Experimental Physics - II
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Lecture - 51
Expt. For Brewster angle

we will demonstrate the Brewster's verification of Brewster's law and measurement of the refractive index of the material of glass slab of prism whatever, we will use for reflection.

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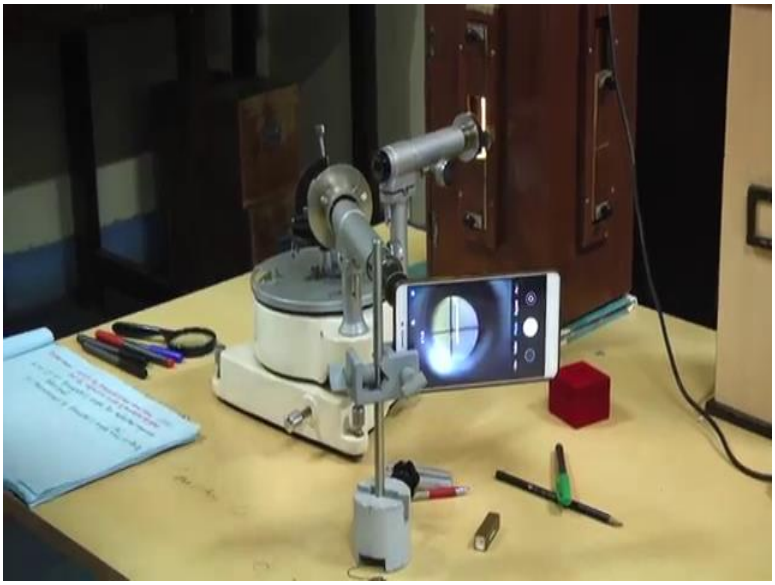

this is the, you have seen this spectrometer earlier also. this is the prism spectrometer. this we have used sodium light source, this is the collimators, this is the prism table, and this is the telescope, we have leveled it, mechanical level using the spirit level and then optical leveling, after that we have put the prism here. this one surface refracting surface this is apex angle a b c.

a c this face refracting face, we are we are using as a reflecting surface. this reflecting surface; this reflecting surface we are using for reflection of incident light on it, this also telescope as well as this collimator are set or the parallel rays, because for before doing any experiment, we have to make ready this spectrometers. this we can start from here for this experiment that this parallel rays are coming and falling on the prism, this

surface. Here, we are not using this one as a prism here, just we are using as a reflecting surface,

this is the surface lighter of falling on it and then it is reflected, what I told for a particular incident angle I will catch the reflected rays and then this reflected rays are polarized or not that I want to check. I have to use a polarizer as a analyzer. this is the polarizer as a analyzer we have set, this is the eye piece and other end of the telescope, we have set a polarizer, it is inside you cannot see from this side. these here, there is a polarizer actually. this one is polarizer of I think (Refer Time: 03:53) there I can show you, this, I think yes.

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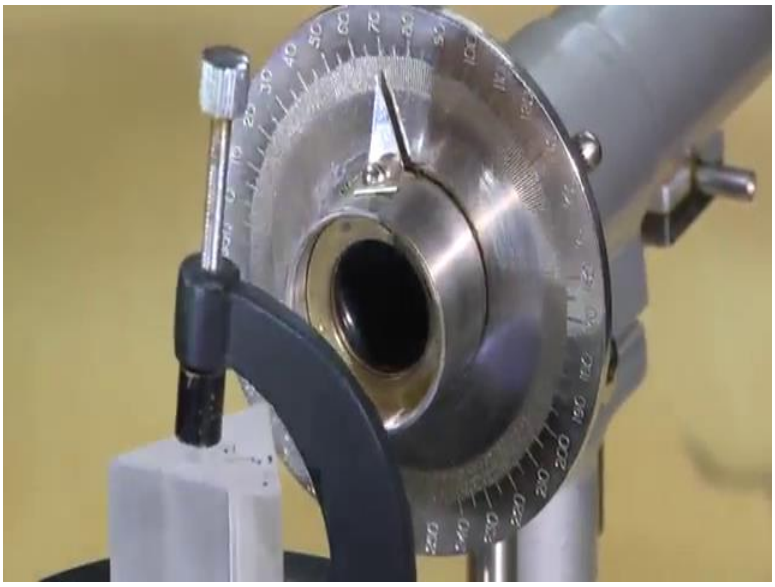

polarizer this angle also you can find out there is a scale and inside this there is a polarizer, inside there is a polarizer, this polarizer actually you can rotate the polarizer, you can rotate the polarizer see this, I am rotating the polarizer as I told for a one complete rotation of the polarizer I should get extension of the reflected rays means; I should not get the reflected rays, then I can say that is these reflected rays whatever I am getting that is the polarized rays,

at present I have set at Brewster's angle, I will demonstrate you first this that change of intensity of the reflected rays and then I will disturb it and show you that for any other reflection angle of reflection will not get this extinction of reflected light,

