Experimental Physics - II
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Lecture - 28
Determination of the angle of minimum deviation from (i-D) plot for a given prism and hence to determine the refractive index of the given prism

today we will demonstrate another experiment using the spectrometer and prism.

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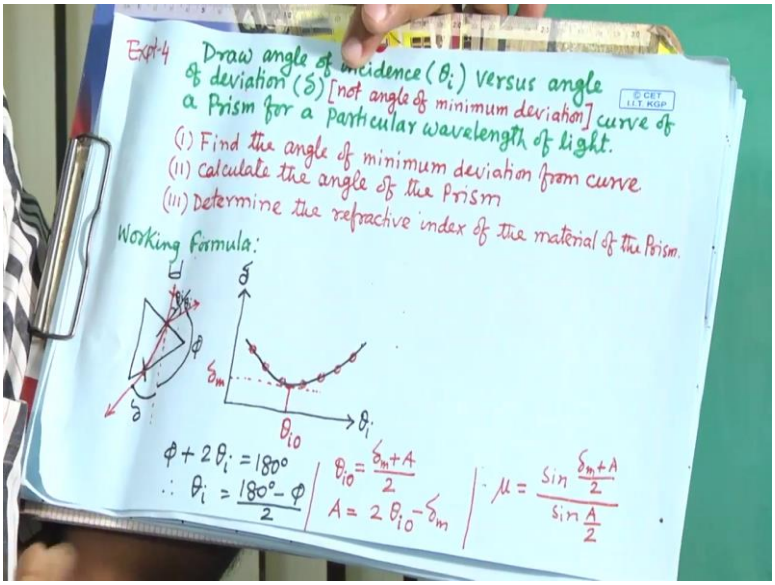

this experiment is draw angle of incidence versus angle of deviation; not angle of minimum deviation; this curve of a prism for a particular wavelength of light.

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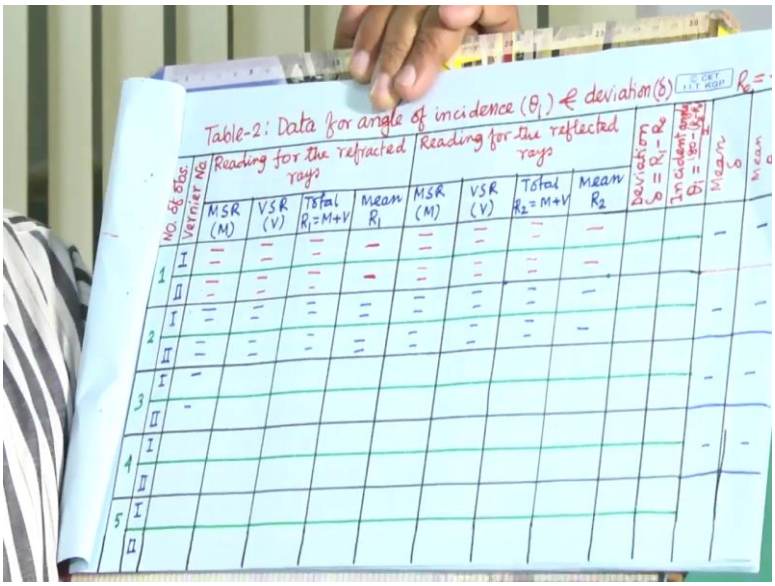

let me show you the how to do that.

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now I have to put the prism. this is for a particular; this experiment is for a particular for a particular wavelength. here this is the; this source, that source we have taken that is the sodium source. here yellow light we are getting sodium D-line. it has a particular wavelength.

