PROFESSOR: In this demonstration, we're going to study the interference of light. In particular, the interference of two beams of light. And we will use a simple Michelson interferometer to study the interference. And here it is.

Here we have a helium neon laser, and here is the beam from the laser being reflected by this mirror here, and then another mirror over here, into the Michelson interferometer. We have a 50-50 beam splitter, which reflects half the light into this mirror in this arm. Then the mirror reflects the light back through the beam splitter, again reflected by this mirror here into this lens, and then onto the screen. The second arm, we have the light transmitted through the beam splitter onto the mirror in the second arm. The mirror reflects light back to the beams splitter, which is then reflected here onto this mirror, through the lens, and onto the screen.

So now I'm going to cover up one of the mirrors or block one arm of the interferometer. And then, let's look at the screen now. And we'll see only the light from this arm.

Now, if I block the arm here and take the card away from this arm, now you'll see the beam from the arm over here. So in order to see interference, I'm going to lift this card so that both beams are superimposed. And then, as we see on the screen, we see the fringes as a result of the interference of the two beams, one coming from this arm and one coming from this arm.

You see that there is a very nice contrast between the bright and the dark parts of the fringe. And the contrast is where the information is. If you have no contrast at all, then essentially you have no no interference.

Now, I want to illustrate how sensitive this interferometer is. All I have to do is lean on the table here, and you can see I can make the fringes move due to a misalignment of the interferometer. Another way is by actually misaligning the interferometer by adjusting the alignment of this mirror here. You can see, every time I touch the mirror, there's shaking, because I'm disturbing the setup. But if I take my hand away, the stability is restored.

So again, I'm going to misalign the interferometer. And you can see that I can vary the spacing between the fringes, which is due to the misalignment. Also, you can see that if I can work hard enough, I can make the field almost dark by making the spacing between the fringes so large that-- here we are. You can see very nicely how it's going in and out, and I can press on the table to make the light go completely out and onto maximum value simply by leaning on the table. This means that the beams are practically superimposed almost exactly on each other.

Let me go again back to where I was with the original alignment and show you another way of altering the path difference. In this way, I want to do it in a controlled way by mounting this mirror here. If we can get a close-up at this mirror, we can see that this mirror is mounted on a piezoelectric crystal over here. And when I apply a voltage to the piezoelectric crystal, I can make the length of it change. Which means that this length of this arm will change, and then we'll see the fringes move.

So let's do it. Now, I'll connect my voltage source to the piezoelectric crystal. And then, now, if we can see the fringes, you can see they're pretty stable. And if I turn my voltage source, you can see that the fringes go backwards and forwards, because I'm applying a slowly varying sinusoidal voltage onto the piezoelectric crystal, which, in turn, is modulating the length of the arm of this interferometer.

So, in summary, we've seen how two beams of light interfere. We looked at the interference pattern. We looked at the contrast and the fringes. We looked at the spacing between fringes due to misalignment. And we also looked at how sensitive the setup is to very small perturbations of the order of wavelengths of light to the interferometer.