I think of, I will show you; I think we have to set the camera mobile camera to show you, yes. put theirs in eye piece position put the yes. I think we light these (Refer Time: 05:54) yeah, I will keep in other position yes, on mobile screen ok, we are using camera of the mobile, we focus the we are seeing the cross wire and on the plane of the cross wire, this image of the slit we are seeing. this image we are seeing is the nothing, but refracted rays, we are seeing the refracted rays this image formed due to the refracted rays.

Now, I am changing the angle of the polarizer means, optics axis is rotating then what is happening just check, I am changing intensity is you see is decreasing; intensity is decreasing, intensity decreasing now, intensity 0, ok no reflected light. I am continuing the continuing the rotation again it appears it become maximum, you see it become maximum; this become maximum then still I am continuing.

I will get another position in a complete rotation, I will get two position for complete extinction of light, yes this is another position. If I continue the rotation carefully, I have to do, again, it appears, it appears, it appears, it becoming you see maximum, this is the complete one rotation. I am getting twice maximum and twice 0, So; that means, this incident angle reflecting angle of reflection is set at Brewster's angle,

now I have to take reading of this I am not going to take, because I am old person, I feel difficult to see. it is more or less I can say that this; this 0 and this 0. this reading is 3; this is 340, this is 350, this 340 and then I can say 1 1 2 yes. I think it is around 342; this angle is around 342, it looks to me 342,

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approximately I am taking this reading 342. other one also you should take other one also you should take, ok whatever reading any way. this other one it is 162 it is a 162, then I will take the direct reading, but before taking direct reading I would like to show you that if I just change the incident angle, then the light reflecting light is coming that light should not be polarized, when I will rotate; when I will rotate the polarizer, I should not get the complete extinction of the light,

now, what I will do? I will just change the; I will just change the angle of, I will change the angle of; so, this I will I think increase the angle. I will increase the angle. I am not changing the reading. I will increase the angle by this, I have changed the angle by this. Now, I have to find out; I think, I have to find out the angle of this reflecting light I have to catch, I have to lose it. I have to catch reflecting one, I think I have to go the other direction, because I have to increase this time; no, I have to, I got it. I got it yes, I got it. we will set the camera, and we will set the camera.

now it is not at Brewster's angle. let us set the camera, mobile camera and get (Refer Time: 12:40) reflected rays on the, now, this is the, you can see this is the reflected rays I have changed the, I have taken different incident angle, it is not Brewster's angle, now, I will rotate the polarizer then you see this how this intensity of this image is changing. I am rotating, I am rotating, I am rotating, I am rotating. it is decrease, it become

minimum, but not 0, then rotating continuing this rotation, then it is decreasing. Now, at this position it is become minimum, but not 0, sorry, not 0, it is partially polarized,

it is partially polarized, it is not completely polarized, because it is a angle is, it is nearer out this I have not changed much near out the Brewster's angle. this is the; what you have to do you have to change the incident angle and then do the complete rotation. See whether you are getting; I am getting this position. Now, I have to; what I have to do? I have to change it from this angle I have to change I will increase and see whether any improvement means whether this minimum we are getting almost 0 or we are not getting this minima, this less intensity compared to the earlier one.

depending on that I will change the angle in opposite direction, or I will change the angle continuing the same direction, that way from one angle in which way if you go you are getting the improvement. that way you will find out the correct angle, incident angle that is Brewster's angle. my reading was of 342 and 162 the other side, because I have not disturbed anything. I will take now direct reading; I will take now, direct reading. I will remove this, remove this sorry.

no; probably I have not changed the hopefully, I have not change. It is very is I should not change this one, because I should not change the ok, that is I think may not be (Refer Time: 16:12) take out, take out this one, I have removed the prism. during using the prism, one has to be really careful this, because this prism table is attached with this Vernier scale. this scale should not, should not rotate then you will not get the correct reading. it is a, so I will take; hopefully yes, I think luckily it is tightened. I will take the direct reading; I will take the direct reading yes, only problem, when I stood this their reading, so this cross wire position was not one side with this so fine.

