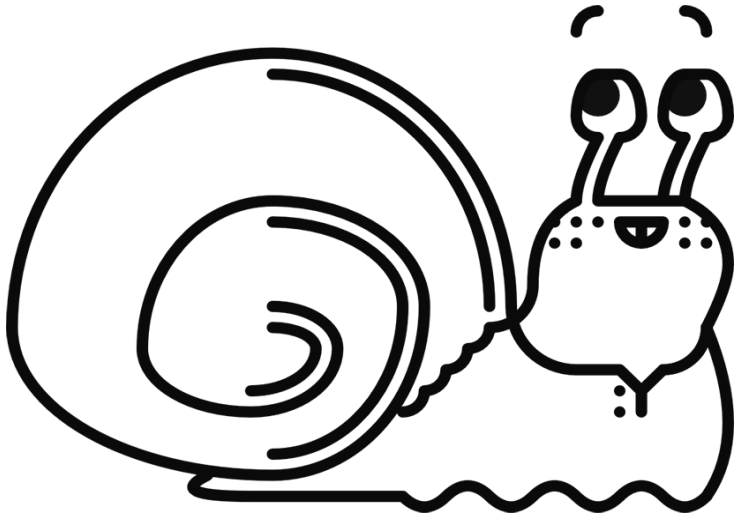
Logistics:
Affia Pollock, CJ Carnahan

Spanish Translators:
Daniel Ramirez

Editor & Proofreader:
Natasha Blush, Pepper Blush

Cover Art & Illustrations
Natasha Blush, Pepper Blush, Kathy Deloria

Enjoying Snail Mail?
Learn more about how we do it at:
CodeVA.info/ProjectSnailMail



RESOURCES

To keep up with what CodeVA and Eureka are doing and to see current class offerings, visit us at **CodeVirginia.org**

Computer Science Classes and Learning
adafruit - adafruit.com
hour of code - hourofcode.org
micro:bit - microbit.org

Art & Design
earsketch - earsketch.gatech.edu
gb studio - gbstudio.dev
makecode - makecode.com
piskelapp - piskelapp.com
scratch - scratch.mit.edu

Get Snail Mail shipped to your home, always 100% free. Sign yourself or a friend up at CodeVA.info/SnailMail

DID YOU KNOW?

The reason Blu-Ray got its name was because rather than using a red laser to read the disc information the Blu-Ray players use a blue light laser. The wavelength of blue light is significantly shorter (450 nanometers vs the 780 nanometers of red light) which make the discs able to store much more information and higher quality video while retaining the same size and shape of normal DVD's.

EUREKA WORKSHOP

CodeVA

CodeVA
300 E Broad St
Richmond, VA 23219