PROFESSOR: So 8.03 is the physics of vibrations and waves. It's the third course of physics. It is not a general Institute requirement, except of course, physics majors will have to take the course. We cover the traditional material that you find in all vibrations and waves-- coupled oscillators, resonance phenomenon, mechanical oscillations, electromagnetic oscillations. And over and above, I try wherever possible to make students see, also, through 8.03, the familiar world around them, at least the world that they have heard about.

I spend one whole lecture on musical instruments, which is a resonance phenomenon. I tell them why sunsets are red, and why the skies are blue-- which is an immediate consequence of Rayleigh scattering, which is part of 8.03. I talk to them about rainbows, about coronae, and about glories around airplanes.

Particularly rainbows can be completely understood in all detail, qualitatively and quantitatively, if you understand 8.03-- if you understand the basics of 8.03. We refer to that as Snell's law, but also the Fresnel equations. A combination of the two will tell you everything you want to know about rainbows.

And I always tell the students that looking at rainbows is very different than seeing rainbows. And indeed, I ask them a dozen questions about rainbows, the rainbows that they have seen so many times in their lives, and most of the students cannot even answer one of those questions. And I make them see the beauty of the rainbow, but it's the knowledge that is what I call the hidden beauty that makes it exciting. I also introduce neutron stars and black holes, and I talk about Big Bang cosmology because we cover Doppler shifts. So my goal is, wherever possible, to go the extra mile and make students see things that are often hidden in courses like this.

We evaluate the students through traditional exams. The lectures are given in the main lecture hall of MIT, and then the students meet in smaller groups with professors. We call those recitations, which is largely problem solving.

When I came on 8.03, on 8.03 I also had some kind of a contest. I showed them a picture that I took at DeCordova Museum in Lincoln in June of 2004. And it's a real picture. It's really interesting to look it up on the web. It's also on the OCW.

You see my shadow, and around my head are some remarkable colors. And the question was, what causes this? And it's not so easy to come up with the right solution.

It was also the astronomy picture of the day on, I think it was, September 13, 2004. And I received 3,000 answers from all over the world, but there were only 50 that had the basic idea correct. And only 5 of them had the real physics completely correct. And almost no students at MIT got a substantial amount of extra course credit, but since I promised course credit, depending upon at what level they were able to explain it, about a dozen got a little bit of course credit.

But I don't think there was one-- yeah, maybe one or two complete explanations. And I can't tell you what it is now because then I would give it away. The students who look at the website of OCW of 8.03 will see that picture, and I leave it up to them to send me email and tell me what they think it is.

But if they're smart, they can find, somewhere, the solutions because I think it was in December of 2004 that I gave the solutions to the astronomy picture of the day. And so they were made worldwide known, and so everyone who made the wrong guess could read the correct solution. It's a strange picture. It's a very interesting picture.

I don't think there's any difference between 8.01, 8.02, and 8.03 in depth. They're just different courses. They cover different materials.

However, since in 8.01 most lecturers will cover resonance phenomena, therefore it is natural to introduce musical instruments which are the result of resonances. Since in 8.03 resonance phenomenon are almost at the heart of the course-- so they are enormously covered to incredible depth, way more quantitatively than in 8.01-- the musical instruments come up, in a natural way, again. In 8.01, you are likely to cover-- you don't have to, but you're likely to cover-- the Doppler effect-- the famous effect that when a train approaches you, that the whistle has a higher pitch than when the train goes away from you. Well, we also cover that in 8.03, but at more depth.

And we cover not only Doppler shift for sound, but also Doppler shift for light. And that's where Big Bang cosmology comes in in a very natural way. So there are some overlaps, and it is interesting to select those overlap, particularly since those are the ones that appeal to the students a lot. When they learn about Big Bang cosmology, then they're sitting on the edge of their seats. And it's nice if you can do that both in 8.01, and you can do that also in 8.03.

And the same is true for red sunsets and rainbows. If you cover 8.02, electricity and magnetism, you come to the point that you want to know what light is doing in glass and in water. Well then, the rainbows are a very natural topic to choose. But when you later do 8.03, you go beyond that. Not only do you teach the students what happens with the light when it goes into a material-- it changes direction. We call that refraction-- but you go one step further.

You also make them calculate the light intensity changes, and that's what we call the Fresnel equations. And that they will not see in 8.02, but they will see it in 8.03. But yet you could still, doing both lectures at different levels, cover rainbows. And that's what students would love to hear about because they will see rainbows at least once or twice a month.

And once they have seen a lecture on rainbows by me, the rainbows will never be the same for them. They will always think of me whenever and wherever they are in the world when they see a rainbow. And that is what I mean when I say, I want to make them love physics and want to make them see through the equations.