Experimental Physics - II
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Lecture - 27
Discussion on the angle of incidence and corresponding deviation of light through a prism and determination of the angle of minimum deviation for a given prism from the plot of the angle of incidence versus deviation

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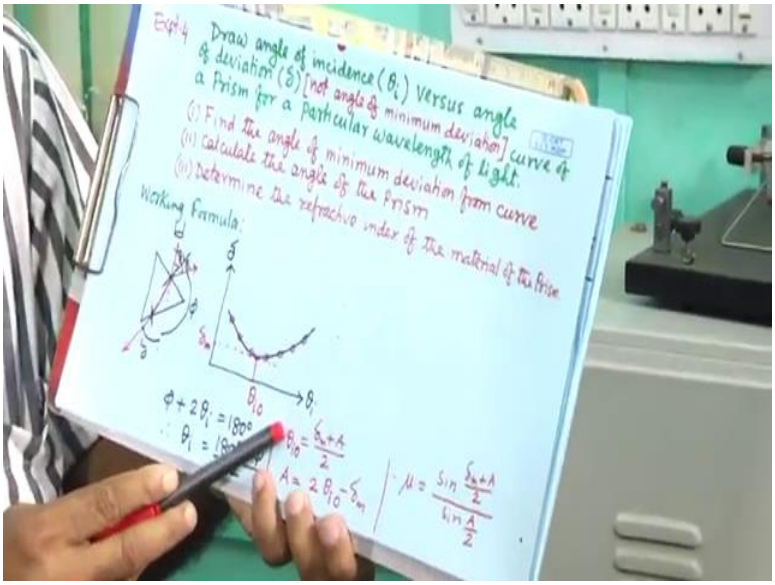

today we will demonstrate another experiment using the spectrometer and prism. this experiment is draw angle of incidence versus angle of deviation, not angle of minimum deviation; this curve of a prism for a particular wavelength of light. for a particular light means for a particular wavelength, if it falls on the prism then we will change the incident angle of the light on the prism and measure the deviation. Then we will plot deviation as a function of incident angle and get a curve.

we will get a curve like this; we will get a curve like this different deviation at different incident angle we will plot and get a curve like this and what is the aim of this experiment? Basically, from this experiment we can find out the angle of minimum deviation, then we can calculate the angle of prism Also we can determine the refractive index of the material of the prism first we have to do the experiment for getting deviation at different incident angle and then these different parameters we will find out from this curve

So obviously, you can see this deviation is minimum at this point; this corresponding this corresponding angle is here theta i 0 I have written. this is the this for these incident angle; this is the minimum deviation. Now, if you increase the angle; deviation is increased deviation is increased, if you decrease the angle also deviation increase Now so now, you know the minimum deviation for this prism for particular wavelength And the using this relation; using this relation that theta i 0 at which you are getting the minimum deviation that is equal to delta m, means minimum deviation plus angle of prism divided by 2

you know the theta i 0 and you know the delta m; you can find out the angle of prism. if you know the angle of prism and the minimum deviation; this refractive index you can calculate from using this formula. already we have done the experiment, how to measure the angle of prism, how to measure the minimum deviation this angle of prism without using this method one can separately one can find out the angle of prism also. And minimum deviation from this curve and get the calculate the refractive index of the material

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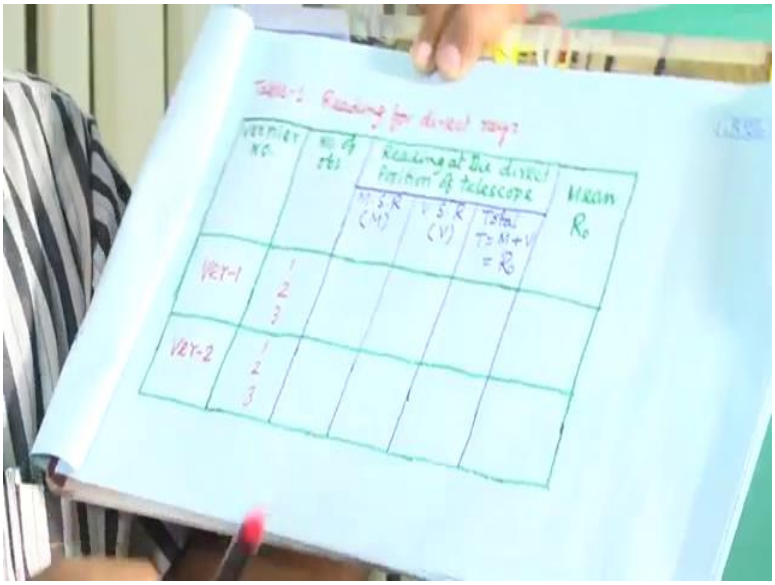

let us do the experiment, let us do the experiment. first reading for direct rays ok, reading for direct rays means this.

