PROFESSOR: Invisible light. And Steve, can you say your definition again?

AUDIENCE: Light that cannot be detected by the human eye.

PROFESSOR: Light that cannot be detected by the human eye. OK, so just because we can't detect that light doesn't mean that there's no light there. So how do we detect these other kinds of light? I know that you guys read about visible light, you read about ultraviolet light, you read about X-ray light. And one thing that I'm going to say in this article, they go back and forth between light and radiation, electromagnetic radiation.

Whenever we talk about these different kinds of light, I always want you to call it "light." So it's radio light, or infrared light, X-ray light, gamma ray light, just to kind of keep things clear. Because any of the measurements that we did with light up until now, we measured its color, we measured its flux, we measured a flux of a certain kind of light, we measured luminosity. Now we can do all of those same measurements, but we can do them with different kinds of light.

We said before, if we had a detector, our detector could detect visible light. If we put a filter in front, and that was a red filter, we'd only let red light through. We'd only let photons that have an energy that we see or recognized as red through. So this is how it works for visible light.

In the case of other objects, in the case of other kinds of light, if we're looking at objects out in the solar system that are giving off, say, infrared light, if we looked with our detector, even if we took the red filter away, our detector is not going to be sensitive to that kind of light. So for us, we were able to look at visible light and we broke it up into red, green, and blue. When we're looking at other kinds of light, we can't use the same kind of detector. We can't use the same kind of camera. We have to have a camera that is sensitive to visible light, or X-ray light, or radio light.

And it's not that we have the same detector and we just put an infrared filter in front, or an ultraviolet filter in front, or an X-ray filter in front. We could do that if we had a detector that was sensitive to all of those kinds of light, but each different kind of light has its own special kind of detector. So we're going to say that invisible light, let's say, must be detected with a special detector for each type of light.

We're going to look at this a little bit more tomorrow, but we're going to look right now at invisible light that was detected by the Chandra X-ray Observatory. Tomorrow morning I'm going to have you read a little bit more about the Chandra X-ray Observatory so you can see the instrument itself. The Chandra X-ray Observatory detects x-rays. If we took a flashlight and we shined it inside the telescope, it wouldn't see anything. It's not sensitive to visible light.

We're also going to look today at images or data taken by the Hubble Space Telescope-- and that detects visible light, but they're slightly different. We're going to see that the Hubble Space Telescope, just like our other detectors, only detects the number of photons that come in. We have to put a filter in front if we want to learn about red, green, or blue light that's coming in.

AUDIENCE: But is it possible to do that? Can the Hubble telescope do that?

PROFESSOR: Can the Hubble Telescope make red, green and blue filtered images? Yeah. So in front of most visible light telescopes, there's a little wheel that has different filters on it, and it drops a red filter in front and then the camera takes a picture of whatever you're looking at. And then you drop a blue filter in front, you take another picture. You drop the green filter in front, you take another picture.

So even out there in outer space there's these filters that drop down in front of the images, and that's how we end up with these true color images from the Hubble Space Telescope. And you guys will see some of these in the press releases that you're using for your expert projects.

So we're going to talk a little bit tomorrow also about how the Chandra X-ray Observatory collects different information. It doesn't just collect a number of photons, it actually does collect information about the energy of each photon. So we don't have to use filters on the Chandra X-ray Observatory. But for right now what we're going to do, in the same way that you guys were looking at these images, these images are all of the Crab Nebula, but they're images of the Crab Nebula that were observed by different telescope.