

Experimental Physics - II
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Lecture – 46
Plane transmission grating (contd.)

Today, I will discuss about the grating diffraction experiment and also, I will demonstrate the grating diffraction experiment.

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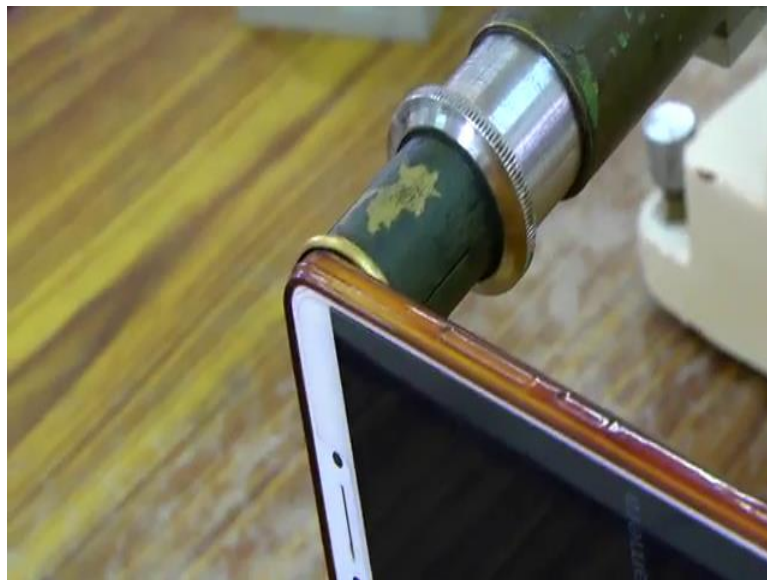
Now, I will show the experiment, so this is the experimental setup for diffraction grating. here this already we have set, and I will show you first the spectra, this is a mercury source, and this is the spectrometer. this collimator is giving us the parallel rays because we have set for parallel rays using the Struthers method and this is the grating this part is grating. light is coming falling on the grating, so we set it for normal condition,

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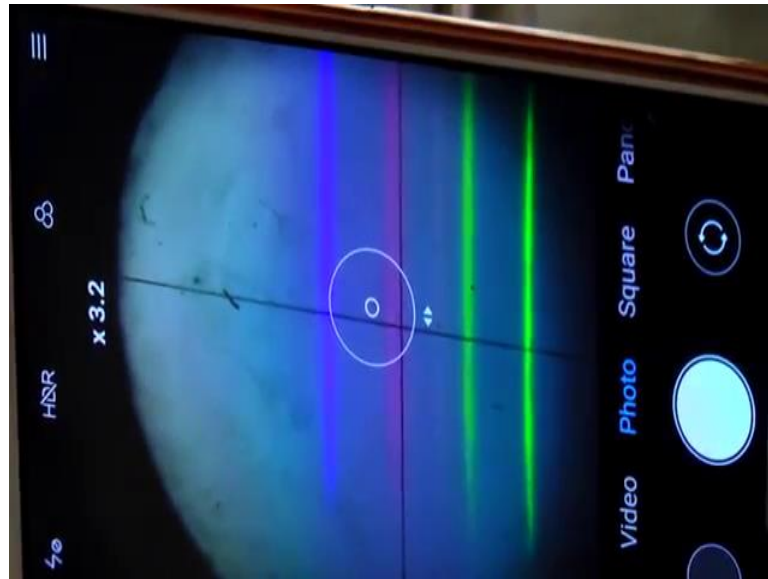
now light is falling normally on it, normally on this grating and then it is refracted different colors will be diffracted for different order.

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now this is the telescope ok, two telescope we are seeing the spectra. here in camera mobile camera we will show this spectra and then I will disturb and try to explain in detail because, before disturbing let me show you this spectra we have save for it because this time taking.

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I think, if I just let me so how I think this is fine. this is here we were seeing this first order spectral lines first order fringe and now in that fringe there are difference spectral lines, as I wrote that blue then green then some yellow then here red then some orange color is there, but prominent is, this four color you know this it is towards violet. this is the first orders and second order started here you see this one we are seeing second order here.

if I rotate these telescope, I will go towards the second order I am rotating ok, you can see the I am going towards the second order, I am going towards the second order I have to shift the camera slightly. it is the slightly difficult to adjust yes yeah, it is setting camera it takes slightly. I have go out from the range, I have to come here and so see the let me rotate more a side this was the first orders, Now, I am trying to catch the second order I am oh other side I have to do no, I am trying to catch the second order,

If I go other side what happens yes, I am going to other sides. I have to move the this one also yes, I think I have to move more, I have to move more, I have to move more no I think I should I will try the other side I think I got it. But somehow so slightly bigger screen would be better yes bigger screen would be better and yes.