I think approximately I am taking. this is the position of direct. what is the reading of this one? If I see it is 40, it is 50. 41 42, it is the 42 ok, it is the 42 and approximately, tell this 42; 42 point something. my angle will be my angle will be here I can calculate these actual that reading or on table itself I can.

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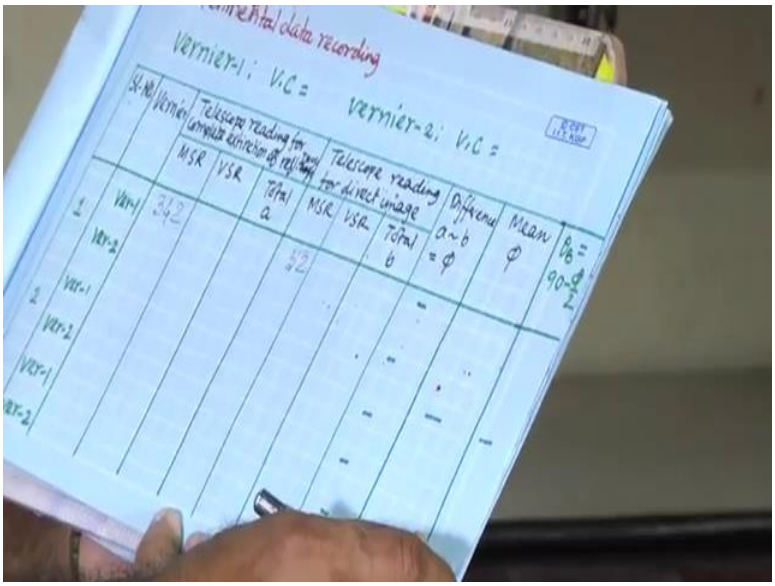

this is the rough calculation I am doing, this main scale reading earlier, it was 342 probably, I forgot 342 and now, I got how much 52, around this is 52, I have not taken this Vernier scale, it is of rough estimation,

in this case this angle so 342 after that it is it will go to the 360 and there it is 52. actually, your calculation will be; your calculation should be this angle your angle 2 theta b, sorry it is not 2 theta b, this phi where is that; where I discuss, ok here.

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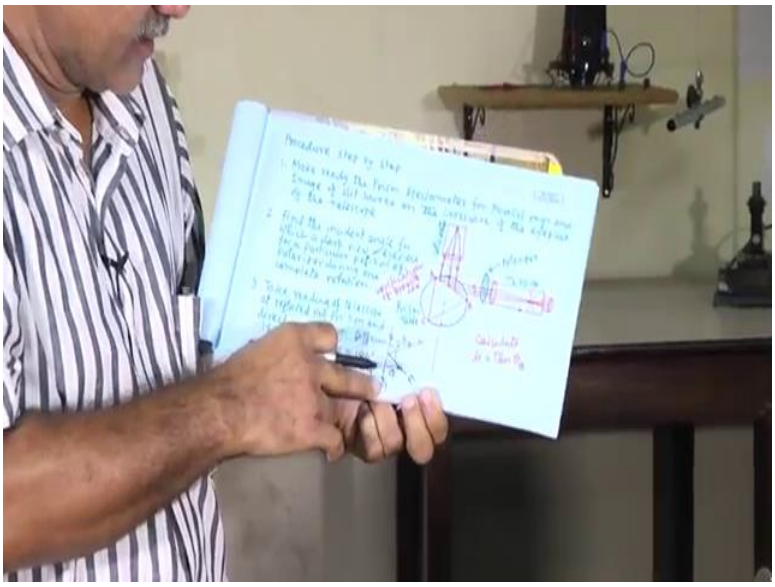

this phi is you are getting; this phi we are getting, how much phi we are getting? 342.

