Infrared: More than your eyes can see

Video transcript

MICHELLE THALLER: These days we're all familiar with night vision cameras, but how do these things work? How is it that you can just turn on this camera and see the invisible? Another use of night vision cameras that you might not be familiar with is there ability to see through smoke and dust. Fire departments commonly use cameras like these to find people trapped in smoky rooms or to pinpoint the exact location of forest fires through clouds of smoke.

So how do these things actually work? What are we really seeing when we look inside a night vision camera? Well, it may surprise you to learn that everything in the universe emits some kind of light it's just not the kind of like we're used to thinking about. The sun for example, our star, emits visible light. That's why our eyes evolved to detect that kind of light. But that's not the whole story.

I'm sure you are familiar with all the different kinds of visible light, all the colors from violet to red. But there are actually lots of other kinds of light that our eyes aren't sensitive to. The reason all the colors of light are different is that they have different energies. And what you see here is that the light has different wavelengths. The blue light, for example, has a higher energy, so it has a shorter wavelength. The red light, on the other hand, has less energy, so it has a longer wavelength.

But that's just the light, we see with our eyes, that's not all there is. The shortest wavelength light are gamma rays, which can have wavelengths smaller than an atom. The longest wavelengths are radio waves, which can have wavelengths larger than the entire earth.

The kind of light an object emits depends on its temperature. We're used to thinking of something hot giving off light. But it might surprise you to learn that objects that are cooler, like myself, give off a kind of light too. And that's what a night vision camera can pick up. That sort of light is called infrared light.

There world sure looks a lot different in infrared light. Remember that what you're actually seeing is temperature. Something that's warm is going to look bright in the infrared. And something that's cold looks dark. Ice-cream, blow dryer.

And infrared radiation is actually a measurement of temperature. Places on my face that are cold, like my nose, appear dark in infrared camera, because they're giving off less infrared radiation. And places that are warm, like my mouth, or the hair next to my head, are brighter, because they're warmer. You can even see my breath in my nose if you look carefully. And this is an ice cube.

And humans, of course, are not the only things that emit infrared light. What do you think you can learn about animals by observing them in the infrared? What about reptiles? Remember, they're cold blooded. Giraffes-- here's a Nubian ibex. What do you think horns look like in the infrared? Can you even see a gorilla in this picture?

If you look carefully, you'll notice you can still see the zebra's strips, even in the infrared. How about elephants? What about a polar bear? How about a rhinoceros? Check out the horns. A cat, notice the infrared footprints. Deer in the dark. A helicopter, notice the plume of heat from the engine. Earth movers with hot smoke stacks. A car engine, turning on and heating up.

Infrared light also has a lot of really interesting properties that visible light doesn't have. For example, it can often pass through things that block visible light entirely. I have a black plastic bag. And as you'll notice, you can't see through it at all. With but with an infrared camera, there's no problem.

But just like infrared light can penetrate some things that stop visible light, it also gets stopped by some things that let visible light through. For example, here's a piece of glass. And as you can see, none of the infrared gets through at all. If you haven't guessed, that's how the greenhouse effect works. Infrared light can't get through gases like water vapor in our atmosphere, which means that the heat is trapped and our planet is getting warmer.

So what am I, an astronomer, doing with an infrared camera? Well, if everyday objects look different through an infrared camera, you can bet objects in space do too. For example, here's an image of the constellation Orion, which you're probably familiar with in the night sky. But now, let's look at it through an infrared camera. Look how much you're missing.

Astronomers are also hoping to use infrared light to find planets around other stars. Planets don't give off any visible light of their own, making them nearly impossible to see close to a bright star. But in the infrared, planets give off their own light, making them much easier to find.

Astronomers will soon be able to use very sensitive infrared cameras on a new space telescope, the Space Infrared Telescope Facility, and it should give us a whole new perspective on the universe. At that point, we'll finally be getting a more complete view of the universe. Right now, we don't even know what we're going to discover. There are so many wonders out there. We'll finally be able to see more than our eyes can see.

[MUSIC PLAYING]