I am getting first order nicely, but I am facing difficult to catch the second order. But I will try to show you; oh, it is going off I am always coming back to the first order oh, I have to go in opposite direction we have been has to be; we have been has to be in same

direction. I think he can try to set it for second order with the second order. yes, this is the second order, if I see now separation of this so these this four colors in camera it is not very prominent, but through this telescope directly you can see very nice intensity. there are these four colors there are four colors for second order, so this just different order you will see for different color it is a prominently it has come

yes; so, you can move now what you have to do we have to move these telescope and said the crosswire for a different color and take the reading from Vernier, for different order first order second order starting from this side extremely as I mentioned extremely left. it should set and then take reading and then move in the same direction set another one take reading vernier 1 and vernier 2 and then go for the next one. this way in camera is the difficult so because I have to adjust camera all the time. whatever I showed you here so this fringe this is the second order and you can get the first order, if you; I think if you move this way. If I move this way again, I am trying but I will not do that ok, because it is a time taking anyway.

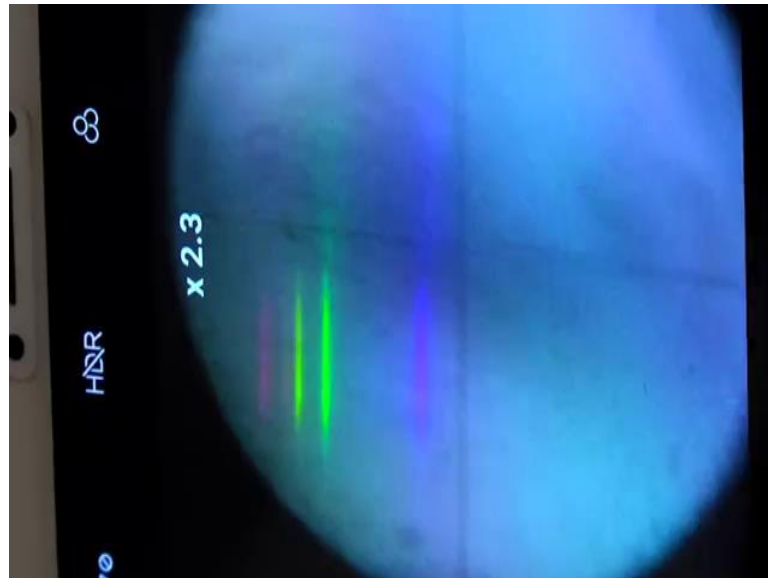
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I will now see the fringe from the telescope, I can see here clearly so I am moving the spectrometer telescope this, whatever the first order I showed you and second order. this central one you know this is the white one you know this I can show you this central one which only central one, so that is the white one because all are coming with zero angle.

let me show you this is the central one, I think if I can say it, I can show you central one, yes.

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yes, this is the central one you can see these white, white specter lines you can see, so this is the center. left and side if you go left and side of this if you go, so you will go you will get the first order; you will get the first order; you well get the first order yes, I am getting first order I will just increase this one yes. I am getting you see this is the central one that side, then I will get the first order.

one has to adjust actually its slightly difficult to adjust, yes this is the first order if I put in center. you moved to continue then we will get second order, so that way starting from the central you go to the extreme left you go to the extreme left.

now that central one is white as I showed you ok, then I am going towards the extreme this then extreme now extreme, I am going from my side is the , so this is the second order I am getting the; so this coinciding this crosswire with extreme that color it is yeah, looks me to likes blue or violet, I will set it there then as I mentioned that from vernier 1 vernier 2, how to take reading I many times describe so you take reading and continuing, now what I will do, I will just show you the procedure of doing experiment I will disturb it. I just unlock it. it is a free to move; it is the free to move I just disturbed.

set the grating surface for normal incidence of light, this direct reading of the telescope without grating, so main scale reading, vernier scale reading for two we have to note down,

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Then from this whatever reading it is a approximately I can tell you, so this is around I can see 90, then I will add with this reading 90 and then at that place I will set. it should be around 180 or 0 yes; it is 0, it is around 0, so take this reading telescope is rotated through 90 degree and set at angle, so it 0 for this vernier. another Vernier you have to note down it should be 180.

now what I have to do is that 90 degree now I have to put this one you see there are two screw is connected line. I have to put this one actually we should put parallel perpendicular to this one; perpendicular to this one. I think so if I put this way is becoming parallel to this anyways, so you have set like this here. I can do it in different way actually if I want to set perpendicular to this two lines.