Now, I will put the prism on the prism table. this apex of the prism will coincide the center of the center of the prism table So; now, first what we will do; we will set it for

minimum deviation we will set it for minimum deviation. for minimum deviation I have to find out. I will unlock this telescope and move other direction. let me; remember that we have taken the direct reading. this Vernier should not disturbed, it should not rotate; that means this prism table with Vernier we cannot rotate we should not rotate.

when reading will change. we should lock this prism table; we should lock prism table we should lock this prism table. I have locked it and this telescope that is the unlock. I can move telescope, but I cannot move the Vernier prism table attached with Vernier. So; prism table have two option you can rotate the prism table with Vernier.

if you rotate this one. that I have locked and without rotating the Vernier only prism table I can rotate, I can rotate you can see this is fixed we will use this one We will rotate the prism table without rotating the Vernier because that I cannot do since I have taken the reading, direct reading. only reading will change due to the motion rotation of the telescope. with reference to a particular position of the Vernier scale.

I cannot disrupt the Vernier scale Now I will set this prism for minimum deviation position. I have to set for minimum deviation position. this is the base this is the base light is falling on this refracting surface. light will fall on it and then one part of the light will be refracted, and this refracted rays always goes towards the bend towards the base. for refracted rays I have to look towards the base I have to look towards the base yes and try to I will try to find out the minimum deviation position, I rotate prisms; yes. I got the image; yes.

this is the minimum deviation position, if I rotate this way it is going right side, if I rotate this way then it is at minimum deviation position, if I continue the rotation. it is also going this way

I set it at approximately at minimum deviation position then I will bring the telescope at this position, I will bring the telescope at this position and yes. So; this I have set at the minimum deviation position what I have set the at minimum deviation position; actually what we will do; this is the incident angle for minimum deviation position I will not take this reading say because minimum deviation position I want to find out from the curve. what I will do; I will I will. what about the incident angle what about the incident angle? For this incident angle approximately, this is the minimum deviation position I can take

this reading, or I may not take this reading what I will do; I will increase. this is the normal you know.

now and this is the incident rays that is fixed, the normal is this It is attached with the prism this normal Now if I rotate this towards; if I rotate towards anticlockwise. what will happen? this normal will go towards the incident rays towards the incident rays so; that means, angle of the incidence will decrease and if I rotate clockwise from this position if I rotate clockwise from this position then what will happen then what will happen? The angle; this normal will rotate this way angle of incidence will increase. what I will do? approximately I will from this position I will increase or decrease by 2 degree approximately 2-3 degree

for both position I will take the reading, then again, I will further I will increase by 4 degree in both side 6 degree from both side, 8 degree from both side. that way this is the approximate rotation incident angle for different position incident angle that we will calculate. we will look for each step of angle, we will look for the refracted rays and reflected rays, we take the reading and then we will get the deviation and incident angle.

this way one can do or what we can do other way. this is the minimum deviation position approximately. now, I will decrease the; I will decrease the; decrease I will decrease the angle approximately by say some 10 degree also. and then; that means, I will I will take the incident angle some small value of incident angle, from there step by step I will increase the incident angle then I will pause the minimum position and then further I will increase.

I will increase the incident angle and take the reading. I think I will take I will decrease the incident angle by say 10 degree approximately. this is the normal. I have to rotate anticlockwise and I will look I will look at the; I will change and look at the look at the reflected rays because I should not lose this one, I am changing the angle; yes, as per as possible. Yes, that is the maximum change I can do because after that it is going out of the view maximum up to this I could do

now this is the minimum incident angle ah. I will start experimenting from this position. I will take the telescope now at this point, yes, I can see. I will fix the telescope, I think it is; I am facing difficult this to slightly it is a fixing slightly tricky. yes; I will tighten it I

will tighten this telescope. Now I will use this fine screw to make the spectral line coincide to the cross of the cross wire

what is this position? For a particular incident angle incident angle what is the incident angle I do not know but starting from the minimum deviation I have kept at present I have kept the incident angle small incident angle. this by starting point and then I will increase the incident angle step by step and do the experiment.

for different incident angle I will take the; I will note down the deviation now, this is; obviously, refracted rays this is obviously, refracted rays. according to this one. I set a particular incident angle approximate angle for that. reading for the refracted rays reading for the refracted rays. I have to take main scale reading Vernier scale reading total.