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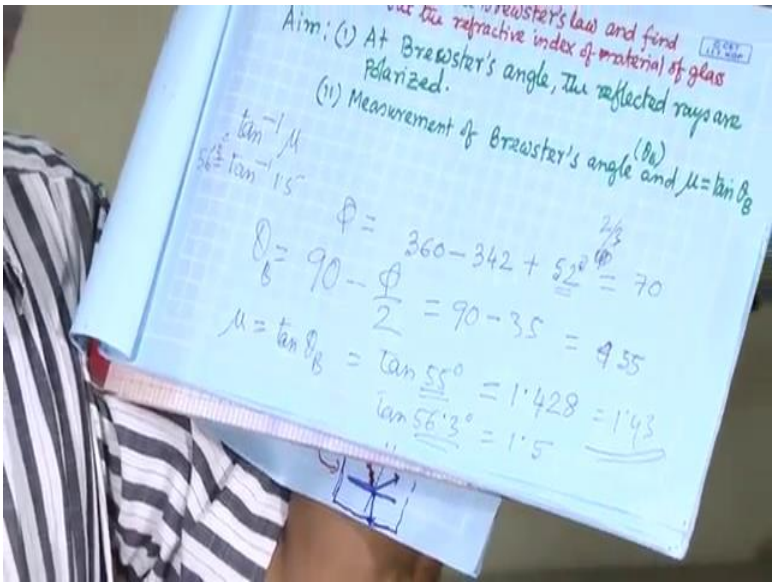

Here, I can calculate 360 as I told you how to calculate that one 360 minus 342 plus 52, it is how much it is coming? This 18 plus 52 70, it is coming around 70, that is phi; that is phi 90 minus 5 by 2 that is theta B, 90 minus 35 it is 70, this 35, then you are getting around 45; no 55, you are getting around 55 that is the theta B, Now, you calculate tan theta B that will be the mu value for glass can you calculate tan.

Student: 55.

Tan 55 degree, what is the tan value? Tan 55 degree; yeah, tell me this, what is the value? It should be in degree.

Student: 1.428.

1 point.

Student: 428.

428, it is a 1.40, for glass it is 1.5. these are just rough calculation. this we are very close to the actually, this reading just roughly I have taken, for 155 so tan inverse; tan inverse mu, if mu is 1.5; tan inverse 1.5, what is the value in degree?

Student: 1 point tan of 1 (Refer time: 22:29).

Tan inverse.

Student: 56.

50.

Student: 6 degree; 56.3.

56.3.

Student: Degree

Ok, degree how it comes?

Student: (Refer Time: 22:46).

No, you are telling tan 56; you will tan 56 point.

Student: 3.

3 degree will be.

Student: 1.5.

1.5.

Student: Yeah.

Ok you can see this how sensitive, this value you can see how sensitive this value. when it is 55, we are getting 1.428, when it is 56.3 just difference 1.3 so then it is you are getting correct result 1.5. when I was taking this reading this 52 actually, this was 52, I can 52 degree and I can say this it was almost 40 I think two-third degree. It was two-third degree accurately, if you take so it was more so it will be more this roughly, I have taken you know.

Student: (Refer Time: 23:53).

if you take accurately this reading. it is a 55 degree approximately, I have taken at accurate angle will be 56.3, if you take reading more observation and correctly, if you note down the reading from both Vernier, you will get the correct result, I got approximately this result and this result is very-very sensitive to the angle you see just I showed you this difference angle difference for correct result and the result I got. this

result I got, because I have taken the reading, just rough reading, no Vernier, reading etcetera, just to show you the calculation approximately,

this is a very nice experiment just simply you put the prism your spectrometer is ready you put the prism, this you angle the change, you catch the reflected one and see this one and then rotate the polarizer and see whether you are getting 0 intensity or not, If not then again you change the angle this side check it if improve, then continue change. that way you find out this incident angle for which you will get the extinction of the light means no light; (Refer Time: 25:38) light you will get for a rotation of the polarizer, That means, this incident, that reflected light is polarized, is completely polarized and for that whatever incident angle that is called a Brewster's angle.

that Brewster's angle this reading and this direct reading if you note down and then you can calculate Brewster's angle from Brewster's angle you can calculate the mu, this very nice experiment; actually, this polarization, this is the realization of polarization one can realize very easily and this series, this is the very brilliant idea of Brewster's you know this. It is a so simple method one can produce the plane polarized light based on the reflection, I will stop here.

Thank you for your attention.