The Case of the Optical Fingerprint

by **Radha HS**

Playing Sherlock with lasers

Need a blood test? I, for one, hate them – tie tourniquet, rip syringe packet, poke needle, draw blood and wait for the report. Luckily for me, this procedure might soon become a once-upon-a-time relic. Instead, shining a laser on the crook of the arm will let us 'see' the levels of haemoglobin, sugar, or whatever else needs to be tested, almost instantly!

Light is a mysterious thing. Shine it on your hand in a dark room and you can see the hand. Shine a laser (also a type of light) on your hand and voila, you can 'see' inside it and right under your skin. No blood, no cuts and no needle. Like a pair of X-ray spectacles!

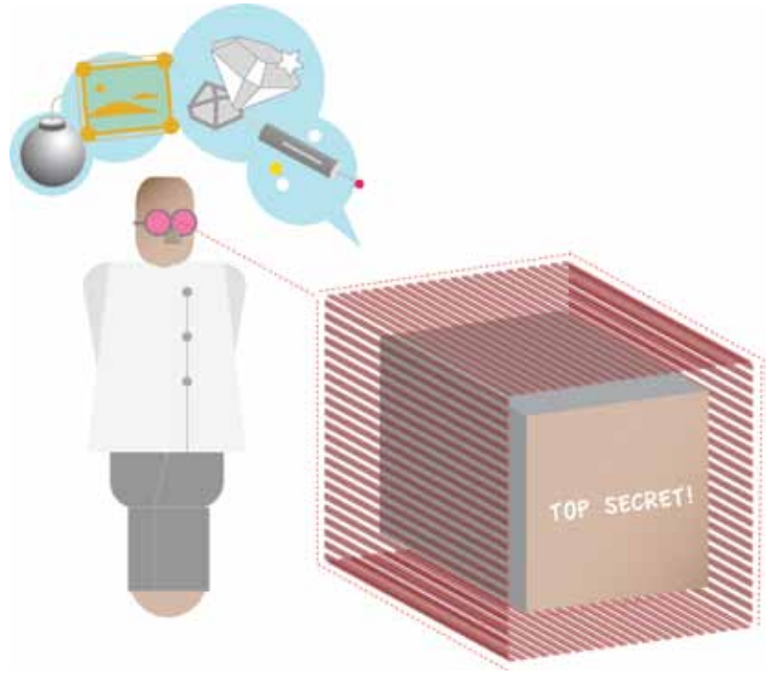
Artwork: Devashish Guruji

Mysteries of light

Have you watched laser displays? Lines of light or lasers of different colours are used to make interesting patterns. While multicoloured light particles make up regular light, lasers have identically-coloured light particles only. A red laser is made of red light particles, and a green laser, just green ones. That said lasers can come in infinite shades of red, green or any other colour.

Now, when a laser is passed through any material, be it bone, tissue, rock, gas or even a liquid, it bounces off the molecules in the material, and exits a bit differently from how it came in. For instance, a green laser might exit as a reddish band of colours or 'spectrum'. This is called the Raman Effect, named after the Indian scientist CV Raman, who proved that every spectrum is unique to the material it has passed through: this is called an optical fingerprint!

Quick Aside: So confident was Raman that his work on the scattering of light would fetch him the Nobel Prize for Physics in 1930, that he booked steamer tickets to Stockholm two months before he was informed that he had won!



Laser detectives

Police routinely compare fingerprints from a crime scene against thousands of fingerprints stored in a database. A match translates to a suspect. When a match isn't found, it could belong to a first-time criminal. The optical fingerprinting system works in the exact same way. An optical fingerprint is matched against existing optical fingerprints of various materials or chemicals in a database. A match identifies the material. When one isn't found, then the spectrum is analysed and added to the database for future reference.

In the past few years, crime scene investigators have been using portable equipment to shine a laser on the evidence in order to 'see' it (such as the age of a blood stain) *in situ,* or in its original location. Similarly, when ocean chemists want to study sediments on the ocean floor in situ, they equip a remotely-piloted submersible with something called a Raman-based probe. The sub sticks out the probe, sucks up water and then a laser helps 'see' the chemicals in it.

Scientists, chemists, art conservationists and biologists are all figuring out how to use optical fingerprinting to 'see' bombs in war zones, fake paintings, cancerous tissue, minerals in lunar rocks, fake medical drugs (through the packaging), pollutants in the air and even rotting teeth!

If you want to delve further into this mystery, look up these links:

Forensic investigation: *www.youtube.com/watch?v=QoyZNrIBviY&feature=relmfu*

A meeting of science and art: *www.youtube.com/watch?v=1UgnmVgWfOg*

If you'd like to know more about CV Raman, go to: *www.nobelprize.org/nobel_prizes/physics/laureates/1930/#*