two three observation at least two observation one should take. what I will do? for this refracted rays I have to take the reading of the Vernier one, I am not taking reading. I will note down I will note down. for Vernier 1 main scale reading and then Vernier scale reading then total I will note down

Similarly, for venire 2 I have to take reading. for Vernier 2 I have to take reading. I will note down Then again just you try to set again you try to set more accurately possible just and then again take the second times this reading second times this reading for Vernier 1 and Vernier 2 for Vernier 1 find out the mean R 1 and for Vernier 2 find out the mean R 1

now, I have to take reading for the; for this; for this incident; for this incident angle, I have to take reading for the reflected rays now reflected rays. this the refracting surface. one part is refracted, and another part is reflected. I have to look for reflected rays.

with weird eyes first I should see the yes that is the base. I; this the minimum angle as I told. it is almost it will be close to the normal to the; yes, I can see it will be close to the normal to the prism; prism means on this phase. I can see from here. I will unlock this telescope, then move with weird eye I have seen now I will place it here I will place it here yes.

then I will lock to the telescope, I will lock to the telescope; where is this; yes, I will lock to the telescope. then I will use fine screw I will use fine screw and set at the cross position cross wire yes, I have set

this the position for the refracted reflected rays now, I will take reading for Vernier 1. I will take reading for Vernier 2 then I will note down I will note down for Vernier 1 for Vernier 2 I will note down the reading Then you take the second time just again try to adjust and get better position coinciding with the cross wire take the second set and find out the mean.

this is R 2 now from here you can calculate this you can fill up the later on this R 2 and R 0 direct reading, R 0 from the table 1 from table 1. whatever the R 0 you should I think note down somewhere R 0 equal to note down somewhere here

you take R 0 and minus from R 1 minus from R 2 and then here 180 minus that R 2 minus R 0 divide by 2 that will be the. then you are getting accurate incident angle and for that what is the deviation you are getting this is for a deviation for a one incident angle now I will change the incident angle in which direction I will go?

I kept this incident angle as the at smaller angle Now from here I will increase the incident angle means I have to all the time I have to rotate because this is the normal. I rotate clockwise. normal we will come this way.

this angle we will increase because this direct this incident rays is fixed; I am rotating the prism table by approximately 2 degree say that I can do because I should not disturb the disturb the Vernier. only I have to rotate the; this table what I will do. I will look at the refracted rays then I will not; it will not be missing.

I am now increasing the incident angle approximately 2 degree say; yes, I have change it. Now I will repeat the measurement, I have to unlock the telescope I have to unlock the telescope; I will take the telescope at refracted rays yes it is at the refracted rays I will locked it, I will use the fine screw take the reading for Vernier 1 and Vernier 2 for refracted rays take the reading for Vernier 1 and Vernier 2; again take the second times repeat

Then I have to go for the reading for the reflected rays, unlock it, go here and check and check the reflected one oh I have to look it's; the yes, I can see now yes, I set it here Locked it use the this screw fine screw to find movement of the telescope, take the reading take the reading for second incident angle take the reading for reflected rays same way you take the reading for Vernier 1 and Vernier 2 then second times you take second times you takes and then find out the mean value

this way you continue for now again I will change now again I will change the incident angle increase; I will increase the incident angle by approximately two more yes

Repeat the experiment for refracted rays and reflected rays take the reading take the reading take the reading complete it, then again I will change further 2 degree yes take for refracted rays and reflected rays the reading then I will continuing the change; yes, I have change again repeat it, then I will change now it is started to reverse. Now reflected refracted one start to reverse means I am approximately at the position of the minimum deviation I will change it is now moving this other way

now this angle is higher is greater than the angle of the of the minimum deviation position incident angle repeat the experiment for refracted rays reflected rays you take the reading, then I will continue for second position not second position for second higher angle from the minimum deviation position. this way at least 4-5 reading you take then I will go for next step take the reflected take the reflected take the refracted and reflected one

this way you take as much as possible you can For this position again repeat the experiment then this position again you repeat the experiment then this position again you repeat the experiment, then this position; yes, it is the output of the fill I cannot go up to this. up to this I can.

