PROFESSOR: In this demonstration, we're going to study the reflectivity of light at a dielectric interface or a piece of glass. The setup is here. We have a laser, a helium neon laser. He's the beam from the laser.

It will be reflected by a mirror, and then we pass it through a quarter wave plate. So the light here is circularly polarized, and then we pass the circularly polarized light through this polarizer. So that by varying the transmission axis of the polarizer, we can vary the state of polarization of the light coming through the polarizer, and the light goes onto a piece of glass here.

Then we have the transmitted light, which is here, falling on this circular screen, and the reflected light falls on the screen also. So by varying the angle of incidence here, we can vary the spot on the screen. First, we'll start with vertically polarized light or transverse electric by setting the polarizer here along the vertical axis, and the white arrow indicates vertical polarization.

So we'll start with a small angle of incidence close to zero, and then we'll slowly work up. And what you want to watch is, here, we go through 20 degrees, 30 degrees, or so on. What you see is that the intensity of the light increases as we approach 90 degrees.

We're here, 80, and then 90. And you see that the light gets pretty bright. Now we go back again. It is 50 degrees, 40 degrees, and so on all the way down to zero angle of incidence.

Now what I'm going to do is change the state of polarization to the horizontal one by changing the transmission axis of the polarizer. And then now, let's look at the reflectivity as a function of angle of incidence here, again, with polarization along the horizontal plane or p polarization. Let's see now what happens.

So we start, again, about 4%. Here's 10 degree marker, 20 degrees, 30, 40. Now you can see that the light is getting dimmer and dimmer. Here is 50, and here, we reach the Brewster angle, where the intensity is zero. And then here is 360 degrees, 70, 80. And you can see the light intensity is getting bigger, and bigger, and bigger.

In order to look at it a little bit better, let's dim the room lights and do the experiments again. We're going to start with vertical polarization, or s polarization, or if you wish, transverse electric. And then we'll start varying the angle of incidence from zero.

There is 10 degrees, 20, and you can see that the light intensity is increasing. Here's 30, 40, and you can see it's increasing nicely. 50 degrees, here is 60, 70. Now it's really getting bright, 80. And then as we approach 90, you can see that the angle, the reflected beam, is more intense than the transmitted beam.

And here, we are very close to 90. And then, again, you see the other spots due to multiple reflections. Let's go back now. Here we are. The intensity is going down. Here's the 60 degree marker, 50 degrees, 40, 30, and so on all the way to zero.

Now what I'll do, I'm going to change the polarization to horizontal polarization or p polarization. But just to make sure I have it right, I'm going to do a little check on the Brewster angle, and then we'll start again. So here now with this horizontal polarization, I'm going to now vary the angle of incidence as we watch this spot on the screen.

You can see the spots. The intensity is going down. Here's the 20 degree marker, 30, 40. And now, the spots are getting dimmer, even more, 50. And as we get close to the Brewster angle, it goes to zero at 56.5, then here at 60 degrees, 70 degrees.

Now it's picking up intensity fast, 80. And as it gets close to 90 degrees, intensity heads towards 100%, and suddenly, looks brighter than the transmit in intensity. Also, of course, you see the effect of multiple reflections, so let's go back. It's 80, 70, 60, getting nice and dim.

And at 56.5, it goes to zero and then picks up, again, at 50. So now, let's go back to the Brewster angle, where it's extinguished. But the light is pretty close to zero, and let me then change the polarization back to vertical. Here we are.

Go back to the vertical, and we see that the spot gets brighter and brighter. So here, it is with vertical polarization, and here is the intensity with horizontal polarization. In summary, we have shown how light is reflected at a dielectric interface or a piece of glass.

We've shown that for polarization in the vertical plane or s polarization, the reflectivity goes from about 4% for zero angle of incidence to 100% for 90 degree angle of incidence. In contrast, for horizontal polarization or p polarization, the reflectivity, again, starts at 4%, but goes down to zero at the Brewster angle. And in this case, for glass is 56.5 degrees and then goes rapidly up to 100% for 90 degree angle of incidence.