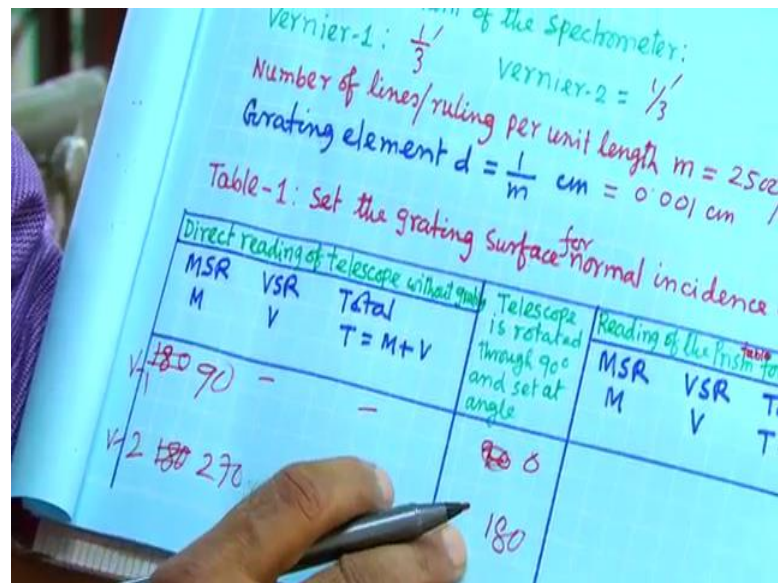
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this is the grating, and this is the holder here you see it is written students grating and this lines here written 2500 lines per inch; 2500 lines per inch, LPI. that we have to note down; that we have to note down that this vernier constant of course, this is one-third inch one-third earlier you know one-third minutes means 20 second and number of lines per. this is the 2500 per inch per inch.

per inch so in centimeter how much it will be one has to calculate. this per inch and this is a approximately if divided by 2.54, so approximately 1000 lines per centimeter, you note down so grating element you can find out $1 \text{ by } 1000$, $1 \text{ by } 1000$ mean 0.001 centimeter so that will be the grating element.

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Now, this as I mentioned this main scale reading direct whatever the reading it is a main scale was 0 and this vernier something, total these now this I put at vernier ones it is a 90 and when it was 0 so for vernier 1 that one for vernier 2. actually, here we have to write vernier 1 and vernier 2, so vernier 1 0 and this vernier 2 it would be 180 corresponding you have to note down,

no, here it was I showed it is the 180, this 180. I think no, this reading was around 90, so this I set at 0 for vernier 1 and this would be 270 and for vernier 2 and this would be 180 for vernier 2. this is a Vernier 1 and this vernier 2 V 1 vernier 1 and vernier 2 ok, so this reading So now, prism set a 45 degree.

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Now, I have to set prism; it is not prism this is prism table we have to put at 45. before that we have to actually you take holders ok, it will hold the fringe. Now you put as I told generally, we put perpendicular to the yes, I think this way perpendicular to all of the line and it should be at the surface should be at the center ok, the surface should be at the center anyway.

since the screw is here let me put and put in such a way distance you keep this it should be at center, you see it should be at center. I set at 90 degree so forget that one. here what do I have to do so I have to see the after putting I have to rotate this prism table and see the see the refracted one, I think yes; I got it, I got the reflected one, so that means it is exactly at 45 degree.

I will take this I will take this reading; I will take this reading from vernier 1 and vernier 2. Now whatever readings so I will add I will just rotate by 45 degree or 135 depending on in which direction you have to rotate, whatever reading is here so I will approximately I have to see this reading it is a I can see this 1 2 3 4 5 around 44, it is I can see around 44. I will rotate by more 45, so say it is 45 approximately.

from here I will rotate by more yeah. I will go 89 degree I think 45 90, 89 degree is if it is 45 89 degree. I have to go to 89, this is 189 yeah, I think I have to go around 89 yes. it is approximately just taking to the 89 So now, it is at normal now if fixed it, you do not disturb this part you fixed it; you do not disturb this part you fixed it and then you would

see the order, for normal incidents you see the order I think I have to unlock it I have to unlock this one, this is the prism table locked and this is the telescope, then yes I got the fringe this is central one, then you go to the next one this table angle of diffraction you have to measure. it is the now central fringe.

as I mentioned this go to the first order, yes clearly, I can see this first order as I showed you in mobile camera second order I can see clearly, extremely left and going so I will set crosswire. here I will fix the telescope then I will use the fined screw. So now, this reading I have to take this for second order and I think this is the violet color, it is the blue or violet you have close to that, then I will shift for the next color it is the red one, you should use this one because I think for that I have to lock it, but here it is somehow feeling difficulties.

then save the next color of second order take the reading next color second order. complete second order go to the first order complete it, then go to the other side for first order and then go to the second order and way again you can come back and take repeat the measurement. you can take average of this two reading,

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Order (n)	Color	VST. No.	Reading for the diffracted image with the telescope at the	VST. No.	Value of angle of diffraction	Wavelength
1	Blue	101	101.0	101.0		
2	Green	102	102.0	102.0		
1	Yellow	103	103.0	103.0		

And then this table will be complete; this table will be complete and then you calculate different parameters as I describe, this is the experiment very nice experiment you can measure the wavelength of source, here mercury source we have used, for any other source also a wavelength how we will know the wavelength of a light. these very nice

experiment and accurate experiment and accuracy depends on the quality of grating, if lines of number of lines per inch or per centimeter is higher.

your measurement will be more accurate spectrometer that our vernier scale and circular scale is very it is a list count or vernier constant its one-third minute means 20 second already it is very good spectrometer, resolving power dispersive power as well as the wavelength of different source one can measure from this diffraction grating experiment. I will stop here.

Thank you for your attention.