you can take at least 3-4 reading at the smaller angle of the angle at minimum deviation and 6-7 reading at the higher angle then the minimum deviation position. complete this table, calculate the minimum deviation calculate the minimum deviation yes.

here you are getting for you are getting for Vernier 1 and Vernier 2 deviation from Vernier 1 deviation from Vernier 2 incident angle also from Vernier 1 and Vernier 2.

here you are taking this reading will this come same similar. mean of these two you are taking here.

for a particular angle you are getting what this angle you are getting mean deviation, for this angle you are getting minimum deviation, for this angle you are getting. this way you take at least 10 reading. Now here next they will for drawing graph.

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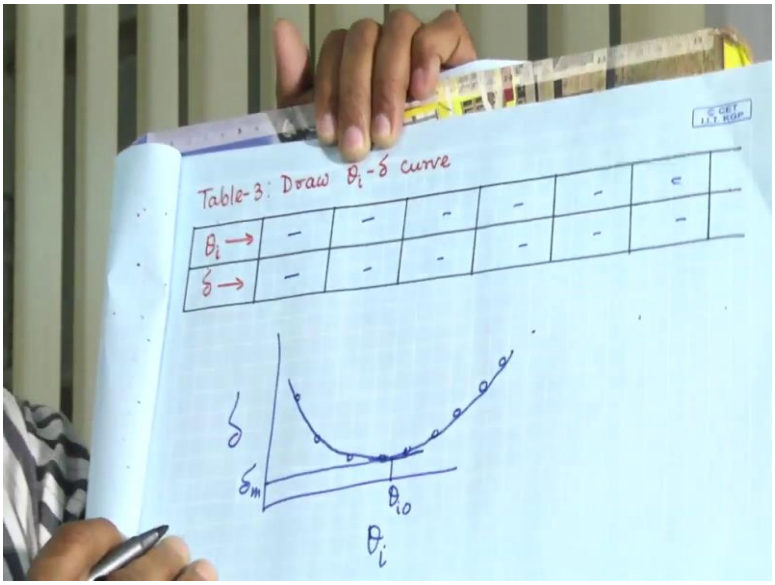

Next, they will for drawing graph. from this table 2. you have you know the incident angle and then the corresponding deviation it is not minimum deviation. you just note down them here note down them here

Now, your task is to draw. this is the incident angle theta I and this is the deviation So; you plot it for; it is the smaller angle as I told then I increase the angle rotating the prism you will get this type of data this type of data you will get and you connect them. Actually, you should not connect you should draw a smooth curve

this is your delta means deviation versus incident angle curve now, from there you can find out the just this is the minimum deviation, this is the minimum deviation you draw a line. this will be minimum deviation and corresponding angle will be say theta i 0

if i; if you get theta i 0. as I showed you that you can calculate the you can calculate the angle of prism, you can calculate the angle of prism using this one 2 theta i 0 minus delta m or you can find out the angle of the prism just doing the experiment how that already I

explained. this apex you have to put towards the collimator and this base just opposite now reflected from this phase and reflected rays from this other phase.

take reading moving the telescope take reading for this both reflected rays and half of it wherever the angle you will get difference half of it is the angle of prism that way also you can find out A and then you calculate the corresponding refractive index because del m and a is known to you and you calculate the refractive index using this formula

this is a very nice experiment and how to find out the refractive index using the delta theta i curve. for; this is another way to find out the refractive index of the material of the prism for a particular wavelength. Here this refractive index for sodium D-line wavelength is 5893 angstrom I will stop here.

Thank you.