

MITOCW | Optics: Optical spectrum analyzer | MIT Video Demonstrations in Lasers and Optics

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PROFESSOR: The confocal resonator that we've looked at has many uses, and we'll illustrate one of them right now. So far, the laser frequency going into the cavity was only one frequency. We only had one frequency coming out the laser, because we selected it by means of the polarizer. Since the laser oscillates at several frequencies, at least two, at different polarization, then, again, by rotating the polarizer, I can select the other frequencies.

So the cavity can be used as a spectrum analyzer. So if we look onto the scope, as I rotate the polarizer, you see that I can bring in other resonances. And these are not associated with transverse modes of the cavity, but they are associated with the frequencies of the laser.

So here we are. Here is when the laser is operating single frequency going into the cavity. Now, I rotate the polarizer, and I admit the other frequencies from the laser, which are different polarizations. So in this way, the confocal resonator can be used as a spectrum analyzer. Now, in practice, you have to be careful in selecting the free spectral range of the resonator of the confocal cavity, so that there's no confusion about the separations in the frequencies of the light source.

So here we are again. Here's when the laser single frequency going to the resonator. Here we have many frequencies. And if we had selected the free spectral range correctly, we would be able to measure exactly the spacing between the modes of the laser.

So then, in conclusion, the set of demonstrations, we've looked at the plane parallel cavity, we've looked at the condition under which the modes superimpose. It was very touchy-- very touchy alignment with the plane parallel cavity. Then we looked at the cavity with curved mirrors. And we saw lots of transverse modes if we don't have the length of the resonator adjusted suitably. We also found that when the length of the resonator was equal to the radius of curvature of the mirrors in this case, the confocal condition, we found that the modes coalesced into two residences. And, finally, we showed how such a focal resonator can be used to analyze the spectrum of a light source like this laser.