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this the collimator, this is the telescope. this set up is already it is in the condition of doing experiment means using the Schuster's method. we set it for parallel rays leveling and then for parallel rays whatever requirement before starting any experiment using the prism. that is done and how to do that we have showed you, explained you we will not repeat it. So now, reading for direct rays right means this is the source and this is the slit is here slit source is here.

from collimator parallel rays are coming and directly falling on the telescope. Now, I will set I will set the cross wire at the direct yes. this is the direct position of the telescope where the slit image coincides with the cross wire. I keep cross wire this way it's really crosses not in plus position cross way; this and this spectral lines are like this; spectral lines are like this. So now, what you have to do?

You have to so we have 2 Vernier: Vernier 1 and Vernier 2, now I will take reading from Vernier 1. main scale reading, how to take reading I explained then Vernier scale reading right and then total that we are telling R 0 or Vernier 1, similarly I will take reading from Vernier 2. right now, this reading I can show you or tell you; I have up to use I think one has to be careful is disturbed is disturbed. because my body touched the actually one should clamp it; one should clamp it.

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One should clamp it and then I will use this fine cross wire, but somehow it is not working, get some I understand. I have to disturb, yes. Now, I set at this position then I clamped the; I clamped the telescope, I cannot rotate only I can rotate using the using the this fine screw, but still it is not working ok; I think I have to some disturbance Yes, now it is working I think; first we have to take reading for direct rays

let us see the spectrometers; this spectrometer is set for the parallel rays how to get the parallel rays, how to level it so that we have discussed. that we have already met will not repeat that one. So now, first for direct reading we have to set this we have to bring this we have to bring this telescope parallel to the collimator parallel to the collimator yes. approximately I have set this cross wire to the spectral lines. So now, I will clamp I will clamp these telescope, I cannot rotate it Only using the fine screw I can rotate it ok, using the fine screw only I can rotate it

reading will change also. So now, using this fine screw I will set the spectral lines exactly at the cross point of the cross wire, yes, I have set it Now, we have to take reading of the Vernier 1 and Vernier 2 for this position. I can use light for see this reading and also, I will use the this one. reading I can see this is approximately 350 and then 0, it is 50 49 48 around 347 as the 347 and one as to find out the Vernier. I am not going to do that and also other one we have to take reading.

it is around I can see 0 is of Vernier is meeting it is around 170. that is around 350 and this is around 170 of course, so it will be close to that; now you can see the reading difference between these two is 180. 350 and 170, it is not exactly 350, it is the 347 and then some Vernier constant one have to find out and this is 170 I think around 173 or like this after taking reading just cross check, that it should be approximately 180 difference ok, take the Vernier reading carefully. using this magnifying glass, one has to see carefully; one should need very good eyes

find out I am not going to do that. write the reading; write the reading Vernier main scale reading for Vernier 1 and then Vernier scale reading And Vernier constant is 20 second, the same spectrometer we are using earlier we have shown that it is 20 second this total reading R 0 that is M plus V So now, for Vernier 2 also write down, now just we take generally observation 1 2 3 this means. again, you just adjust you just adjust and try to make more accurate and again take reading. this way 3 times and we take reading; that is to minimize the experimental error we take more observation

whatever the reading on one should note down. this way this for direct reading of the telescope for direct reading of the telescope; that means, this telescope is parallel to the collimator, direct light from the collimator is falling on the telescope. And we are seeing the image and what is the position of the telescope at direct ray that we find out in this method. one has to calculate the mean R 0 for Vernier 1 and mean R 0 for Vernier 2

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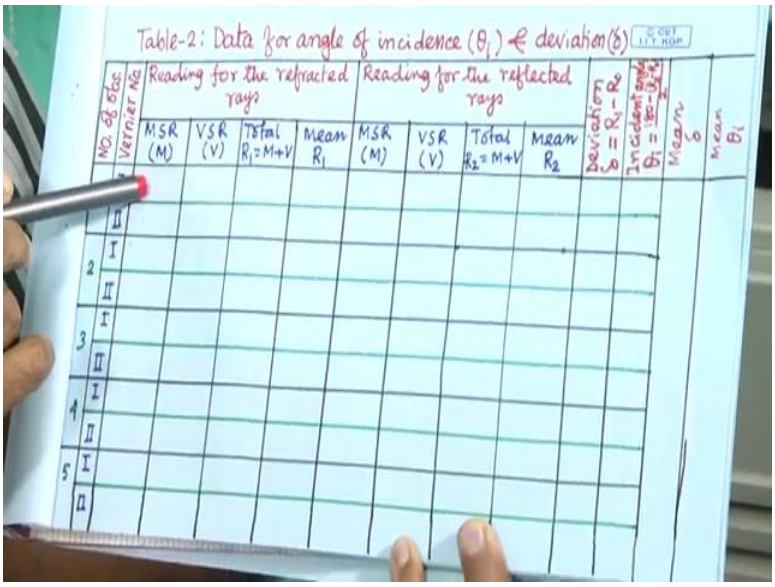

Now, next what we have to do? Next we will take data, we will take data for angle of incidence and deviation ok; remember this is not minimum deviation is the deviation the table here I have written number of observation, I have written number of observation Then Vernier numbers, then reading for the refracted rays; again this main scale reading, Vernier scale reading, total reading. We will take observation ok, 1 to 3 observation, 3 observation or at least 2 observation you should take, then we find out mean that is we have given R 1 for refracted rays R 1.

then next reading for the reflect reflected rays reflected rays. here also main scale reading, Vernier scale reading, total this R 2 then mean R 2. for these each one for different angle of incident angle that. this is for this each observation is for each incident angle ok, for observation 1 this for a particular incident angle for that angle; for that angle we will set the telescope at the refracted rays, take the reading for Vernier I and Vernier II. We set the telescope at the reflected rays, take the reading for Vernier I and Vernier II

this deviation then deviation is that refracted rays; refracted rays R 1, position of the refracted rays R 1 minus the direct R 0 is the position of the direct rays from direct rays whatever the refracted rays emergent rays; that angle is deviation and incident angle; incident angle. that is theta I; that is theta i equal to 180 minus; 180 minus this R 2 means refracted rays position of the refracted rays minus the position of the direct rays

So that means, this from direct rays from direct rays what is the; what is the angle of the refracted rays? that is the deviation from direct rays what is the angle of what is the angle of the reflected rays? that is R 2 minus R 0. from 180 from here you can see from 180 minus of this angle. here you can see this is the direct rays, this is the direct rays, this is the direct rays that R 0 reading is R 0 that we have taken, now this is the; this is the refracted rays So now, this reading we are taking that is R 1. R 1 minus R 0 that is delta and reading of the reflected rays that is R 2. this is the reflected rays R 2.

So now, direct one R 0 ok; R 2 minus R 0 is this angle these angle So now, this the normal; theta i; theta i is the incident angle. refracted angle also theta i. this angle is 2 theta i and this angle is here I have written phi R 2 minus R 0 these angle this angle along this straight line this is total angle is 180. 180 minus this phi means R 2 minus R 0 that will be equal 2 theta i. theta i will be 180 minus this R 2 minus R 0 divide by 2 that

is what here I have written, that is what here we have written theta i equal to 180 minus R 2 minus R 0 divide by 2 we have to take reading for refracted rays, we have to take reading for reflected rays

Then we can get the deviation for a particular for the incident angle ok, then we will find out the mean deviation and mean theta i that you will get for each for each think I should just. for a particular angle this is the angle ok, this is the angle. And what is the deviation? will get from yes this is the mean deviation, and this is the mean theta i and then this then I will change the rotate the prism slightly. I will get this for second position of the prism mean for second for next incident angle of the prism ok, I will take second observation.

again, I have to take for Vernier I and Vernier II reading for reflected rays and refracted rays that way we will continue this 5 6 7 observation for different position of the prism means for different incident angle I will stop here.

Thank you.